The key factors of successful sustainable development: e-Government in Saudi Arabia as an example

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Abstract The increased dependency on Internet applications and emerging technologies created a need for a technology that provides scalable, robust and most cost effective solution. Sustainable development is not only ensuring a better quality of life on the global scale; but also including environmental, economical and social concerns. Taking e-Government service as an example of sustainable development; it allows an organization to automate their business processes to better manage those processes, and therefore better manage of their services. This paper addresses the key factors of successful sustainable development. Best practices and lesson learned on implementing e-Government service in Saudi Arabia will also be addressed.

Introduction Recently, sustainable development has gained more and more popularity. The EITO (European Information Technology Observatory) expects that the growth rate of the IT markets in Europe will become very close to that in the US. The European ICT (Information and Communications Technology) market is expected to maintain its growth rate over the years (IEE 2003). Sustainable development is the era of “e,” hardware, software, service and people. This introduces the e-Government service; where information or tasks are passed from one participant to another for action, according to a set of organization procedural rules. Therefore, in the early years of the 21st century, Saudi Arabia considers information technology as the potential for making major contributions to sustainable development through the implementation of e-Government services in its ministries and agencies.

The purpose of this paper is to discuss the factors of successful sustainable development in information technology. The first section introduces briefly the global sustainable development. Then, light will be shed on the key factors of successful sustainable development. After that, practices on implementing e-Government service in Saudi Arabia are described and discussed. Finally, conclusions and recommendations will be given.

Global Sustainable Development Sustainable Development could be defined as world commission on environment and development that emphasises the importance of ensuring the satisfaction of present need and for the generations to come (Griese, Mueller, Reichl and Stobbe 2001). It combines environmental, economic and social concerns. The success of sustainable development concept relies on the stakeholders. It depends on their ability to start a dialogue among business, civil society and governments; and create a common partnership for progress on a global and local level. More, its future depends on the ability of integrating developing nations and nations in transition into this process (Griese, Mueller, Reichl and Stobbe 2001). The first step for sustainability calls for business in the field of information and communication technology to achieve more value from lower inputs of materials and energy with reduced emissions. The following objectives refer to the whole lifecycle of ICT service: reducing the consumption of resources, reducing the impact on nature and increasing service value (Griese, Mueller, Reichl and Stobbe 2001), (Griese, Stobbe, Reichl and Stevels 2005).

The first objective is to reduce of the consumption of resources. Processes and services should be redesigned and innovated to minimize the absolute use of resources (Boyle and Coates 2005), (Griese, Stobbe, Reichl and Stevels 2005). Similarly, feasible studies and estimates have to be conducted to achieve the actual cost of resource depletion, where consumption of resources must be considered over a sufficiently long time scale (Boyle and Coates 2005). Hence, future generations will not be disadvantaged economically, socially or environmentally, by excessive and unnecessary consumption. The second objective is to reduce the impact on nature. Environmental damage should be considered when using renewable resources. It should be used within sustainable extraction or harvest rates. Waste discharges, i.e., air emissions, water discharges and dispersion of harmful substances, should be within short term assimilative capacity of the environment (Griese, Mueller, Reichl and Stobbe 2001), without long term accumulation (Boyle and Coates 2005). Finally, increase the service value. Service value increases by providing services or products that match the true functional needs of the customers (Griese, Mueller, Reichl and Stobbe 2001). This would ensure smooth operations at every stage of the process.
Key Factors of Successful Sustainable Development

Several investigations were made into organizations in the world to highlight the sustainability factors, including the area of information and communications technology in European market. European market is being fuelled in part by the need to revise business practices to take advantage of developments in e-Commerce (IEE 2003). Since 1996, European information technology market managed to have an increase to about 9% (IEE 2003). Such a growth rate is difficult to match in any other sector of the economy comparable in scale or importance with information and communications technology. The European ICT market is expected to maintain its growth rate over the years. The lifecycle of ICT service mentioned in the previous section is considered as the initial step towards e-sustainable information system. Considering other organizations, the drivers for this growth are discussed as follows:

