Towards a Procedural Model for Sustainable Information Systems Management

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Abstract

The increasing economical, ecological and social significance of information systems (IS) demands reorientation for IS management. Ever-growing energy consumption, waste streams, data amounts and performance expectations require management concepts that consider these forces. While concepts of corporate social responsibility or sustainability have been applied to other industries, IS is still lacking a theoretical and conceptional foundation. The purpose of this paper is to apply the concept of sustainability into the field of IS management. As a contribution to the ongoing discussion of "Green IT", we provide a theoretical foundation and justification of sustainable IS management using the resource based view. Thereafter, we develop a sustainable IS management procedural model, that lines out the most important steps towards the implementation of sustainability within IS organizations. This model should provide IS managers, such as CIOs, with a framework for including sustainability in business operations.

1. Introduction

Due to the growing global impact of IS[1] on economy, ecology and the society, IS management is increasingly challenged to take the concept of sustainability into account. Sustainable management can be understood as a concept of long-term simultaneous optimization of economical, ecological and social objectives to generate a lasting superior financial performance for the business [2 and 3].

In 2008, the global information and communication technology (ICT) spending is expected to grow by 10.3 percent to over $US 3.7 trillion, accounting a share of 6.4 percent of the World's gross domestic product (GDP) [4]. From the world's 50 most innovative companies 16 are highly ICT related [5].

The ecological impact of the IS business has been discussed under the headline of "Green IT", which has been the key topic of the CeBIT 2008, the world's largest ICT trade fair, showing its practical relevance for the ICT business. The global ICT industry is claimed to account for approximately two percent of global carbon dioxide (CO2), a figure equivalent to the aviation industry [6]. A study from 2005 on the global power consumption of servers revealed that servers worldwide, including related cooling and auxiliary infrastructure, used 123 000 Giga Watt hours (GWh) of electricity, an amount comparable to the power consumption of a country such as Poland [7]. Google by itself, operates about 450,000 servers consuming nearly 800 GWh a year [8].

Social and ecological problems additionally derive from waste of electronic products (e-waste), which is increasing three to five percent each year, making it the fastest growing waste stream in the industrialized world [9]. Information and communication equipment as well as monitors make up 25 percent of the approximately 20 to 50 million tons of e-waste generated each year. This means that a minimum of 5 million tons per year of ICT related waste is being produced, an amount comparable to the weight of almost 9000 fully loaded Airbus A380 passenger planes containing dangerous metals, such as lead, mercury and cadmium.

However, sustainability in IS does not only cover the aspect of "Green IT". Further challenges derive from "information waste" clogging up IS. Analysts from IDC (International Data Corporation) [10] expect an increase in the amount of digital information produced from 281 exabytes in 2007 to 1,800 exabytes in 2011.

The above facts not only point to a huge need, but also to a great complexity of sustainable management in IS. Porter and Reinhardt [11] argue that companies have no other choice than to deal with sustainability and that the challenge has moved from "whether" to "how" to integrate corporate sustainability into day-to-day management decisions. Despite the hype in trade press, especially concerning "Green IT", the topic of sustainability in IS management is still lacking theoretical foundation. The research questions arising from this are:

- What is the scope of sustainable IS management?
- Which theoretical foundations could be applied to the concept of sustainability?
- What are the links between sustainable IS management and business value?

[1] Henceforth information systems (IS) are defined as a combination of information and communication technology (ICT), people, processes, and organizational mechanisms, to gather, process, store, use and disseminate information to improve organizational performance [1].

- How could sustainability be efficiently implemented in IS management?

In order to address these questions, we need to create a clear view on IS management and the concept of sustainability. Building up on this, the next step is to line out the connection between sustainable IS management and business benefits. For this we are proposing the resource based view (RBV). We will argue that sustainable IS management helps to accumulate, secure and foster competitive advantages therefore leading to superior long-term performance of IS. Consequently, we introduce a procedural model for sustainable IS management, which provides theoretical foundation to the topic and a starting point for further research in this field.

