Sustainable e-services

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Abstract. Information technology has transformed our way of life during the last decades. With Internet available to the masses, e-business, e-commerce, e-government, e-mail, e-education, and all the other e-something have popped up. What was once done with pen and paper, with a phone call, or by actually meeting people are now done over the Internet via e-services. During these same decades an awareness of the immense impact human activities have on the planet we live on has resulted in numerous initiatives in the struggle for a more sustainable world. E-services do have an impact on sustainability, and the methods used to model and develop e-services should be able to ensure the deployment of sustainable e-services. This paper explores why sustainability should be taken into account in the development of e-services.

Introduction

If we browse the Internet we will find companies, educational institutions, governments, special interest groups, entertainment, you name it and its there. All of them are offering some service or another, may it be a simple one as a text to spread information, or as sophisticated parts of an e-business system to provide a sales channel for your convenience. Along side the Internet revolution we have seen an accelerating downward spiral of environmental and sustainability impact. This is not to say that services offered over the Internet are to blame, but they do have an impact.

It is acknowledged that e-business and e-commerce has a sustainability impact, both positive and negative. A review of the research on the environmental impact of e-business and information and communication technology (ICT) made by Yi and Thomas gives a good overview of the research that has been done during the

last ten years in this field (Yi & Thomas, 2007). The dominant concern in the research presented is the environmental impact as the result of using e-business and ICT solutions, such as energy consumption, transport, and the computer industry. Some research has also been done on life cycle assessment and other methods to assess environmental impact from e-business (*ibid.).*

In this paper I will look at reasons for taking sustainability into account when dealing with e-services. Yi and Thomas (2007) have shown that the predominant research concern is with the resulting effects of e-business, not with the e-services that fuels e-business. Since the main focus is on the economic effect of e-business, very little research has been done regarding how to make the e-services sustainable and providing methods to aid developers to reach this goal. In fact, I have failed to find any research with this goal. The first two parts of this paper will explain the two concepts of sustainability and e-services, followed by a discussion high lightening the relation between e-services and sustainability.

Sustainability

In the scope of this paper sustainability refers to the notion stated by the Brundtland Commission that defines sustainability as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs." (United Nations, 1987). This line of thought is the backbone of sustainable development and a great deal of work has been put into efforts to live up to this goal. The best known of these initiatives are the Agenda 21 programme run by the United Nations (United Nations, 1992).

The Agenda 21 programme was revealed at the United Nations Conference on Environment and Development, also known as Earth Summit, in Rio de Janeiro 1992. This programme is divided into four sections covering pressing issues regarding; social and economic dimensions, conservation and management of resources for development, strengthening the role of major groups, and means of implementation (*ibid.*). The progress on implementing Agenda 21 was reviewed at the United Nations Earth Summit+5, in New York 1997, five years after the Rio de Janeiro conference, thus the +5. As a result of the conference it was recognised that even though positive results had been achieved related to the goals of Agenda 21 the situation was actually worse in 1997 than it had been in 1992 (United Nations, 1997). At the Johannesburg Summit in 2002, marking ten years since the adoption of Agenda 21, the United Nations once again stated that they should commit to the Agenda 21 program. As for the questions at hand they once again drew the conclusion that even though progress was made, the downward trend was still worsening (United Nations, 2002).

In practice sustainability refers to the efforts of minimising the negative effects regarding economical, environmental and social impact of an activity (*ibid.*), may it be by a production company, service provider, a governmental body etc. This implies that there is a way of measuring sustainability. However, far from all the factors that are taken into account are possible to express in exact figures. Furthermore the benchmark is not necessarily the same from case to case. Actors

and businesses have different kinds of impact on sustainability, thus different indicators come into play. There are also laws and regulations that have an impact on the benchmark for good sustainability performance.

The term *sustainability analysis* was introduced in 1992 by Barry Dalal-Clayton to broaden the scope of the Environmental Impact Assessment (EIA) procedures to include all the facets of sustainability and thereby creating a tool more in line with the content of Agenda 21 (Dalal-Clayton, 1993). EIA is defined by the International Association for Impact Assessment as "The process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made." (IAIA & IEA, 1999). The development of EIA is a direct result of the The National Environmental Policy Act of 1969 as it became the United States environmental law the first of January 1970 (The National Environmental Policy Act of 1969 (1970). Pub. L. 91-190, 42 U.S.C. 4321-4347) with the purpose:

> "To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality." (*ibid.*)

Sustainability analysis focus on a set of indicators that are simple and practical to measure thus providing a tool for trend and impact analysis of a project. Dalal-Clayton (1993) presents a few indicators in his article that reflects the type of indicators that he saw as relevant examples spanning the three main areas of sustainability; economical, environmental and social indicators. The indicators has since been more refined as well as given more emphasis to social aspects.