The increased impact of Internet technology for internal knowledge management applications and for Business-to-Business (B2B) e-Commerce contributed in IT sustainability (IEE 2003). At the beginning of 2006, the number of citizens online in the world reached up to 1.018 billion, 20% were in the United States. The combination of technology and information creates a network effect where businesses, citizens and government come together in search of new products and services (Cohen and Eimike 2003). It is revolutionary because of its speed and global aspect which impacts the traditional market place and introduces new concerns. In 2004 the Saudi Government started a project to equip each citizen’s house with a laptop, as it considers IT to be a form of sustainable development. At the beginning of 2006, the number of citizens having this technology reached around a million. Therefore, as the community interacts with the Internet, the incorporation of web-enabling capabilities into applications and databases is necessary. This is achieved through enabling easier and effective upgrade of legacy systems into networked intranet/extranet application environments. As a result, collaboration between citizens will be done seamlessly and it will increase the quality of life of e-sustainable solution with much less impact on the environment (Wimmer and Bredow 2002). Moreover, the adoption of Internet Protocol (IP) is gradually becoming the preferred platform for fixed and mobile services integration and enabling more cost effective voice and data integration.

The Strategy Analysts are expecting that the number of Global System for Mobile Communication (GSM) users will increase from 1.7 billion at the end of 2005 to 2.5 billion by the end of 2010, a 38% penetration rate. In Saudi Arabia, many contracts were signed with various companies to operate the 3rd and 4th generations of GSM technology. This in turn reduces the cost of data communications; as a result of increasing availability of broadband technology and new generation packet switching technology. Hence, having a collection of service alternatives, the more sustainable product would be selected for use. This will make sustainability the goal of the citizen, the product analyst and the designer. As a result, using open systems would comply with technology standards where the technology should be fully opened; and provides 100% of its API (Application Programming Interface) in both Java™ and Microsoft™ development worlds. Moving towards sustainability in an organization means an organization planning its resources through knowledge sharing between designers, developers and other employees rather than being people dependant. Organizations still could deliver to the world their services in the absence of an employee. All of these factors work together and state that the implementation of an IT solution is an ongoing activity.

E-Government Service in Saudi Arabia

This section of the paper would discuss and describe one of the successful stories of e-Government services in Saudi Arabia, as an example of sustainable development. Since 1995, Saudi Arabia planned the implementation of e-Government services in its different ministries. In 2002, Ministry of Finance analysed and studied the implementation of SaudiEDI (Saudi Electronic Data Interchange) project (Al-Mousa 2005). The goal of this project is to build and operate its business and technology infrastructure to serve government organizations and the trade sector of Saudi Arabia. Through its services provided, SaudiEDI will help government agencies and businesses to simplify their work processes and improve productivity through the use of information technology (Al-Mousa 2005). The implementation grows slowly due to some reasons that will be discussed later. In 2005, the Ministry of Finance accomplished 20% of the project where incoming documents could be processed electronically (Al-Mousa 2005). In 2004, Ministry of Petroleum and Minerals studied and analysed its internal business process to build an e-Government solution, called “Correspondence Management System.” This system handles all incoming and outgoing correspondences to the office of his Excellency the Minister of Petroleum and Minerals. In November 2003, the system was completed and went into production and is considered to be the first vital and leading sustainable e-Government solution in the Kingdom. Accomplishing such a project went through several scenarios with various stakeholders. In this section, benefits of e-Government service will be presented. Then, the technology used to implement such service will be introduced. Finally, different layers of security for e-Government services will be given.
Benefits of e-Government Service
There are common issues raised when a government acts to implement new technology. These issues include costs, benefits of adopting new technologies and other effects on productivity and customer service (Jackson and Curthoys 2001). Government differs from private sectors in important ways due to politics and media scrutiny. Government requires vast amounts of information in making decisions and delivering services. The goals and the objectives of e-Government derive from areas that government most needs to improve in the 21st century. The following are the benefits gained from implementing e-Government:

