
Analysis of the management of business informatics framework from the green ICT viewpoint

Alena Buchalcevova

Department of IT,
University of Economics, Prague,
W. Churchill Sqr. 4, Prague 3,
130 67, Czech Republic
Fax: +420-224-095-426
Email: buchalc@vse.cz

Abstract: This paper concentrates on two key areas connected with business informatics, i.e., business informatics management and the role of ICT in promoting sustainable development. The surveys mentioned in this paper show that organisations in the Czech Republic do not devote sufficient attention to these areas and thus lag behind organisations in other developed countries. To help enterprises with the management of their business informatics, the management of business informatics (MBI) framework was developed. However, this framework does not explicitly address sustainable development or specifically green ICT. Therefore, the analysis of the MBI framework was carried out from the green ICT viewpoint to design the MBI framework extension towards green ICT adjustment.

Keywords: business informatics; business informatics management; methodology; framework; analysis; green ICT; information and communication technology; ICT; sustainable development; surveys; Czech Republic; extension; tasks; practices; customisation; SME; small and medium enterprises; SMEs.

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Biographical notes: Alena Buchalcevova is an Associate Professor at the Department of Information Technologies, Prague University of Economics in the Czech Republic. She has been working at the faculty since 1981. Her research interests include software development methodologies, software quality assurance, business informatics management, enterprise architecture, and green ICT.

1 Introduction

This paper focuses on business informatics and its management. Business informatics is an emerging discipline that combines various aspects of business management, information technology, and informatics with the goal of fully integrating computer science and business administration into one field (WiseGeek, 2013). “Business informatics, which had its genesis in the 1960s, is now the dominant IS community in the German-speaking countries (Austria, Germany, and Switzerland)” (Heinrich and Riedl, 2013).

While numerous methods for business informatics management have been developed so far, the results of several surveys conducted in the Czech Republic show that their usage for the management of business informatics (MBI) remains at a low level. This fact, as well as limited customisation possibilities of these well-known methods, led our team to develop a MBI framework that should help enterprises (including SMEs) to manage their business informatics. The first version of the MBI framework was defined at the end of 2012 and was published in Vorisek et al. (2012). However, the MBI framework is still being developed, and in Autumn 2014, it will be used in two pilot projects. One of the main advantages of the MBI framework lies in its definition of factors that influence the MBI. Based on these factors, a suitable solution can be selected. Despite the growing importance of sustainable development and the role of information and communication technology (ICT) in its support, the MBI framework does not explicitly address the question of sustainable development, or more precisely of green ICT. Thus, the aim of this article is to analyse the newly developed MBI framework from the green ICT viewpoint and propose enhancements that will support green ICT principles and practices adoption in organisations in the Czech Republic.

This paper is organised as follows. Section 2 describes the MBI framework, its purpose, structure, meta-model and various types of applications. Section 3 introduces the concept of green ICT and its importance and outlines the status of green ICT adoption in the Czech Republic. Section 4 defines the methodology of the MBI framework analysis from the green ICT viewpoint. Section 5 represents the main contribution presenting the results of an analysis and a proposal of an MBI framework extension towards a green ICT adjustment. Section 6 describes the evaluation of the proposed extension. Lastly, the conclusion is described.

2 MBI framework

Many methods for business informatics management have been developed to date. The well-known methods, standards or frameworks include COBIT (ISACA, 2012), CMMI (CMMI Institute, 2013), ISO/IEC 20000 (ISO/IEC 20000-1, 2011), ITIL (TSO, 2007) and TOGAF (Open Group, 2009).

Seeing a broad adoption of these methods worldwide, our team at the Department of Information Technologies at the Prague University of Economics conducted a nationwide survey focused on various characteristics of business informatics management during 2010. The survey identified the following key business informatics management challenges (Pour et al., 2013):