There are different approaches to how a sustainability analysis could be realised as well as what to do with the result. As for this paper the guidelines developed by the Global Reporting Initiative[1] (GRI) will act as the template to answer both these questions. The main reason for this choice is that GRI are a non profit organisation that targets every corner of the globe represented by a wide range of stakeholders. This implies that their method is generic in the sense that it doesn't favour any particular organisation or the goals of any specific political or national entity, although regulations that are enforced upon an organisation have to be taken into account. Furthermore, the underlying philosophy as stated by the Brundtland Commission, and the types of indicators that are used are roughly the same independent of source.

In the case with GRI the sustainability analysis is used to facilitate a sustainability reporting framework where organisations can set up a benchmark to their performance against norms, rules, self imposed standards etc. The benchmark can then be used to compare sustainability aspects over time and thereby identify areas that need extra attention or to demonstrate their commitment to sustainable development.

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[1] www.globalreporting.org

As mentioned earlier the indicators represent different aspects of economical, environmental and social impact. These are in turn divided into subcategories containing the specific indicators used to measure performance in comparison with different goals and earlier results. The performance indicators issued by GRI in their G3 guidelines (GRI, 2006) are divided into six categories; Environmental, Human Rights, Labor Practices and Decent Work, Society, Product Responsibility and Economic. Of the total sum of 79 indicators, 49 are labelled as core indicators identified to be of most interest to the stakeholders and the remaining 30 are considered additional indicators that represent emerging practice or are deemed as less relevant for the majority of stakeholders.

The indicators represented in the six sustainability categories are diverse and they broaden the focus from the core activities of an organisation to encompass local, national and global effects caused by their operations. Environmental indicators are those that typically deal with ecological aspects such as energy consumption, impacts of products and services, biodiversity and emissions. Human Rights focus on indicators concerning discrimination, child labour and human rights actions taken. Labor Practice and Decent Work indicators are associated with employment situation, salary ratio between men and women, hours of training per year and employee, rate of injuries and work related fatalities and equal opportunities. Society covers indicators to measuring the interaction between the organisation and its social context including community interaction, corruption issues and public policies. Product Responsibility is indicators that refer to life cycle responsibilities, customer satisfaction, product and service information, marketing communications and compliance with laws and regulations. And lastly Economic indicators that measures direct economic values generated, risks and opportunities for activities caused by climate change, market presence and indirect economic impact.

E-services

The term e-service is used to describe the phenomenon where services are made available by an information system. An e-service is characterised by being delivered via Internet; being web-based not requiring person to person communication but still interactive in nature, act as an information service providing quality by better information and content, and lastly the facilitation for self-service where the user effectively does work previously done by the service provider (Rowely, 2006). As a result of this, almost every conceivable web-based implementation, where a customer/user can interact with a provider of any goods or service, are considered an e-service by someone.

Arguably the lack of clear cut definition amongst the users of the term e-service is bothersome. But there is an historic reason for the diverse view. The term e-services was introduced to describe the complementary function needed to strengthen e-commerce and e-business (De Ruyter, Wetzels & Kleijnen, 2001). E-commerce has since been defined as “The process of buying, selling, or exchanging products, services, and information via computer networks.” (King &

Turban, 2003). E-business is then considered to be a broader definition of e-commerce including servicing customers, collaborations, and electronic transactions (*ibid.*). In both the narrower term e-commerce and in the broader term e-business the concept of service is used and it is the implementations to cater these service needs that are termed e-services. Since e-services are derived from the earlier concepts it is not difficult to understand the confusion about what should be called an e-service and what should not.

From an e-service provider's perspective an e-service is just one of many systems to fulfil business goals. Other systems deals with order handling, procurement, shipping, customer support as well as hardware aspects such as networks etc., and all of these different systems need to be closely integrated to achieve a successful online company (Cox & Dale, 2001). In this multitude of different system components, the parts that deal with customer relations are usually referred to as Customer Relationship Management, and are largely relaying on e-services when conducted in a web-based environment. In this perspective e-services will be related to all parts of the system where customer relations have a role to fill. This role may range from pure services such as providing information to a part of e-commerce with the aim to sell goods (Voss, 2003).