One of the benefits of e-Government service is implementing a paperless environment that would eliminate the paper shuffle and save time and money through reducing photocopying, hand delivery and repetitive dragging and dropping activities. E-Government service improves internal paper processing and information sharing. An important internal use for e-Government is to have immediate delivery of mission-critical information. Implementing such services allows for access and exchange of information in real time. It also helps to prevent missed deadlines, project delays and costly rework due to miscommunication between task performers. More, it provides Government-Public interaction. E-Government is the most effective technology to accept and respond to requests for services (Cohen and Eimike 2003). Citizens are one component of e-Government. According to Oracle Magazine: “we should have quick access to information and authority to make decisions so that we address customers’ needs and concerns… and really be of service” (Al-Shaikh 2002). Moreover, e-Government provides online reports and audit trials. Decision makers need to review the performance of users, for example, make sure tasks are not late or overdue. Advanced audit trial, coupled with the automatic notifications, offers powerful assistance for decision makers to monitor efficiency and guarantee requisition completion. The previous benefits would make the e-Government system works smoothly. When the system is accessed by the public and citizens, security has to be designed and implemented to assure information and decision security and privacy, since failing to implement the appropriate security mechanism would result in project failure. This feature will be discussed in the following sections.

Technology used to implement e-Government Service
When building an e-Government system, the concept of sustainable development is realized. The system has to be scalable with very high availability, reliability and performance regardless of the amount of content and/or users. The solution also has to integrate the new features brought by acquired solutions into its core server over the time instead of keeping separate solutions with redundant features (Jackson and Curthoys 2001). More, it should be Unicode compliant by using the universal transformation format-8 (UTF8), which means that it shall support single-byte languages such as English, French, or Italian, and double-byte characters like Arabic, Korean or Japanese (Kanji). The content should be available anywhere and anytime. The solution should comply with technology standards. When implementing e-Government services, the following technologies have to be considered:

Document Management
Many content assets within an organization follow a consistent path through the content lifecycle: content is created, reviewed, revised, and approved, then used and ultimately superseded or discarded. The content’s life and the business processes stages can be automated using workflows. Workflows formalize the steps in a business process; lifecycles define the business rules for changes that apply to content as it moves through the stages of its life (such as Draft, In Review, Active, and Obsolete). Document management manages the complete lifecycle of office documents from collaborative authoring to archival; key features include indexing, check in/checkout, versioning, annotations, workflow, and life-cycle management. Fig. 1 and Fig. 2 show content life cycle and content workflow respectively (Meckel 2004).
Document Imaging

Document imaging has a high visibility when implementing a sustainable application. It replaces high cost, legacy systems with standards-based, high performance platform for all unstructured content. It is the software for scanning, indexing, retrieving, and archiving digital images of text, graphics, engineering drawings, and photographs (Meckel 2004). Typically systems provide workflow functionality and limited document management functionality.

Web Content Management (WCM)

One of the sustainability factors is the incorporation of web-enabling capabilities into applications where WCM could be used. It is the software that enables the collection, assembly, staging, maintenance and delivery of textual and graphic content for the primary purpose of disseminating information via the web. The standard definition of WCM includes both a staging and delivery component (Meckel 2004). Table 1 summarizes content services. The first step in WCM is to collect the relevant content and add it to the corporate content repository. Content comes from a variety of sources, both internal and external to an organization. Then, content files will be stored natively in all known formats, including rich media or compound formats. Each item in the repository is protected by powerful and flexible security called Access Control Lists (ACL). It controls who can access the content and the level of access each party has where content can be encrypted in the repository or when it is delivered to a user. WCM is responsible for managing links between related content and treats content in multiple formats as part of a single document, called a compound document or virtual document. Finally, assembly and publishing services can be integrated with popular commercial word processors and publishing tools.