2. Towards Sustainable IS Management

2.1. The value chain of IS business

In order to define the field of research it is necessary to identify the relevant scope of IS management and to outline the key activities of IS product and service provisioning. The IS business consists of internal (in-house) and external organizations that provide products and services that can be assigned to ICT, including hardware, software and services. These types of enterprises generally follow the processes *source*, *make*, *deliver*, and *return* through which the value creation takes place. The management of these processes defines the scope of IS management. The foundation for this process oriented concept originated from the Supply Chain Operations Reference (SCOR) model [12], a well-known value chain concept in industrial management, which makes it applicable for IS hardware providers. The transfer of the SCOR model to IS software and IS service providers has been done by Zarnekow et. al. by developing the integrated information management (IIM) model [13]. The IIM model focuses on the whole IS value chain including customer and supplier relationship, while traditional IS management concepts are focusing on the management of applications [14]. Figure 1 illustrates the value chain of IS business, including a *return* process and the stakeholders interests:

The *govern* process encompasses the strategic functions, procedures, and measures, which ensure that allocated IS products and services contribute to the business goal achievements. In particular, the IS governance determines the supervisory functions, organizational structures, and processes. The core tasks are divided into strategic alignment, value delivery, risk management, controlling, and resource management.

The *source* process covers all tasks within the supplier relationship management. Usually, IS organizations purchase hardware components, software solutions, personnel or other technological resources. These resources are used in the production phase and are transformed to marketable IS products.

The *make* process comprises all tasks for the management of IS product and service production. Based on an industrial management procedure, the make process is divided into a portfolio management, a development management, and a production management. The focus is therefore the efficient planning, development and production of IS components.

The *delivery* process is responsible for the customer relationship management and depicts the classical sales part. The main objective is to transform customer demands into internal requirement specifications for IS production.

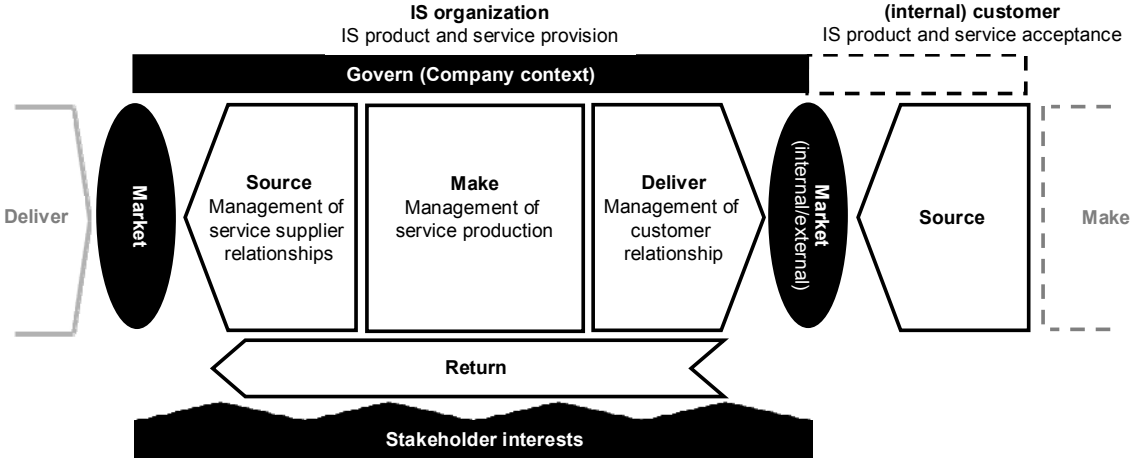

Figure 1. Value chain of information systems product and service provision

Otherwise, it communicates internal capabilities and basic conditions to the customer. Hence, the delivery process has a mediator function between the internal make and the customer's source process.

Based on the original SCOR model we include a *return* process into the supply chain operations. The *return* phase depicts the processes of recycling, preserving and reusing tangible and/or intangible resources, clarifying that possessed resources or means of production used or produced in the value chain are recyclable and fundamental information (e.g. customer requirements) has to be documented and preserved for internal analysis and future strategic directions of the company. Moreover, it ensures a lifecycle oriented view on IS products and services, including a waste management and reutilization of products in the value chain.