It has become increasingly important for businesses, and thereby e-business, to look at the life cycle cost of products and services. Life cycle cost is the measurement of the combined cost in economical terms during the total lifespan of a product from the time it is conceived until it is faced out and no longer supported. This cost includes all costs associated with the product even less obvious ones such as environmental impact and disposal (Dunk, 2004; Barringer, 2003). The product may be tangible or non tangible in nature. Since many of the costs by the nature of business to customer relations will be related to the customers, e-services will play a role for e-business in their effort to estimate life cycle cost. And according to Dunk the profiling of customers is in itself one of the reasons for a business to use life cycle costing in their organisation (Dunk, 2004).

Both life cycle cost and sustainability reporting are used as prognostic tools to plan for the future as well as performance indicators to validate the success of an activity. They are not dependent on each other but they should be able to complement each other, and life cycle cost estimation already includes certain aspects of sustainability assessments.

Discussion

It is obvious that e-services play an important part as a mediator in the information flow between users and different parts of business systems. Furthermore, e-services support the activities of an actor's presence on the Internet, as well as the actor's internal activities. An actor in this case may be a company, organisation, institution, government or part there of, etc. One of the characteristics of services, and this should hold true for e-services, is that it is

non-material in nature. This however is not the same as saying that the use of e-services doesn't play a role in activities that have a very material result.

Dimensions of e-services

As a reference to the degree of digitalization of a commercial activity Whinston, Stahl and Choi (1997) made a diagram (Figure 1. The dimension of electronic commerce) to show where on the scale from traditional commerce too pure electronic commerce an actor would be found. They describe the market as composed of three components; agents that interact with the market, products on the market, and processes where agents interact in regards to the products on the market. Each of these three components can be either physical or digital. Physical are defined as activities taking place offline such as buying a car at a car dealership. The person buying car is a physical agent, the car is a physical product, and the transaction is a physical process between two physical agents, the buyer and the car salesperson. Digital on the other hand are activities taking place online such as searching the web which is done by a digital agent, the person doing the search. The execution of the search is a digital process, and the search result is a digital product.

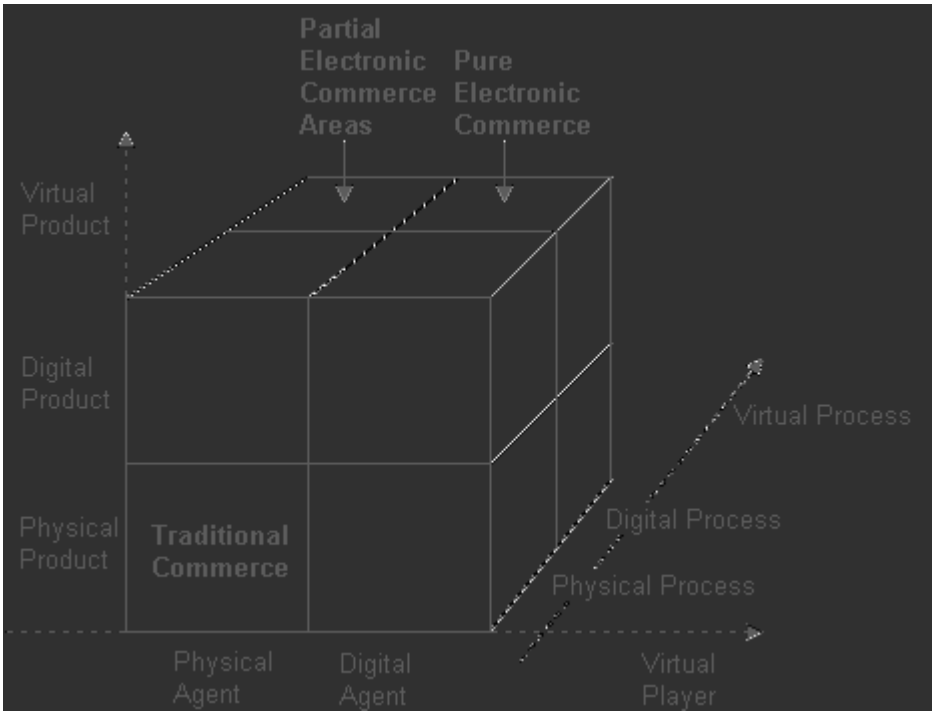

Figure 1. The dimension of electronic commerce, (Whinston, Sthal & Choi, 1997).

