Key Success Factors for Sustainable Strategic IS Planning and IT Infrastructure

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Abstract: *Paper is intended to provide an expert view on the approach to transformation of business processes toward business sustainability, or sustainable business processes, with a focus on ecological thinking. Furthermore, it highlights the argument that approach to corporate sustainability is interdisciplinary process spanning from the fields of sociology to applied technological innovation and advances in the IT/IS sphere of influence. Through a review of an amalgam of very recent literature a versatile business model is recommended bridging together most effective strategic information system planning (SISP) tools for building a sustainable business processes to be deployed in practice. An article is intended to help high and middle management extend the notion of sustainable development to their every-day managerial activities while protecting the organization well-accepted business principles.*

Keywords: *Corporate sustainability, BPM, IS, IT infrastructure, Green IT and IS*

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Introduction

Information systems (IS) and Information Technology (IT) has in many significant ways contributed to the sustainability cause in the past decades as an instrument to raise awareness about ecological thinking, communicate and distribute information, increase productivity and optimize the use of natural resources, and reduce travel and transportation (Huang, 2009). However, all these deeds do not excuse these technological systems and constructs from continuing to stand up for the environment advocating and supporting sustainable business practices and systems. Powerful and wide-spread technology and significant role of information systems in our everyday lives are all reasons why IT and IS should be at the forefront of the battle for sustainability.

For almost four decades it has been a greatest challenge for IT&IS professionals and business executives to align the overall business strategy with IS&IT development planning and investments. This goal became even more ambitious when executives faced the need to reconcile the corporate IS&IT planning with green strategies and sustainable and ecological thinking. The reality is that the use of IT and IS systems significantly impact the environment at every stage of its life and use cycle: consumption of raw materials, energy and water in the production phase and furthermore the consumption of electricity by use of computer, servers, displays and other hardware. Furthermore, waste of computer components has becoming a tremendous problem due to its toxic content (Murugesan, 2008).

Green IS&IT strategy should encompass all the above mentioned stages of IT&IS system life, and at the same time be aligned with corporate business strategy. To achieve this goal companies, need a holistic, systematic and well-planned strategy, deep-seated in the principles of sustainable and ecological thinking toward addressing comprehensive set of environmental concerns. Reconciling the traditional companies' objectives, such as profits, costs and competitive advantage with environmental and sustainability targets is by far greatest challenge of all, however the following text will demonstrate that there are common factors which inevitably lead in the same direction.

Corporate Sustainability and IT&IS Infrastructure

In the past two decades the fight for sustainability has expended from regulators and government agencies to corporate world. Following the ecological thinking principles, aware business executives have formed an organization – World Business Council for Sustainable Development which has grown in 2000 to count 150 international companies (Dyllick and Hockerts, 2002). However, the locus of their fight for sustainability has been mainly dominated by *„eco-efficiency "*, e.g. energy saving strategies, recycling, utilization of sustainable products, which have for sure colored most of the companies' green (Dyllick and Hockerts, 2002, 131). Furthermore, companies have mostly focused on consumption of energy by the datacenters and extensive physical hardware machines and servers. According to analyst from Gartner Research, IT departments of fairly large companies spend about 5% of their total budget on energy costs, however the IT's „dirty secret "is that more energy is

consumed during the production and shipping process of hardware (PCs, servers etc.) than during its actual usage (cited in Saran, 2007).

Progressively standards for achieving sustainable business practices are becoming more demanding – besides the efficient use of resources and energy, companies should take into consideration the entire life-cycle of products and therefore reconsider many aspects of doing business in order to maintain the recognition of being compliant to sustainability standards. The decision to incorporate practices such as, life cycle analysis, environmental auditing and reporting, outsourcing decisions and choice of suppliers depending on their commitment to environment, are becoming a crucial element of companies' strategy and competitiveness (Elkington, 1994, pp. 91).

Environmental policies and guidelines have been primarily the task of government agencies and regulatory to be imposed on the corporates. In this arrangement the corporate world has adopted by inertia a very reactive role, in addition to the obligation of compliance. However, due to a very dynamic and changing market conditions, companies require an innovative and unique business practices which will add value to the entire business model and products and thus grant these companies a competitive advantage in its respective industry (El-Gayar and Fritz, 2006). A competitive advantage could be measured by an additional value added to products, better cost-management practices, a robust and efficient information system and IT infrastructure. During last decade many companies have discovered that incorporating sustainability into its overall long-term business strategy would possible grant them all the above, namely: additional value to products, better cost management and efficiency of IS&IT infrastructure. Achievement or retention of competitive advantage in its respective industry and stable stream of income should be the end-results.