In addition, stakeholders interests are taken into account. The reason for doing so is that the diversity of stakeholders like shareholders, policy makers, suppliers, labor unions, customers or others, can have a major impact on corporate - in this case IS management - performance. Summing up, the model cuts the value chain into four core processes which have to be considered simultaneously for implementing sustainability in IS management.

2.2. Understanding the concept of sustainability

Sustainability has been extensively discussed within corporate management[2] under the synonyms of corporate social responsibility (CSR), greening the business, eco-efficiency or eco-advantage. Although many studies concerning sustainable management have been introduced, sustainability in IS has not been evaluated until now. Global development and challenges (see Section 1) as well as the general need to align IS strategy to corporate strategy, form the need for an integrated concept of sustainability in IS.

The word "sustain" derives from the Latin "sustenere" [19]. In its primary sense it can be described as survival assurance meaning that an economical, ecological or social system should be preserved for future generations and, thus, necessary resources should only be exploited to a degree where it is possible to restore them within a regeneration cycle. The most common definition from the Brundtland Commission defines sustainability as a *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* [20]. All definitions of sustainability have the preservation of the economical, ecological and social system for the benefit of future generations in common. These dimensions represent the three main pillars of sustainability and are known as the "triple-bottom-line" concept [3]. The "triple-bottom-line" concept provides a framework to companies to measure and report their performance and organizational success in relation to these pillars.

Especially at the business level, sustainability is mainly equated with the economical or financial sustainability [21]. However, integrated corporate sustainability is achieved by recognizing the interdependence of the three dimensions over time and keeping an optimal balance between them [22].

2.3. Sustainability within the resources of IS

Due to the importance of resources in sustainable management, we apply the resource based view of the firm. It argues that a firm's competitive advantage depends upon its ability to accumulate, generate, deploy and secure unique and valuable resources [23 and 24]. Following the RBV a sustainable competitive advantage evolves if the resources are also not easily duplicated by competitors [23 and 25]. This indicates a highly economically oriented understanding of sustainability. Competitors are not the only determinant of a sustainable competitive advantage. Resources face various influences by stakeholder groups, thereby determine the sustainability of a competitive advantage or its loss e.g. through governmental regulation.

Resources can be characterized as core resources, which lead to a competitive advantage over competitors, threshold resources, which are essential to be able to compete on a market and unnecessary resources, which can be neglected by the firm [26]. Focusing on resources allows us to explain differences in profitability and strategy among firms in terms of resource differences [27].

A challenge is to define what is meant by a resource. Researchers and practitioners have used a variety of different terms to talk about a firm's resources [24, 26, and 28]. Hart [25] defines resources as the basic units of analysis and includes physical and financial assets as well as employees' skills and organizational processes.

In this paper, we follow the definition of Hulland and Wade [29] who define resources "*...as assets and capabilities that are available and useful in detecting and responding to market opportunities or threats"*. Assets and capabilities define therefore the firm's resources[3]. Assets are either tangible or intangible and

[2] For some works on the topic see [2 and 15-18]

[3] Note: Following Wade and Hulland we view the terms capabilities, competencies, and core competencies as essentially synonymous.

are being used in the firm's processes to create, produce and/or deliver its goods and/or services to a market [30]. Assets can serve as inputs to a process, or as the outputs of a process [31]. From an IS point of view tangible assets are, for example, information systems hardware, network infrastructure or server buildings, while intangible assets are, for instance, software patents or stored information [31 and 32]. Capabilities transform inputs into outputs of higher value [28 and 30]. Capabilities include, for example, skills, managerial abilities or processes [29].

Sustainability in IS can have two meanings: On the one hand, sustainability can be seen as a capability which a company can accumulate and possess [25]. On the other hand sustainability can be seen as a cross-sectional objective that applies to all IS resources, to improve their accumulation, generation, deployment and securing, therefore generating competitive advantages. In this paper we focus on the latter perspective.