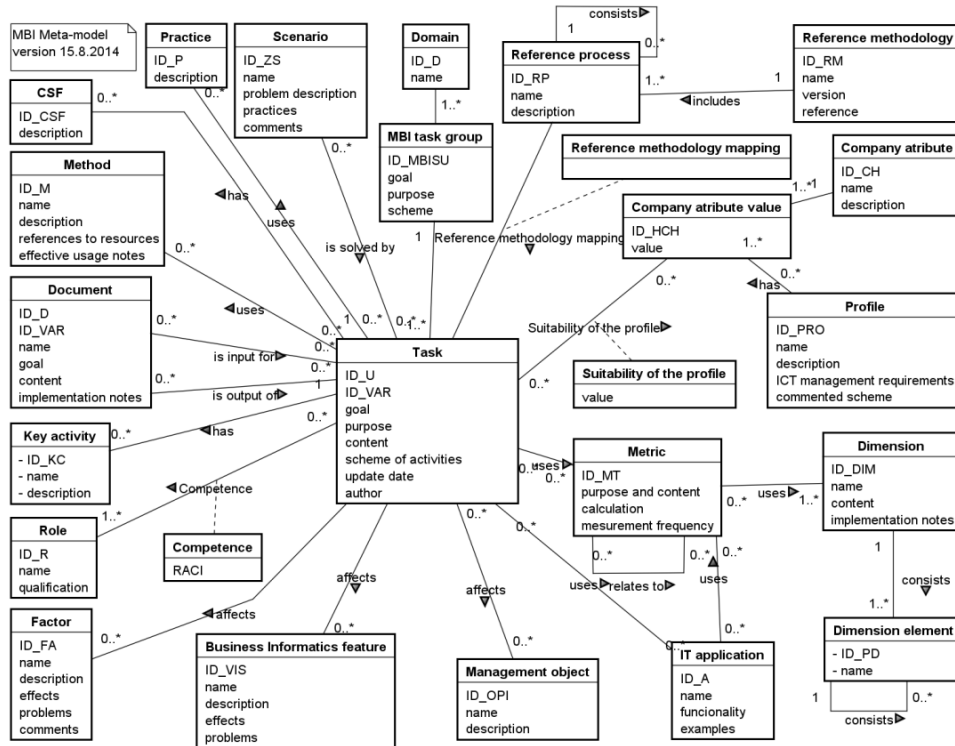
- relatively low ratio of investment into strategic applications compared to investment into technology
- low efficiency of the management of information services
- limited documentation of business processes available to the enterprise management and lack of comprehensive metrics
- lack of support for e-business
- limited utilisation of outsourcing and cloud computing given their potential.

These issues of business informatics management were addressed in detail in a subsequent survey that was carried out among participants of a conference organised by the Czech Society for Systems Integration in February 2012. According to this survey, the most important reason for the low utilisation of the existing methodologies and standards was their complexity, time-consuming implementation and high costs. Furthermore, the implementation of such methodologies requires extensive documentation and high knowledge and skills, even in the case of a small enterprise with a simple information system. Consequently, such methodologies are used almost exclusively by larger companies with a significant IT budget (Pour et al., 2013).

It was the low level of usage of business informatics management methods within Czech organisations and the limited customisation possibilities that led our team at the Department of Information Technologies, Prague University of Economics, to develop a MBI framework. The MBI framework was defined based on an extensive literature review, an analysis of existing standards, methods and frameworks, as well as generalised knowledge gained from numerous consulting projects across a wide spectrum of organisations. The objective of the MBI framework is to provide a support for business informatics management activities in companies that figure as users of ICT services. The MBI framework provides a consistent and flexible business informatics management methodology that incorporates the best practice guidelines for specific industry domains. The MBI framework helps organisations to improve the performance of enterprise IT systems, more specifically to improve the quality, availability, security and effectiveness of IT services and, indirectly, the overall business performance (Pour et al., 2013).

With the aim of a clear definition, uniform understanding and possibility of enhancement of the MBI framework, the MBI meta-model was defined. Figure 1 shows the meta-model that represents the MBI classes and the relationships between them. The MBI meta-model is presented in the UML 2.0 class diagram notation (without methods as it is on the conceptual level).

A key MBI component is the task, which describes how to proceed in solving a particular IT management problem. Examples of tasks include the following: proposal for enterprise IT system sourcing, IT service implementation, service activation, security audit implementation, etc. The MBI framework defines a large number of tasks that are grouped into task groups, which compose management domains.

Figure 1 The MBI meta-model

Each task has several attributes. Some of them, i.e., ID, ID of a variant, author and update date, are used for identification purposes. A task could be defined in variants. A variant of the task describes the specifics of a task realisation in various conditions according to an organisation's size, industry sector or organisation type. In addition to the identification attributes, other attributes exist that represent the specific content of the task, i.e., goal, purpose, content and scheme of activities. An additional content of the task is represented by relationships to other classes. These relationships enable referring to the content that is used in multiple tasks. Another purpose for separating the content of the task into related classes is that these related classes have multiple occurrences in the relationship. The most important related classes are the following:

- **Document** – this class represents a printed or electronic document that is used as task input or output. A document is either a tool of business informatics management (e.g., project plan, project objectives), or provides a solution to a particular problem (e.g., test scenario, tender document for selection of an IT service provider).
- **Scenario** – this class represents a typical issue that needs to be addressed in the life of a business. For example, considering IT cost reduction to be the requirement, the scenario identifies tasks, documents and metrics that relate to IT costs and provides recommendations to achieve such cost reduction.
- **Application** – this class consists of application software that can be utilised for a given task.