An e-service is by nature a digital process done by digital agents. The product can be digital or physical depending on type of service. An e-service that has all

three dimensions in the diagram above classified as digital would be considered a pure e-service. In analog with the naming convention of Whinston, Stahl and Choi e-services that have more physical aspects are considered partial e-services. Worth to notice is that even if the e-service is purely digital it may trigger other activities that are not.

Pure e-service

Pure e-services, such as a search engine on the Internet, will still involve goods changing hands at some level. Of course, from a user perspective a search engine is perceived as a pure service. On the other side of the fence, the e-service providers, the life cycle cost of the e-service has a substantial material impact caused by the operation. Google[2], for example, act as a pure e-service providing a search engine as the core service. They have also developed a lot of other services; such as Gmail as an e-mail service, Google Calendar as a personal time management service, Google scholar as a specialised search engine for academic publications and articles, Google maps that is a service that allows for place searches and exploration, and the list could go on. All of these are examples of pure e-services, but they still have a life cycle cost and sustainability impact.

Partial e-service

As we move along the scale from pure e-services to e-commerce where goods are changing hands, the clear cut non-material property of services becomes more blurred. The reason is, and it becomes obvious when looking at the characteristics of e-services, that even though the e-services are non-material, its function is often as support for very tangible activities. Thus even though the deliverables facilitated by an e-service is non-material, its supportive nature often triggers other actions that are not.

A company that could be considered to be on the opposite side of the e-service to e-commerce scale in regards to Google is Amazon.com[3]. Googles main commodity is information and their e-services are all tailored to provide accessibility to information. Amazon.com uses e-services in a supportive manner to provide information regarding products, but the goal is to sell goods. Naturally one of these supportive e-services is search functionality, which is a function that is more or less taken for granted by the users of any serious e-business.

Amazon.com has also a lot of other functionalities to support the user in searching and information retrieval amongst their products. These could all be considered information gathering e-services, but still its purpose is to guide the user to finalise the buy. An important e-service for Amazon.com is tailored towards user involvement. This allows the users to comment and review the products as well as grade and comment what other users have contributed with.

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[2] www.google.com

[3] www.amazon.com

For the user, and Amazon.com, this creates a wealth of information about the products. From a consumer point of view this is a good thing, and for Amazon.com as well, since it will hopefully draw more business their way. Some aspects of life cycle cost and sustainability impact is more obvious in the case of Amazon.com. The reliance on manufacturing of the products they sell and the need for transportation of purchased goods to the customer is easy to conclude.

In the case with Amazon.com, it is easy to recognise that the use of e-services as an end result will have sustainability impact, and that they have a responsibility for how this sustainability impact will manifest itself. This responsibility is not always as evident. If a company provides a service that act as a meeting place between different users there is a higher degree of complexity in how to express life cycle cost and sustainability issues. An e-service as that provided by eBay[4] is in a sense a pure e-service. It is a trading place where people can meet to exchange goods, but eBay itself doesn't provide the goods. Ebay just provides a place where sellers and buyers can communicate in order to do business. This in itself is a pure e-service. Never the less, it triggers a lot of actions that has sustainability impact, mainly in the form of transport to deliver the goods between the users.

In all the examples above the use of e-services in there own right or as a mediator, triggers actions that have an impact on life cycle cost and sustainability impact. This means that when a life cycle cost approach is taken into account there will be a multitude of effects to consider when developing an e-service. Both are connected to, and caused by, the different activities that are related to the e-service during its entire life span. The majority of these life cycle costs are of course no different from any other software development endeavour. However, when deployed, the use of an e-service will trigger actions that will have an impact on the life cycle cost of the e-service itself, but in many cases also the life cycle cost for other services and products, since e-services often act as support for such activities.

Further work

How to relate to sustainability impact caused by e-services during its life cycle is certainly an area for further research, as is the need for research on the complexity related to the effects triggered by the use of e-services. The later is in many ways a precursor for sustainability impact analysis since it will be impossible to assess impact without the knowledge of the total scope of the activities affected by the e-service. Sustainability impact in itself is at least measurable in accordance with the variables proposed by GRI and similar initiatives. The question at hand becomes how to take these variables into account when modelling the e-service itself.

This paper has only touched the surface when it comes to the issues of sustainability in relation to e-services and there are many avenues for further work. A logical starting point would be an in depth analysis of traditional system

[4] www.ebay.com

engineering methods as these are often utilised in e-service development. This should be followed by an investigating of to which degree system engineering methods support e-service modelling as a concept of its own, thus providing e-service modelling as a method for defining the service to be realised by means of system engineering paradigms. And finally, the goal is, to explore methods for sustainable e-service modelling.

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