3. Theoretical foundation of sustainable IS management

Since we follow the IS value chain (Section 2.1) we can assign three different theories for the justification of sustainable management to each of the phases: Transaction cost theory (TCT) can be applied to *source*, production theory (PT) to *make* and stakeholder theory (ST) to *govern* and *deliver*.

Resources are either produced internally from other resources or acquired from the firm's environment [27]. The TCT investigates the coordination of transactions, which can be defined as the transfer of property rights of a resource between two contracting parties [33 and 34].

The specificity and uncertainty connected to this transaction determines the transaction costs for different types of coordination possibilities. These possibilities range from in-house production (make) over long-term contracts (hybrid) to spontaneous market acquisitions (buy) [35]. TCT claims the higher the specificity and uncertainty of the transaction are, the more efficient a sustainable solution becomes, in form of long-term contracts and eventually in-house coordination because of transaction costs. Sustainable management of the resource strengthens the ties between the contracting parties beyond the economical level within the sourcing process, hence, intensifying and securing their long-term relationships. Especially for resource transactions with high specificity and uncertainty, this would lead to lower transaction costs in comparison to other coordination mechanisms. That is the reason why some companies with employees as core resources usually offer additional social incentives to intensify and secure this relationship.

PT deals with the efficient input-output relations. Nowadays many resources, especially those with high ecological and social impact, are connected with economic incentives imposed by stakeholders. These incentives might, for instance, derive from government regulations towards more efficient technologies for lower energy consumption, "green" investments, or they could also be immaterial, for example as an award for "sustainable behavior", acknowledged to the company. It is obvious that these ecological and social incentives need to be recognized to determinate an optimal input-output relationship for IS product and service production. Schaltegger and Synnestvedt [36] point out that a limited amount of ecological and social activities[4] lead to an increase of economic success until a point where after the costs of these activities exceed the benefits leading to decreasing economic success. The managerial challenge as Schaltegger and Synnestvedt [36] state is to choose the optimal level of ecological and social activities to achieve the highest economic success and to obtain this level at the lowest possible costs.

Stakeholder theory is a normative theory of corporate social responsibility. It states that the manager's duty is to balance the shareholders' financial interests against the interests of other stakeholders such as employees, customers or local community, even if it reduces the shareholder returns. The managers' objective within the stakeholder theory is to balance profit maximization with the long-term ability to do business. Stakeholders are voluntarily or involuntarily connected to the companies' resources, making them potential risk bearers for the companies' fortune [37]. A possible classification distinguishes between five typical groups of stakeholders: investors and risk assessors, rulemakers and watchdogs, idea generators and opinion leaders, business partners and competitors, consumers and community [17].

The sustainable management of resources, within the economical, ecological and social dimensions seems to provide orientation on how to balance profit maximization and stakeholders interests. An increasing extend of sustainability activities leads to higher costs but also to lower calculated expenditures due to declining stakeholder risks (Figure 2).

[4] Note: Schaltegger and Synnestvedt use the term "Environmental activities". In this paper we see "Environmental activities" as a generic term for ecological and social activities.