- Metrics – these are expressed in the context of dimensional modelling as indicators and their analytical dimensions. Metrics determine the key indicators of task performance, i.e., key performance indicator (KPI) or key goal indicator (KGI).
- Method – this class describes formalised processes and guidelines for fulfilling the goal of the task.
- Practice – this represents the recommended management practice that can be used to accomplish particular tasks.
- Role – this class expresses specific responsibilities of a role holder. Such roles include CIO, operations manager, project manager, IT architect, etc. Roles are linked to individual tasks using the responsibility assignment matrix (RACI) format applying the four key responsibilities: responsible, accountable, consulted, and informed.
- Factor – this class has a significant impact on the way a particular task is performed. The most important factors include organisation size, industry sector (in which an organisation operates) and organisation type (i.e., private company or public institution). Considering the example of the factor organisation type together with the task preparation of a tender for the supply of IT services, the solution of the problem for a public institution is completely different than in the case of a private company. The reason is the legislation that has to be followed in the case of public institutions.

To assure that key features of enterprise information systems are considered, the concept of business informatics features was introduced. Regarding each task, its possible impact on business informatics features (e.g., availability, user-friendliness, security, integrity, etc.) is measured in the form of a yes/no record. This way, it is possible to discover all of the tasks that affect a particular information system feature.

A full implementation of the MBI framework involves a creation of a comprehensive system for business informatics management. Alternatively, the components of the MBI framework could be used selectively based on scenarios. This method of using the MBI framework is likely to be preferred by smaller companies, as it can be utilised directly to solve specific business informatics management issues without the need to develop a comprehensive business informatics management model.

The MBI framework was described in detail in Vorisek et al. (2012) and then was presented at the business informatics management conference arranged by the Czech Society for Systems Integration in January 2014 where it enjoyed major success. The MBI framework is available as a web application (at website mbi.vse.cz), and the MBI community participates in its further development. Additionally, the ITSMF association expressed its interest in cooperating on the MBI model development.

3 Green ICT

ICTs have evolved into a key enabling infrastructure across industries while proving to be a powerful driver of enhanced living conditions and opportunities around the globe (Global Information Technology, 2013). ICTs also play a crucial role in endorsing sustainable development. On the one hand, ICTs cause environmental problems at each

stage of their lifecycle. Individual impacts need to be monitored in the whole cycle of ICTs. Murugesan (2008) divides this into four phases as follows: green design, green manufacturing, green use and green 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 equipment, and cooling systems evinces a permanently increasing trend. This rise of electrical energy consumption leads to the growth of greenhouse gas emissions, which are caused by coal and oil processing widely used for producing electrical energy. According to Rowe (2012), ICTs generate approximately 3% of the global CO₂ emissions. Watson et al. (2010) propose to develop a new subfield of IS, namely energy informatics, that recognises the role that IS can play in reducing energy consumption and, thus, CO₂ emissions.

Currently, consumers dispose of 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 the 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 hand, ICTs can be seen as a tool in addressing the environmental problems. Currently, 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 et al., 2009). For example, Hilpert et al. (2013) developed and evaluated a software system for greenhouse gas emission tracking in logistics. Various ways that information systems can meet environmental challenges and ensure sustainability are discussed in Loos et al. (2011). Seidel et al. (2013) argue that the primary role of information systems in sustainability transformation is to create action possibilities for sense making and sustainable practice that provide organisations with a key transformative power in becoming environmentally sustainable.

There exists a certain disunity in the terminology of sustainable ICT, for example, green IT, green IS (Boudreau et al., 2008), sustainable IT (McWilliams and Siegel, 2001), or environmental sustainability of IT (Elliot, 2011). 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; it involves pollution prevention at the end of a product's use, product stewardship to minimise the environmental footprint during use, and the use of clean technologies to reduce the use of polluting materials and develop environmentally friendly competencies. The OECD defined green ICT “as ICT with better environmental performance than previous generations (direct impacts) and ICT that can be used to improve environmental performance throughout the economy and society (enabling and systemic impacts)” (Mickoleit, 2010). The term green ICT consists of both green IT and green IS.