Building the Theory of Corporate Sustainability

Business Process Management (BPM) approach

An approach to transformation and innovation in business practices is an interdisciplinary process with business-related and people-related content and issues concerning design and architecture. To measure the efficiency and effectiveness of processes in terms of the general behavior and practices, a maturity models have been introduced to the fields of Business Process Management (BPM) and Software engineering. These models guide organizations toward prioritizing activities and designing the roadmaps. De Bruin and Rosemann (2007) and Rosemann and vom Brocke (2010) developed a concept of BPM maturity model which contains six crucial components for successful and effective business management namely: strategic alignment of corporate goals, corporate governance, overall methods, information technology, people and culture (cited in Pernici, Aiello, vom Brocke, Donnellan, Gelenbe and Kretsis, 2012, 284). Thus, in order to get the most accurate diagnosis of companies processes to fix them and achieve better and more efficient business practices interdisciplinary approach as an amalgam of different fields of studies and perspectives are most needed.

Since corporate sustainability is entire company's target/goal affecting all of the business practices and departments – from hygiene maintenance, operation

processing and high level executive decision making – the most encompassing way to address this issue is through the Business Process Management (BPM). This phenomenon has been revolving throughout the decades and is very flexible to changes and innovation thus manager should use it as a tool to diagnose inefficiency and tailor the processes that will be highly efficient (supporting the main business goals) and highly sustainable (supporting the environment)- all at the same time. Seidel, vom Brocke and Recker (2011) emphasize that only through the employment of business process change and BPM methodology (process analysis, process performance measurement and process improvement) the altering capability and function of IS and the subsequently the role of IT, will be fully effective in transforming the business toward sustainable practices.

Coinciding roles of IS and IT in making of sustainable business

It is important at the very beginning to make a distinction between IS and IT systems as both are integral tools to sustainable business, however they differ in terms of ways of contribution to the cause, for example: IT is a set of products, mostly hardware, that processes, transmits and stores the data and promotes sustainability with a focus on energy saving, reducing the equipment waste and optimizing utilization. On the other hand, IS (information systems) is an amalgam of organizational goals and strategies brought to life through information system and software to achieve sustainable business practices (Boudreau, Chen & Huber, 2008). For example, Pernici, Aiello, vom Brocke, Donnellan, Gelenbe and Kretsis (2012) discussed the process of IS engineering with the focus on energy efficiency pointing out that application could be more or less efficient depending in the infrastructure in which it is running (different platform would require different levels of energy). Therefore, it is crucial to discuss the existing theories on the role of the hardware components (IT) in the building process of sustainable business model.

On the role of Information technology

In IT processes consumption of power by data centers and hardware have been popular topics; however, the power usage by networks has not been mentioned that often in the context of sustainable IT infrastructure. The fact is that networks consume more energy than data centers and this trend will be constantly increasing. Thus it is of crucial importance to consider the organization of business practices and systematization of human resources in regard to information processing and information sharing (Pernici, Aiello, vom Brocke, Donnellan, Gelenbe and Kretsis, 2012).

Huang (2009) defined t*he sustainable IT development* as a set of principles that takes into account at the same time and with equal importance the business goals and the environment. He proposes a new theoretical approach for the lifecycle analysis of IT equipment with an explicit focus on the sustainability and he calls it „sustainable system development lifecycle "(SSDLC). SSDLC includes six stages: sustainable planning, sustainable analysis, sustainable design, sustainable implementation, sustainable maintenance and sustainable disposal (Huang, 2009). At each of these stages environmental requirements should be in focus: energy- efficient equipment and power-management software should be used in the planning and design stages; system testing for energy consumption, proper installation, proper system migration during testing and implementation and proper

maintenance to ensure that system if working in the most efficient state to extend its endurance and detect any inefficiencies in time. In addition, effective and sustainable disposal of the equipment is a final, however, most important stage that has been in most cases neglected. (Huang, 2009). This theory of SSDLC should be guiding principles for all IS&IT and business executives in the process of transformation and changeover to sustainable business practices.