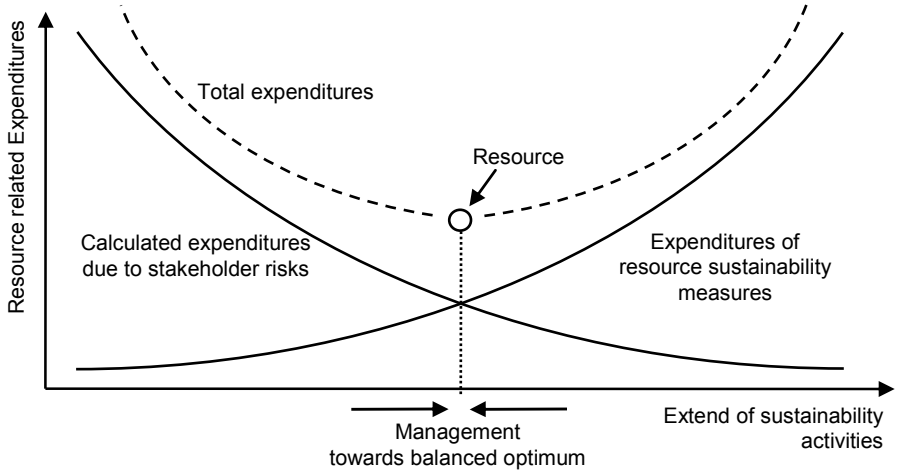

Figure 2. The connection between sustainability and stakeholder risks

The objective for sustainable management is therefore to identify and obtain a balanced optimum by keeping the resource related expenditures at a minimum. Notable is the fact that over time the calculated expenditures due to stakeholder risks, e.g. new regulations or customer expectations, might shift, hence creating a demand for active management.

4. Implementing sustainability in IS – a procedural model

In Section 2 and Section 3 we have shown the relevance of sustainable IS management from a theoretical perspective. This creates the need for a model or framework that supports a practical implementation and leads us back to the initial question: How could sustainability be efficiently implemented in IS management?

In this section we propose a procedural model for the implementation of sustainable IS management that gets applied over the entire value-chain of IS (Figure 3). Starting point are the resources of IS. They get evaluated concerning their impact on the economic success, the ecology and the social relevance. Thereafter, the measures need to be prioritized before they finally get implemented. Continuous controlling will ensure to balance the sustainability objectives.

4.1. Resource identification

There is a vast variety of approaches to identify IS resources: McKeen/Smith [38], divided IS resources in technology, people and processes, which are needed to meet the challenges of the firm. Bharadwaj et al. [39] suggested six dimensions: IT/business partnerships, external IT linkages, business IT strategic thinking, IT business process integration, IT management, and IT infrastructure. Wade and Hulland [29][5], analyzed a broad variety of IS studies dealing with the resource based view and extracted eight key IS resources: external relationship management, market responsiveness, IS business partnerships, IS planning and change management, IS infrastructure, IS technical skills, IS development and cost effective operations.

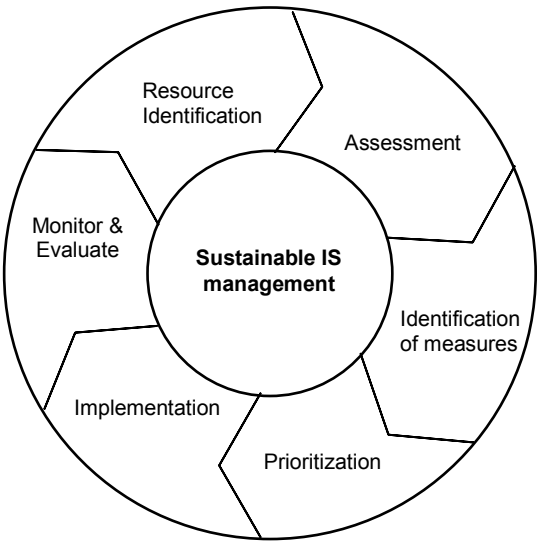

Figure 3. Procedural model for sustainable information systems management

Practitioners from the Office of Government Commerce (OGC) [40] distinguish between capabilities such as management, organization,

[5] Note: For a more comprehensive overview see [29]

processes, knowledge and assets such as information, applications, infrastructure, financial capital, which are combined to create goods or services of value. In general, it can be said that resources of IS infrastructure include tangibles, such as buildings, machinery, IS hardware, electrical equipment and any kind of office installations, as well as intangibles that enable their usage, such as electricity, water, paper or location. Knowledge resources can be seen as capabilities which include the insights, understandings, and practical know-how of employees [41]. This knowledge can be classified into tacit and explicit knowledge [42]. Tacit knowledge is connected to people and is deeply rooted in action, commitment, and involvement in a specific context, which makes it hard to externalize (e.g. skills, talents, way of thinking, attitude, manners, cultural competence). Explicit refers to knowledge that is transmittable in formal, systematic language and was generated by combination or externalization (e.g. applications, manuals, reference models) [42]. IS governance is defined by Weill and Ross [43] as *"specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT"*. Resource of IS governance therefore subsume capabilities dealing with management, organization or processes.