For example, Loeser et al. (2011) state that green ICT contributes to accomplishing a competitive advantage not only by cost savings (through direct usage of green ICT or an improved utilisation efficiency of other business resources) but also through the possibility of differentiating from the competition. Marett et al. (2013) conclude

“that sustainable information systems can be a viable option in a business context if usage leads to economic benefits”. Similarly, Seidel et al. (2010) postulate that “the successful adoption of sustainable practices requires organizations to consider social and ecological responsibilities as well as economic opportunities in a balanced way”.

According to surveys (Fujitsu, 2010; Rowe, 2011, 2012), green ICT practices are adopted across the world. Furthermore, green ICT is a subject of research. According to Melville (2010), there was only one paper focused on environmental sustainability in significant IS journals in the period from 2000 to 2007, whereas in the years from 2006 to 2013, Malhotra et al. (2013) analysed 30 journal papers (14 from eight leading IS journals and 16 from management journals). They classified the papers according to their adherence to the green IS or the green IT domain and their place along the value space of research: conceptualise (review papers, conceptual frameworks, etc.); analyse (case studies, ethnographic analyses, quantitative empirical analyses, hermeneutics, etc.); design oriented (design science); or impact oriented (implementation and sustainability impacts using action research, in vivo real-time approaches, etc.) They found that “most studies are green IS (23), and all but one are in either the conceptual (10) or the analyze (19) categories. Thus, at least based on this sample of journals (which are at least somewhat reflective of ‘important’ research in the field), very little research is being done in the areas of design science and impact dimensions” (Malhotra et al., 2013). According to vom Brocke (2013), green IS as a research area is still emergent.

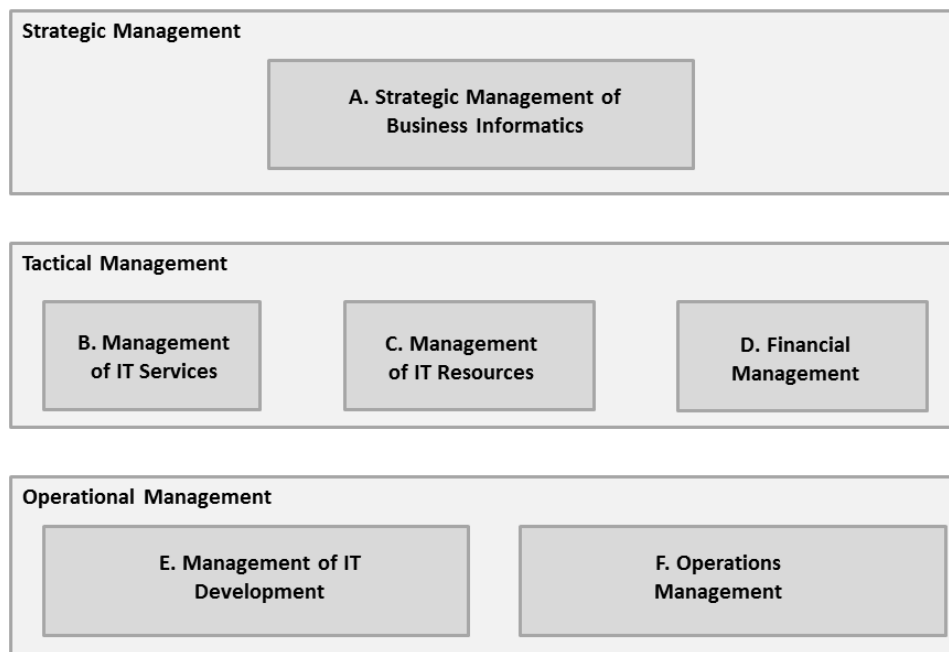
Moreover, to address environmental challenges, particularly global warming and energy use, governments and business associations have introduced a range of programmes and initiatives focused on ICTs and the environment. The OECD Report *Towards Green ICT Strategies* (Reimsbach-Kounatze, 2009) presents survey results of 92 government programmes and business initiatives across 22 OECD countries plus the European Commission. However, the Czech Republic was classified among the group of countries that do not conduct any green ICT programmes. This lack of government support of green ICT initiatives in the Czech Republic could be seen as a reason for a low rate of both green ICT awareness, as well as green ICT practices adoption in Czech enterprises, as confirmed by the results of a survey conducted in November 2011. The results of this survey are described in detail in Buchalcevova and Gala (2012a, 2012b) and Gala and Buchalcevova (2012). The survey focused exclusively on small and medium enterprises (SMEs), where out of the total of 294 that were sent appeals, 61 replies were obtained and further processed, which represents a response rate of 20.7%. Just to highlight key findings, it can be stated that drivers and inhibitors of green ICT diffusion, which were defined based on international surveys (Molla et al., 2009, 2010, 2011), were also valid for SMEs in the Czech Republic. However, they were perceived to a limited extent in comparison with the international surveys (Buchalcevova and Gala, 2012a). Another part of the survey concentrated on the ICT lifecycle viewpoint consisting of the following phases: ICT procurement, ICT use and end of ICT use. The survey results indicate that a great potential exists among businesses to improve within all of the phases observed because only 30% of respondents apply the principles of green ICT in all of the phases. In the phase of ICT procurement, companies do not stress enough the extent of ICT producers’ and distributors’ environmental friendliness. The challenge of the ICT use phase lies in the fact that enterprises do not measure the energy consumption of ICT and are therefore hardly able to identify the potential for savings. This is also confirmed by a low utilisation 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, which is the only phase partially regulated by legislation, a significant potential exists among a number of businesses to enhance, or at least to achieve law compliance, because 24.6% of companies do not implement any activity at this stage (Buchalceva and Gala, 2012b).

