Identifying the Contemporary Status of E-Service Sustainability Research

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ABSTRACT

Sustainable development is a world-wide major concern, required in every domain of life, including that of government. E-services are widely acknowledged for the contribution they make to e-government. The research question raised in this study is: What is the existing status of e-service sustainability research? The research method used is a literature study that adopts a concept-centric approach. Selected literature was then analyzed using the twin concepts of e-service sustainability itself and the enabler (secondary) effects of sustainable e-services. The Triple Bottom Line's model was used to further categorize the findings using economic, environmental, and social sustainability concepts. The results of the study revealed a lack of research into e-service sustainability. By way of contrast, it revealed 20 articles that cover the enabler effect. Existing research is related to economic and social dimensions, with the most common topic being related to user satisfaction.

Keywords: *e-Government, Enabler Effects, e-Services, Government e-Services, ICT, Sustainability, Triple Bottom Line Model*

INTRODUCTION

E-services are beneficial to citizens worldwide in many ways; indeed, they have been proven to be important enablers of successful e-government (Stamoulis et al., 2001). The number of e-services in use is increasing in both the developed and the developing world (DESA, 2012). In addition to the direct benefits of e-services, they can impact on other interdependent systems, such as economic, environmental and social systems. This is possible because e-services utilize pervasive computing devices, such as the Internet and other ICTs. To date, the e-service concept is relatively new and not well defined (Islam & Scupola, 2011). In its broadest sense it could cover almost any sort of digital application. E-services are of particular interest in the public sector because of their potential to increase efficiency as well as effectiveness (Haque & Pathrannarakul, 2013). In this paper we delimit our scope to focus only on e-services

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in the public sector. We limit our definition of e-services in the e-government domain to "the electronic delivery of government information, programs, and services often (but not exclusively) over the Internet" (Dawes, 2002).

In this paper, we perceive e-services to be a subfield of e-government, which in turn is a subfield of the IS/ICT domain, see Figure 1. This means that research into IS, ICT, and e-government in general is also relevant to the field of e-services and vice versa.

Researchers have pointed out the positive and negative impacts of ICTs on economic, social and environmental systems (Mitrea et al., 2010; Hilty et al., 2006). Sustainability, which is considered to be a positive impact, has become an increasingly important concern for political, social and economic reasons. Thus, the number of technology-related sustainability studies is increasing (Mitrea et al., 2010; Viet et al., 2011). This growing interest in the sustainability of e-government is indicated by a comparison of UN e-government surveys undertaken in 2010 and 2012: the number of instances of the term *sustainable* increased from zero to 41, respectively.

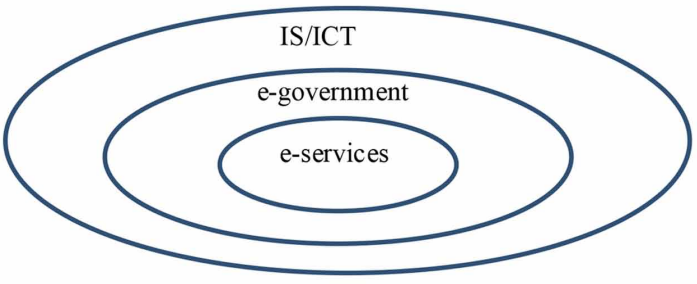
Sustainability largely emerged as a concern following the United Nations Conference on Human Environment (UNCHE) held in Stockholm, Sweden, in June 1972. The most recent UN conference, Rio+20, was held in Rio de Janeiro in June 2012. The message that came out of Rio+20 was one reason for selecting the e-government domain, and specifically research into e-service sustainability, as the subject of this paper. E-government in general, and e-services in particular, are both emerging fields; indeed, they are the focus of governments all over the world. Investigating the status of research into the sustainability of e-services will make it possible to direct future efforts within this field.

The research question raised in this study is: *What is the existing status of e-service sustainability research?* The boundaries of the study are limited to e-services in the e-government domain. E-services are one of the major components of e-government and sustainability is the requirement of all systems, irrespective of the domain to which they belong (UNCSD, 2012).