It has to be noted, as Hart [25] states, the interconnectedness between certain resources. Meaning the accumulation, generation, deployment and securing of certain resources might depend upon having already developed other resources before.

4.2. Assessment of IS resources

The first step of the assessment is the characterization of each IS resource as core, threshold, or unnecessary (see Section 2.3). Core resources have to be preserved in order to remain competitive in the present and future. Threshold resources might not lead to a competitive advantage, but there might be no possibility to get rid of them either (e.g. electricity, local authorities). Unnecessary resources are not inevitably useless to IS, they might even generate a certain amount of benefits, but they are not essential for survival and might get sold, outsourced, or just neglected in the future. Helpful questions to determine the type of each resource provide Weill and Ross [43]: "What is the unique and valuable position targeted by the firm?" and "What core processes embody the organization's unique market position?"

In the next step the ecological and social impact that determine the amount of externalities have to be evaluated. A high amount of externalities by a resource increases the potential risk from stakeholders, offers ways to differentiate from competitors and makes external incentives more likely. A low amount of externalities makes sustainable management less advisable. Generally, portfolio planning models represents a two-dimensional, matrix-based framework that can be used to evaluate business unit performance, to formulate business unit strategies, and to set performance targets [44].

The significance of the IS resource and its externalities can be positioned in a portfolio to generate strategic orientation to which degree sustainable measures should be taken or not (Figure 4).

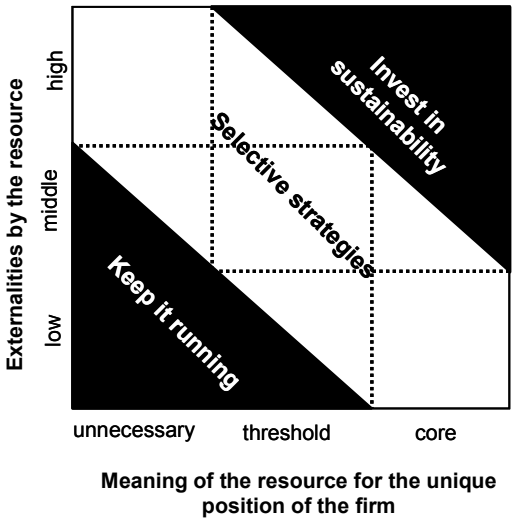

Figure 4. Assessment of resources

As shown in the portfolio, three strategic directions can be derived: "keep it running", "selective strategies", and "invest in sustainability". While "keep it running" matches a lower importance of the resource with a low externality, the strategy "invest in sustainability" represents a major impact on the performance by the resource and high externalities as well. Resources categorized in this quadrant can be defined as core resources that need to be managed sustainably.

4.3. Identification of measures

The next step is to identify measures that support the ecological and social dimensions of a resource to control or minimize its externalities. Applying the concept of sustainability into the filed of IS management requires an integrated view on the entire value chain of IS organizations. For each of the phases of IS organizations providing hardware, software or services we open up an initially continuum of appropriate measures. Table 1 gives an exploratory overview, and depicts some already existing concepts

that are currently under discussion. “Grid computing” for instance, is a concept for the collaboration of computers to perform very large computing tasks together. Its objective is to provide the maximum of service output with a minimum of computing power input, which leads to lower energy consumption in total. Therefore we positioned “grid computing” in the *make* phase of IS services. In the deliver phase standardized reporting is recommended. An example for this is the “EU Code of Conduct for Data Centers”, to which the organization could refer, to underline its commitment towards stakeholders.