4 Methodology of the MBI framework analysis from the green ICT viewpoint

The previous section presented the importance of green ICT practices and documented the attention directed to green ICT practices adoption worldwide. However, the Czech Republic lags in this respect compared to the world and should thus focus on possible improvement. The newly developed MBI framework could be an ideal tool to promote the implementation of green ICT practices within organisations in the Czech Republic. The current version of the MBI framework does not explicitly take into account sustainable development or green ICT. Therefore, the analysis of the MBI framework was carried out from the green ICT viewpoint to design the MBI framework extension towards green ICT adjustment. The conceptual model of the MBI framework analysis is shown in Figure 2, which depicts individual domains of the MBI framework divided by management levels. These individual management domains were gradually analysed. The analysis revealed that green ICT is reflected among all management levels as well as all domains, but the largest impact was found in the strategic MBI, management of IT resources, and operations management domains.

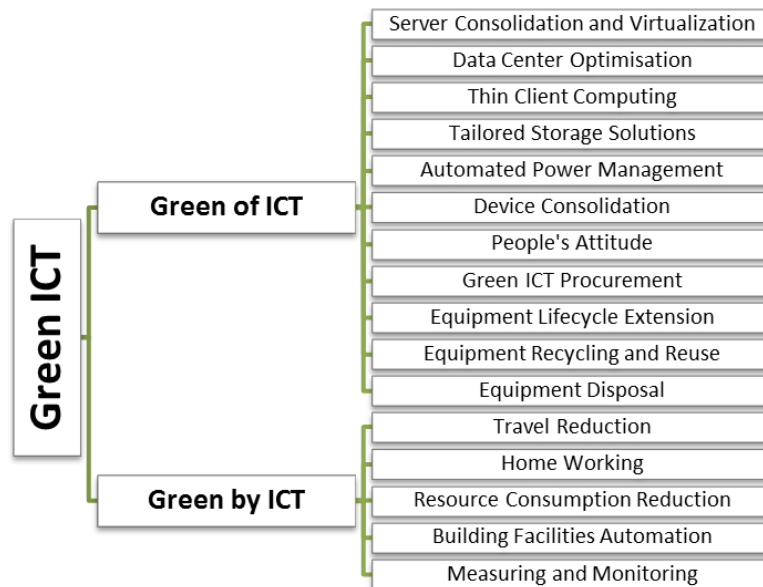
Figure 2 Conceptual model of the MBI framework analysis



While performing the analysis, the meta-model of the MBI framework shown in Figure 1 was utilised to thoroughly examine the components of the MBI framework.

On the green ICT side, the analysis was structured based on decomposition of the green ICT areas that were defined when the green ICT maturity model for the green ICT maturity assessment of Czech SMEs was designed. The model and results of the maturity assessment are described in Buchalceva and Mlejnek (2013). The green ICT maturity model consists of 16 green ICT areas grouped into green of ICT and green by ICT area groups. The green of ICT group represents practices that aim to reduce the direct impacts of ICTs on the environment, for example, the impacts caused by the manufacturing, usage and disposal of ICTs. The green by ICT group encompasses practices where ICT serves as an instrument to mitigate the impacts of other sectors on the environment. The green ICT areas that are displayed in Figure 3 were defined in detail in a book (Basl et al., 2013).

Figure 3 Green ICT areas defined in the green ICT maturity model for SMEs (see online version for colours)



Source: Buchalceva and Mlejnek (2013)

5 Proposed MBI framework extension

The analysis of the MBI framework proved that this framework does not explicitly take into consideration sustainable development or specifically green ICT. Nevertheless, the MBI framework could be quite easily extended, which corresponds to the original intention of the framework's gradual development.