A more dynamic theory approach through the classification of degrees of effects of IT infrastructure on the environment has been developed by Hilty at al. (2006) and Kohler and Erdmann (2004) isolating three types of effects: first-order, second-order and third-order. (Cited in Dedrick, 2010, pp. 175). First-order effect is direct impact on the environment from IT hardware and equipment through the entire product lifecycle - from production to disposal. Second-order effects are impacts on the subsidiary processes such as transportation and industry and third- order effects are more complicated constructs whose effects have a power to change people's lifestyle and the economy, such as an example of home-business built on e-commerce platform (Dedrick, 2010).

Information systems

Even though their means of contribution to the sustainable corporate practices differ, a well-designed IS shall not be successful without efficient hardware components and in the long run such business model will not be sustainable in every aspect of its functional performance and end-result. The overview of the following theories will demonstrate the operational interdependence of IS and IT in the process of reaching long-term sustainable business-model.

Besides *the Real Theory of Management*, that represents the gold-standard guidelines for competitive and successful business practices, new theories have been emerging with a focus on ecological thinking and sustainability that besides the obvious fight for the environment, still guards the traditional profit-making and competitiveness mantra: such theories revolve mainly around the ideas of *eco- efficiency*, *eco-effectiveness*, *life-cycle analysis*, Lean & Green methodologies etc. (El- Gayar and Fritz, 2006).

Hart (cited in Boudreau, Chen & Huber, 2008, pp. 7) identifies three major sustainability goals, namely: pollution prevention, sustainable product utilization and clean technologies. On the level of firm or organization there are many means by which IS and IT could effectively contribute to all three mentioned goals, such as; using virtualization instead of physical servers (to prevent pollution), recycling computer (sustainable product utilization) and video conferencing or SharePoint for clean technology (Boudreau, Chen & Huber, 2008). Among these three frameworks of integrating sustainability into SISP, Boudreau, Chen & Huber (2008) also mention the key concepts of strategic alignment of business processes by using IS to achieve „aggregation, adaptation and arbitrage “, as well as the principles of ecological thinking („eco-efficiency, eco-equity and eco-effectiveness “) as drives toward sustainability of business practices trough the IS/IT deployment (Boudreau, Chen & Huber, 2008, pp.16).

Furthermore, Dyllick and Hockerts (2002) recognized the need to contribute to building a systematic theory of corporate sustainability and they introduced the model approach of six criteria defining three cases for sustainability, namely the business case, the natural case and the societal case. In most firms’ executives follow solely the principles of eco-efficiency in order to achieve positive net value

(economic value) in contributing to environment. Dyllick and Hockerts (2002) add to this business case yet another important criterion, namely the socio-efficiency as a new concept that correlates the firm's value to social impact suggesting that when designing a business case besides the eco-efficiency, socio-efficiency should also be used as a guiding principle. In addition to business case, two authors presented the natural case for corporate sustainability driven by the concept of eco-effectiveness and the societal case defined by socio-effectiveness and ecological equity. (Dyllick and Hockerts, 2002).

Belief-action-outcome (BAO) & Energy Informatics

Nigel P. Melville (2010) adds to the theory of corporate sustainability by analyzing the role of IS and innovation through the prism of two new disciplines, namely behavioral science and design science. A micro-macro model, called belief-action-outcome (BAO), has been developed with an intention to research sustainability issues on diverse levels of granularity and through the different theories and constructs since the field of IS applies many theories among which are some from its own field and many are from different disciplines such as behavioral studies, psychology, sociology, economics etc. (Melville, 2010).

Watson, Boudreau and Chen (2010) contributed to theoretical background by demonstrating a new conceptual framework – Energy Informatics. It is a solution- oriented interdisciplinary idea on how IS should contribute to sustainability with a focus on reducing energy consumption. In other words, energy informatics is a concept that models the relationship between energy and information using the tools from management science, design science and policy formation. It also important to mention that their interpretation and understanding of ecological goals is driven by above mentioned Dyllicks and Hockerts (2002) theories of eco-efficiency, eco-equity and eco-effectiveness. (Watson, Boudreau and Chen, 2010). Besides developing groundwork for a new theory, Watson, Boudreau and Chen (2010) underlined a several fronts where IS scholars and business executives should practice energy informatics, namely: research (9 core research questions have been proposed), teaching, Journals (by migration to electronic format and by actively publishing issues in sustainable IS) and through IS Association (Watson, Boudreau and Chen, 2010).