4.4. Prioritization and implementation

In the next step the selected measures assigned have to be prioritized with respect to feasibility, importance and cost-effectiveness. The decision for pursuing specific measures within certain resources can be based on costs, values and risks resulting from those measures. Many techniques are already present for prioritizing projects that can be also used in this case: Some well-known methods are the cost-benefit or value benefit analysis, the portfolio analysis, the analytic hierarchy process or the prioritization via specific criteria in a checklist. Regardless of the method of choice it is essential to take a top-down approach. The prioritization process should be aligned to the actual business strategy (e.g. revenue increase, expense reduction, efficiency gains etc.). In addition, the strategic position of the firm affects the decision: A first mover or an innovator for instance will have other preferences than a fast follower. Furthermore, the dependencies between several resources should be considered, so that the sustainable measures for one resource can have a positive or negative impact on others. One way to come to a solution is to use the value benefit analysis which is similar to the analytic hierarchy process [45]. In this case, certain criteria have to be identified and selected. Such criteria can be “minimization of risk” or “economic impact” of the resource. Hereupon, the decision makers have to assess each chosen criteria for its contribution to the firm’s performance and strategic direction. This is a critical step because improper selection of weights can influence the decision.

The next step is to score each resource across all defined parameters in order to determine the overall resource score. The resources should be scored by executives for their degree of agreement on a specific scale. As those priorities change because of the altered strategic relevance of IS to an organization, the weights can be adjusted correspondingly, so that the score for each resource is always in line with the business strategy. When all selected resources are scored they can be ranked to determine those that have the highest score. Finally, the number of resources that will be selected can be based on total investments available or other constraints the firm is operating under. Once the measures are prioritized, they can be implemented.

Table 1. Objectives and exemplary ICT sustainability measures

		Types of ICT products		
Value chain	**General objectives**	**Hardware**	**Software**	**Services**
Source	- Demand transparency - Demand compliance to standards - Create lasting incentive systems	- Check for fair labor conditions - Secure natural resources - Check for ISO 9001, 14001	- Recruiting - Comply with social standards	- Check for eco-labels (e.g. Energy Star) - Negotiate lasting service level agreements (SLAs) - Check for certified suppliers (e.g. ITIL)
Make	- Minimize input - Maximize output - Control risks - Comply to standards	- Reduce emission and waste - Efficient production technologies - Minimizing hazardous substances (e.g. RoHS, WEEE)	- Knowledge management - Knowledge management tools - Efficient coding - Use of lasting standards - Development of environmental software	- Virtualization - Grid computing - Cloud computing - Green IT hardware - Thin clients - Cooling and auxiliary
Deliver	- Underline commitment - Use standardized reporting - Cooperate with stakeholder groups	- Environmental marketing - Comply to transparency guidelines (e.g. GRI) - Customer relationship management - Comply to stakeholder standards (e.g. Greenpeace)	- Documentation - Comply to transparency guidelines - Training - Customer relationship management	- Environmental marketing - Comply to transparency guidelines (e.g. EU Code of Conduct for Data Centers) - Customer relationship management (e.g. ITIL)
Return	- Reuse all possible resources - Secure and manage remaining resources - Evaluate and improve	- Recycling of components - Use customer input - Safe disposal of waste	- Reuse of modules - Reuse of knowledge - Validate knowledge - Use customer input	- Reuse of infrastructure - Use of lost heat - Use customer input

4.5. Monitor and evaluate

In this step, the applied sustainability actions have to be measured and evaluated with appropriate indicators. This approach can help business managers to continuously monitor the efforts towards sustainable IS management. Indeed, the reporting is an essential part within the concept of corporate sustainability. Whilst it highlights inefficiencies in operations to managers, it can be also used for showcasing the sustainability efforts that have been undertaken by the company to reduce risks and seize opportunities for improving competitive advantage. This increase of transparency can improve the attractiveness of the company to investors and customers.

The reporting guidelines published by the Global Reporting Initiative (GRI) is the most widely used sustainability reporting framework and provides principles and indicators that can be used by organizations to measure and report their economic, environmental, and social performance [46]. These standardized guidelines make it possible to benchmark organizational performance with respect to regulators such as lawmakers or industry oversight committees. Moreover, it forms the basis to communicate organizational commitment to sustainable development and to satisfy the information needs of internal and external stakeholders.