The design of the MBI framework belongs to the category of design science research defined by Hevner et al. (2004). Extension of the MBI framework towards a green ICT adjustment can be seen as design science research as well, namely according to Peffers

et al. (2007) as an objective-centred solution. The objective of the solution is to design an extension of the MBI framework that allows the management of green ICT practices adoption.

In this section, the proposed enhancement is described. The following adjustments constitute the extended framework and are further described:

- addition of a new business informatics feature
- definition of new tasks
- definition of new scenarios
- definition of new documents
- enhancement of role competencies
- identification of green ICT impact on existing MBI tasks.

5.1 Addition of a new business informatics feature

As described in Section 2, the concept of business informatics features in the MBI framework enables the consideration of specific aspects of business informatics management. The business informatics features are grouped into two groups with the following current feature setting:

- features of business informatics as a whole (performance, effectiveness)
- features of business informatics components (functionality, availability, accuracy and trustworthiness of required functions and information, compliance with legislation, reliability, user-friendliness, security, flexibility, openness, integrity, and standardisation).

Each business informatics feature is described in a standardised form that consists of its identification, name, description, effects achieved by application of the feature, problems with its application and all tasks affected by the application of the feature. To ensure the consideration of sustainability issues in the MBI, a new business informatics feature, i.e., environmental sustainability, should be defined. This feature represents both the direct impacts of ICT on the environment and the enabling and systemic impacts, i.e., using IS/ICT for improving environmental performance throughout the economy and society. The importance of this feature is described for the whole of business informatics; then, it is examined and recorded for each task of the MBI framework.

5.2 Definition of new tasks

All tasks of the MBI framework were scanned on the basis of their division by management levels (Figure 2). No specific task focused on green ICT practices was found. The starting point for applying green ICT practices must be at the strategic management level. Therefore, the addition of two new tasks within the strategic MBI domain is proposed. The first new task U028A Analysing the Application of Green ICT Practices is suggested to be included in the task group analysis of business informatics and the environment. The goal of this task is to evaluate how green ICT practices are currently applied in an organisation. For this purpose, the green ICT maturity model,

described in Buchalcevova and Mlejnek (2013), could be used. The green ICT maturity model was defined and implemented as an interactive website with a self-assessment form at the link <http://Zelene-IT.cz>. After answering all of the questions, the results are immediately presented to users in the form of a graph so they can immediately see the green ICT maturity level of their company. The assessment of green ICT practices application in a company could serve as an input for an improvement that is addressed in a green ICT strategy. The other new task propounded to be included is U036A Definition of the Green ICT Strategy, specifically within the task group target status of business informatics definition. This task aims to prepare a green ICT strategy, a key document that defines a strategy for the application of green ICT practices. The process of green ICT strategy definition is based on the methodology published by Goel et al. (2011). The green ICT strategy should be aligned with the IT strategy, business strategy and corporate social responsibility strategy.

5.3 Definition of new scenarios

As described in Section 2, scenarios serve as a direct and common usage of the MBI framework. They enable, in a simple way, the choice of tasks, documents, methods, practices, metrics and other components that can solve particular management issues. With regard to green ICT, the addition of the following scenarios is proposed:

- green ICT procurement
- green ICT operation
- green end of ICT use
- power management.

These scenarios were chosen because they represent key green ICT practices that can bring significant benefits. First, three are connected with the ICT lifecycle. These situations were also examined within the survey focused on green ICT practices adoption in Czech SMEs (Buchalcevova and Gala, 2012b), and the results showed a great potential for improvement among businesses. According to worldwide surveys and also the attention of researchers, e.g., Watson et al. (2010), power management is a key area of green ICT.

5.4 Definition of new documents

In compliance with the new tasks proposed to be added to the MBI framework, new documents need to be included as well. Document D034A Green ICT Strategy is defined within the task U036A Definition of the Green ICT Strategy, and it is used as input for other tasks impacted by green ICT (see Section 5.6). The document defines not only the purpose of the green ICT strategy and its structure but also provides a pre-prepared template. The second new document is D237A Analysis of Green ICT Practices Application, which is the output of the U028A Analysing the Application of Green ICT Practices Task. This document consists of results of the green ICT maturity assessment for the organisation.

5.5 *Enhancement of role competencies*

As to current roles in the MBI framework, there is no need to define additional roles. However, the competencies of existing roles should be extended to ensure that green ICT tasks are performed correctly. Inspired by the European e-competence framework (CEN, 2014), the inclusion of a new competency CM110 Knowledge of Green ICT practices within the group of business competencies is proposed.