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<th>Content Services</th>
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<td>Create/Capture</td>
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Table 1. Comprehensive and Unified Content Services

Computer Output to Laser Disc (COLD) / Enterprise Report Management

Enterprise reports are created from home grown applications or ERP/CRM packages like SAP™, PeopleSoft™, Oracle™, JD Edwards™, Baan™, and Siebel™. Enterprise report management would manage the lifecycle of large collections of digital assets, such as photographic images, graphics, brand logos and compound documents. This would increase the content value and reduce the total cost ownership as the aim of sustainable development.

Records Management

Records Management is the software for managing long-term document archives through each document’s full lifecycle, including the systematic expunging of documents at the end of specified dates. Normally, records management is performed at the platform or the client level to apply and enforce retention and disposition policies across paper, email and electronic documents. It identifies and captures records with minimal burden on users; providing scalable e-sustainable solution through the automation process. More, it reduces operational costs and human error with centralized policy control.
Security of e-Government Service

Building a comprehensive e-Government solution is a big challenge and a quite complex task. There are already available several generic models that address distinct issues of a complex system on different abstraction levels. The information architecture of Moke (Mok 1996) and the Business Media Framework of Lechner / Schmid (Wimmer and Bredow 2001) provide generic models to slice a complex system into several layers of abstraction. Based on these two models, security has to be investigated on four levels: strategic, process, interaction, and data and information (Wimmer and Bredow 2001).

• Security on the Strategic Level
On the upper layer of abstraction, it is the responsibility of the organization that intends to apply an e-Government service to define overall security strategies. The high level authority responsible for an organization must define security issues such as identification, authentication and degree of confidentiality. In addition, security architecture shall be implemented. The application developers need to consider these security issues. The technology used shall be mapped to existing laws and security decrees.

• Security on the Process Level
This is the responsibility of application designers. Different types of processes could be generated, therefore, multiple levels of access security has to be defined. The whole workflow needs to be investigated and designed to the existing security decrees. Hence, specific security solution has to be designed. The security analyst has to investigate the security of each process. This includes data, client, server, transactions and the type of application protocol, i.e., HTTP or FTP.

• Security on the Interaction/user Level
The interaction level handles knowledge flow of a process. As a user in the application system receives an information object; he will be a part of that process. At this stage, security has to be considered. Different security aspects have to be applied including identification, authentication, digital signature and data integrity by keeping a full record of requisitions and preventing users from deleting earlier versions. More, monitor the efficiency and track requisition completion. Finally, secure the decision made by a user.

• Security on the Data and Information Level
At the data and information level, different security issues have to be applied on the physical and logical data access. Several security mechanisms can be used like firewalls, SSL, data cryptography, proxy server, etc. The implemented applications have to fit into those mechanisms. Applications should be built at a specific system layer. In addition, administrators within e-Government system should use the same standard software. Hence, security on data and information level will be achieved.

Conclusions and Recommendation
In this paper, the factors of successful sustainable development were given. Several technologies and components to develop sustainable services were highlighted. Organizations can accomplish their goals by acquiring knowledge about the technology. Also, community groups can move towards technological sustainability that will allow them to reinforce positive, environmental impacts through the use of information technology. Designers and researchers have to continue to receive feedback from community groups regarding their involvement in the process. At the same time, practices and lessons learned have to be considered when implementing e-sustainable solutions. Technologies discussed offer greater opportunities for governments and organizations. It offers new visions for the future and new ways for sustainability. There are many other technologies that have to be investigated and analyzed based on lifecycle of information and communication technology. Therefore, implementing an IT solution should be technology driven. It is an ongoing process activity through selecting a sustainable solution for present and future needs. Further research in the field of security is necessary to accommodate the rapid growth of Internet applications and regional economic development.

References

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