In order to define appropriate metrics, the sustainability measures identified in Table 1 have to be translated into measurable goals [47]. The goals have to be in accord with the corporate strategy as well as with the basic conditions within each value chain phase (e.g. sourcing strategy). An example for such metrics within the *source* process could be the number of ISO 14001 certified suppliers or the percentage of suppliers with green or eco-labelled products such as the TCO label for IT equipment or the energy star label that defines certain energy efficiency criteria for each product [48].

For translating sustainability strategy into specific performance indicators, existent management systems such as the Balanced Scorecard by Kaplan and Norton can be widened with a sustainability perspective [49].

Another possibility for reporting the effectiveness towards sustainable IS management is to create a sustainability maturity model. Based on the capability maturity model (CMM) that has been designed by the Software Engineering Institute of the Carnegie Mellon University as a process improvement approach, a sustainability maturity model can be defined to set a guidance towards sustainable IS management via specific goals and management ratios. The allocation of the organization into certain maturity levels will show opportunities to improve its performance in order to get into the next higher level. In addition, the maturity level of the IS organization can be used as performance indicator to customers and other stakeholders.

4.6. Case of an IS service provider

To illustrate the procedural model of sustainable IS management, we apply it to an IS service provider (ISP). The ISP is mainly working for the airline and aviation industry. It has more than 3,000 employees in offices in 16 countries. Its consulting portfolio addresses all airline business processes. As a system integrator it is also running a sophisticated data center and covers the entire spectrum of IS services including consulting, application development and implementation, and reliable 24-hour operation.

Following the procedural model (Figure 3), the first step would be to identify all resources, capabilities and assets, of the ISP and grouping them within the categories of core, threshold and unnecessary. Besides others, the data center would be considered as a core resource. The next step would be an assessment of the data center along the IS value chain, to evaluate its externalities (see Table 1, column “Services”). In the *source* process it needs the constant availability of electricity and data lines from external suppliers. The *make* process consumes high amounts of electricity to create the services. In the *deliver* process the data center might provide services that are vital to other organizations. This leads to strong amount of externalities. From the portfolio analysis derives the recommendation of an investment in sustainable measures. These measures need to be identified. Concerning the energy consumption, concepts such as server virtualization or efficient cooling equipment might provide ways towards energy reduction. Limitations of any kind, e.g. financially, demand a prioritization of available measures that would lead to potential projects and an implementation. After the implementation the economical, ecological, and social effectiveness have to be monitored and evaluated before the process of sustainable IS management restarts.

5. Conclusion and future research

In this paper we have shown the relevance of sustainability within IS management. While the concept of sustainability has been successfully adopted in several sectors, the ICT industry is challenged to develop an own view on the topic of sustainability. We provided theoretical foundation to the topic and suggested a procedural model for implementing sustainability in IS management using the resource based view. This approach can be adopted by IS managers and CIOs for applying the concept into their daily business.

To refine the suggested model our future research will follow these next steps:

(1) Further rounds of case studies and expert interviews using the Delphi method.
(2) Integrated implementation of a sustainability strategy by adding sustainability into approved management systems such as IT-Balanced Scorecard.
(3) Development of a sustainability maturity model (Section 4.5) with certain management ratios to monitor and evaluate the progress of IS organizations towards sustainable IS management.
(4) Exemplary benchmarking of IS organizations on the basis of the maturity model.

IS organizations have to be aware that sustainable measures are necessary in order to remain competitive in the future. In addition to the enhanced efficiency through operations via product or service innovations, sustainability in IS management can improve the corporate reputation, the competitive advantage, and the attractiveness to investors and customers. Given the rising prices for energy and other resources the relevance of sustainability is destined to gain even more importance in the future. Hence, the concept of sustainability has an increased relevance for policy makers, practitioners, and researchers. As a result, we reason that sustainability is applicable in IS business and can have a positive impact on the IS business performance.

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