5.6 *Identification of green ICT impact on existing MBI tasks*

In addition to tasks broadening, a definition of existing MBI tasks is affected when taking green ICT into account. Overall, 25 tasks from the total number of 81 tasks currently defined in the MBI framework were identified that need to be modified in coherence with green ICT adjustment. The list of these tasks is shown in Table 1.

Table 1 MBI tasks affected by green ICT

<i>Task ID</i>	<i>Task name</i>
U021A	Analysis and Evaluation of IT Trends
U022A	Analysis of Competition from an IT Perspective
U024A	Analysis of Corporate Culture, Business Process Maturity and Employee Knowledge
U031A	Formulation of a Vision and Objectives of Enterprise IT Systems
U034A	Conceptual Design for Future Development of Enterprise IT
U102A	Services Design
U108A	SLA Reporting, Monitoring and Evaluation
U122A	Implementation and Maintenance of Plans for IT Services Development
U131A	Management of IT Services Sale
U133A	Management of IT Services Purchasing
U134A	Competitive Tendering of IT Service Provider
U201A	Registering and Analysis of Data Sources
U202A	Planning of Data Sources Development
U221A	Analysis of Human Resources and their Qualification
U222A	Planning of Human Resources in IT
U242A	Analysis of IT Status and Quality
U243A	Definition of Technology Standards
U245A	Planning and Control of Technology Infrastructure Development
U301A	Accounting for IT Services
U331A	Analysis and Planning of Business Informatics Benefits
U332A	Analysis of Enterprise IT Effectiveness
U501A	Technology Infrastructure
U502A	Database Administration
U503A	Application Administration
U504A	Software Asset Administration

Tasks were analysed according to individual green ICT areas (Figure 3). These areas are described in detail in Basl et al. (2013), which in addition to the description of the area also presents the demands of the implementation, the estimated cost of implementation, the effects of the implementation for the organisation and for the whole society and the suitability for the specific organisation type. Table 2 displays the results of the analysis of the MBI tasks that are affected by green ICT and that must be modified to support individual green ICT practices. Tasks are listed by management levels.

Table 2 Impact of particular green ICT areas on existing MBI tasks by management level

	<i>Strategic management</i>	<i>Tactical management</i>	<i>Operational management</i>
Server consolidation and virtualisation	U021A, U022A, U031A, U034A	U102A, U122A, U242A, U245A	U501A, U502A, U504A
Data centre optimisation	U021A, U022A, U031A, U034A	U102A, U122A, U201A, U202A, U242A, U245A	U501A
Thin client computing	U022A, U031A, U034A	U102A, U122A, U242A, U245A	U501A
Tailored storage solutions	U022A, U031A, U034A	U102A, U122A, U201A, U202A, U242A, U245A	U501A, U502A
Automated power management	U022A, U031A, U034A	U242A, U245A	U501A
Device consolidation	U022A, U031A, U034A	U242A	U501A
People's attitude	U022A, U024A, U031A, U034A	U221A,	
Green ICT procurement	U021A, U022A, U031A, U034A	U133A, U134A, U242A, U243A, U245A	
Equipment lifecycle extension	U022A, U031A, U034A	U242A	
Equipment recycling and reuse	U022A, U031A, U034A		
Equipment disposal	U022A, U031A, U034A	U242A	
Travel reduction	U022A, U031A, U034A		
Working at home	U022A, U031A, U034A		
Resource consumption reduction	U022A, U031A, U034A	U242A	U501A
Building facilities automation	U021A, U022A, U031A, U034A	U242A	U501A
Measuring and monitoring	U022A, U031A, U034A	U108A, U131A U301A, U331A, U332A	U501A

It is apparent from Table 2 that each of the green ICT areas affects several MBI tasks, mostly on all management levels. At first, tasks at the strategic management level have to be updated to address issues from particular green ICT areas and to explicitly define relationships to two new tasks of this level, i.e., analysing the application of green ICT practices and the definition of the green ICT strategy. Tasks at the tactical management level then serve for realisation of the strategies and in the green ICT area they are crucial for the adoption of green ICT practices. According to the comparison of the cost of implementation of particular green ICT area with the benefits of the implementation that is provided in Basl et al. (2013), the most beneficial areas are automated power management, people's attitude, green ICT procurement and travel reduction. Tasks at the operational management level must then incorporate the execution of real green ICT practices within the management of technology infrastructure and software asset administration.