Competitive advantage: "undeniable" fallout of sustainable business practices

Translating its business practices and infrastructure to ecological and sustainable processes most practitioners and executives identify with high costs and low returns, however sustainability has become a global goal and most of organizational and firms had recognized sustainability issues as critical by incorporating it in its overall long-term business strategy. Those companies that have not done this yet are exposed to high risk of competitive disadvantage for many reasons: costumers worldwide are more environmental consciousness and prefer to buy products with green labels. Furthermore, elimination of many forms of waste (waste of resources, time, and energy) will ultimately lead to lower costs, higher profitability and returns (Boudreau, Chen & Huber, 2008). Practitioners warn that also the outsourcing decision should include, as a grading criterion, vendor's commitment to sustainable business practice. Companies will be ultimately more

motivated to comply with the sustainable standards due to the increased disclosure from companies in relation to their ecological profiles which will directly impact label, image and ratings in their respective industries.

Commoditization leading to sustainability

Making economic value of goods and services eventually will lead to reducing overheads and transactions costs, however according to Editor in Chief of *Computer Weekly* Bryan Glick, such commoditization could be a fertile ground for innovation. Consequently, innovation boosts competitive advantage and cost advantage if it channeled in the right direction toward sustainable development. As an example of services being commoditized for greater good, Glick mentions "cloud services" – large and expensive to maintain IT infrastructure (storage, processors and physical servers) is now replaced by 1GB archive disk space for a one US cent on monthly basis. Thus, cloud computing directly eliminates investing heavily in expensive IT infrastructure which enables firms from very beginning to save on large capital costs which further reduces the barriers for market entry for many firms. (Sako, 2012).

Conclusion

There are many approaches to corporate sustainability and environmentally sound business practices, but the questions still remain how are we to select the business model that will be committed to the environment, profitable and affordable at the same time. The most recent literature on SISP declares this to be a scientific question suggesting that academic research will eventually reveal a manual for the practitioners on how to bring together the costs and benefits of corporate environmental initiatives and transformations (Dedrick, 2010).

Literatures mostly agree that the competitive advantage from new IT technologies and IS innovations will be assured once these are accompanied with other factors such as corporate governance which is very focused on creativity and exploiting new opportunities along with very competitive top and middle management. (Del Giudice and Straub, 2011)

In the meantime, practitioners should keep in mind some of the key approaches to corporate sustainability highlighted in this paper. Most importantly, in designing a sustainable business model one should focus on interdisciplinary approach bringing together sociological, psychological, economical, technological and financial components to construct efficient and lean processes with minimal waste. In the following table are summarized some of the key factors, or in other words, key ingredients which are allowed to be used in the process of making sustainable and versatile corporate processes. All these factors summarized below stem from various disciplines.

Table 1: Summary of Key Factors

IT INFRASTRUCTURE	STRATEGIC IS PLANNING
Virtualization and cloud computing – consumes less energy; prevents the need for a data centers and prevents the need for extensive cooling systems.	CIO&COO awareness – Nexus between Operations and IT toward sustainable business practices
Using virtualization software to divide servers into multiple machines	BPM – a holistic management practices of measuring and re-designing the processes – transformation.
Replacing the old equipment with new energy efficient one – EPEAT and ENERGY STAR certified systems (LCD monitors instead of CRT technology)	LEAN methodology – elimination of all kinds of waste. Deployment of optimization systems Remote workers – less office space, less heat, less power, less commuting.
Power management – activate the power management features on servers and devices; system settings to hibernate and shut down.	Video-conferencing – with employees, customers and suppliers.
Using thin-client computers	Eco –metrics –measuring the use of energy & the levels of emission.
Recycle IT equipment properly: not carefully recycling practices are for companies' serious financial and information security liability.	Corporate environmental reporting Shared service centers
Use of renewable energy	Selecting a supplier according to their commitment to the environment (IS Value Chain)
Use Green IT Standards – Epeat (www.epeat.net), the Energy Star 4.0 standard and the RoHS Directive (www.rhos.gov.uk)	Completely eliminate printing and use of paper

Source: Table compiled by the author from various sources listed at the reference list.

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