6 Evaluation of an MBI framework extension towards a green ICT adjustment

The proposed MBI framework extension as a design science artefact should be evaluated. Hevner et al. (2004) describes various evaluation methods. Observational methods, specifically the case study, would be the most appropriate one. As the original MBI framework was not yet implemented, it is difficult to evaluate its extension in the form of a case study. Therefore, a descriptive evaluation method, i.e., scenarios, is used. Two scenarios of using the MBI framework for specific situations are presented.

6.1 Scenario 1: definition of the green ICT strategy

Problem

An organisation wants to manage green ICT practices adoption and define green ICT strategy.

Solution using MBI framework

Open the MBI application and under the menu tasks select task group strategic MBI and locate the task U036A Definition of the Green ICT Strategy. The description of the task is displayed, and among other things, the purpose of the task is stated, i.e., adopting measures and techniques in IT strategy that enable an enterprise to support the sustainability initiatives of the corporate strategy.

In the description section, the process of developing a green ICT strategy is described, which is based on the methodology for greening an IT strategy (Goel et al., 2011). The process is divided into six key activities that are separately described and interconnected by the process schema.

- Activity 1: Identification of the context for the green ICT strategy, i.e., the corporate strategy, business strategy and sustainability strategy of the enterprise.
- Activity 2: Selection of the appropriate approach to be adopted, e.g., incremental, strategic, architectural, deep green, etc.

- Activity 3: Assessment of the current state of green ICT – for this activity, task U028A Analysing the Application of Green ICT Practices should be used.
- Activity 4: Definition of the target green ICT strategy.
- Activity 5: Implementation of green ICT initiatives.
- Activity 6: Evaluation of the green ICT strategy.

The task also defines critical success factors for task implementation that should be considered. The MBI application also manages all relationships of the task. This way, it is possible to see which roles with which responsibilities (responsible, accountable, consulted, informed) are engaged in fulfilling the task, which documents are used in the task as an input or output, which methods and practices should be used and which metrics for measurement are defined. Links to IT applications applicable for the task are provided. The MBI application also shows all scenarios in which the task is used and all factors, management objects and business informatics features that are affected by this task. To facilitate task implementation, a predefined package with document templates can be downloaded.

6.2 Scenario 2: ICT procurement with respect to environmental sustainability

Problem

An organisation wants to buy new ICT products and consider their environmental impact.

Solution using the MBI framework

Open the MBI application and under the menu scenarios select service management scenario group and locate scenario green ICT procurement. In this scenario, key issues and questions connected with the problem to be solved are stated, including the following:

- Are ecological labels such as ENERGY STAR or EPEAT used when purchasing ICTs?
- When selecting an ICT asset, are carbon emissions on the vendor's side that result from manufacturing, transportation and disposal processes considered?
- Is environmentally friendly ICT delivery (packaging, reducing the number of manuals and CDs shipped) preferred when purchasing ICTs?

The scenario describes practices that can be used for solving these issues and lists all interrelated tasks:

- U133A Management of IT Services Purchasing
- U134A Competitive Tendering of IT Service Provider
- U243A Definition of Technology Standards
- U028A Analysing the Application of Green ICT Practices.

7 Conclusions

This paper concentrated on two key areas connected with business informatics, i.e., business informatics management and the role of ICTs in promoting sustainable development. According to surveys mentioned in this paper, organisations in the Czech Republic do not devote sufficient attention to these areas and thus lag behind organisations in other developed countries. To help enterprises with the management of their business informatics, the MBI framework was developed. However, this framework does not address sustainable development or specifically green ICT. Therefore, the author analysed the MBI framework from the green ICT viewpoint and proposed a possible extension of the framework. The paper describes the results of this analysis and the proposed extension of the MBI framework towards green ICT adjustment. This extension includes the addition of a new business informatics feature, i.e., environmental sustainability, and the definition of two new tasks and two new documents. Moreover, role competencies are suggested to be enhanced, and scenarios, which enable, in a simple way, the choice of tasks, documents, methods, practices, metrics and other components for particular management issues, are extended with four new ones. Overall, 25 MBI tasks were identified to be modified in coherence with the green ICT adjustment. The proposed MBI framework extension was evaluated using scenarios as a descriptive evaluation method. Two scenarios of using the MBI framework for specific situations were presented.

The proposed extension will be reflected in the second version of the MBI framework and will proceed for verification in pilot implementations. As surveys focused on green ICT adoption and assessment of green ICT maturity in Czech SMEs show, a great potential exists among businesses to improve. The MBI framework covering the green ICT area could be an applicable tool that will support the expansion of green ICT in the Czech Republic.

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