The main motivation factor for this study is to gain an awareness of the importance of sustainability and sustainable development in all sections of society for the better economic, social and environmental survival of humanity; indeed, this was one of the indirect messages of the Rio+20 conference (UNCSD, 2012). The contribution of the paper is its investigation into existing research on the sustainability of e-services. Such an investigation does not, as yet, exist.

It seems as if sustainability should be a major asset to public e-services, if one considers the potential benefits of digitizing manual services, such as income tax declaration, renewal of medical prescriptions and online voting. According to Axelsson, Melin and Lindgren (2013), the two major goals of public e-services are efficiency of government and benefits for citizens. In a

Figure 1. Relationship between the fields of e-services, e-government, and IS/ICT



world where all kinds of resources appear to be scarce, increasing the number of efficient public e-services seems to have the potential to meet the demands of a sustainable society.

To date, research has focused on two aspects of e-service sustainability (Mitrea et al., 2010): first, the sustainability of the e-services themselves and second, the sustainability enabler effects of e-services as a means to achieving something else. When we use the term *sustainability of e-services*, we refer to the design and implementation of e-services in terms of ecological, economic and social responsibility. This aspect, which can include information overload for users, security risks and the criminal use of Internet applications, is a neglected perspective of research in this area. Just because a service is transferred from manual to automatic doesn't mean that no resources are consumed or that risks disappear. As an illustrative example, one study found that the performance of two Google search operations consumes as much energy as boiling a kettle of water. A Google search produces 7 grams of CO2 while boiling a kettle of water produces 15 grams (BBC 2009). When we talk about *sustainability enabler effects*, we refer to e-services not as isolated phenomena but as being integrated within a context that involves people and other systems, both manual and automatic.

According to Bengtsson and Ågerfalk (2011) and Klischewski and Lessa (2012), sustainability research in IS and e-government respectively is in its infancy or is even ignored. The long-term success of some projects, such as those involving e-government, is dependent on its sustainability (Klischewski & Lessa, 2012). We believe, therefore, that sustainability research does actually exist. And since e-services are significant to e-government, they are a suitable point of departure.

The main motivation factor for this study is an awareness of the importance of sustainability and sustainable development in all sections of society for the better economic, social and environmental survival of humanity; this was one of the indirect messages of the Rio+20 conference (UNCSD, 2012)

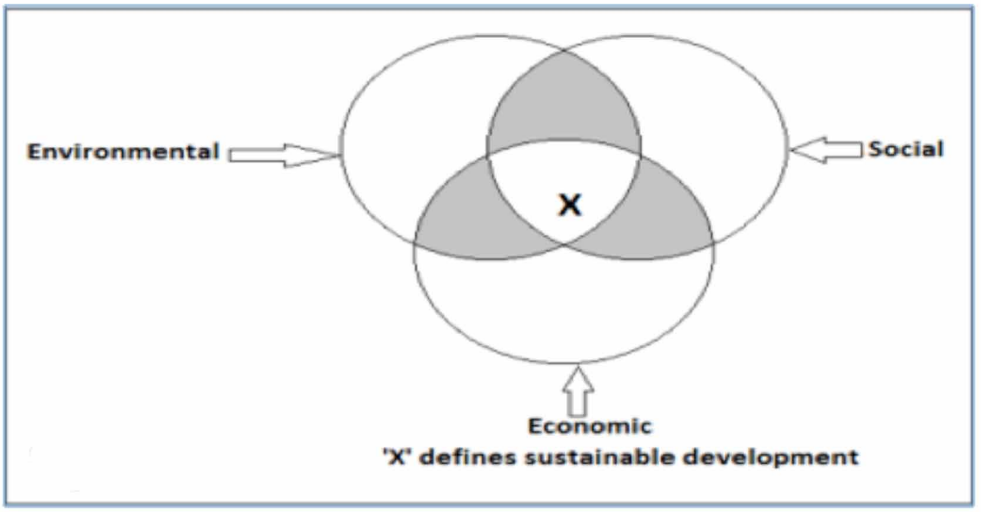
The paper is organized as follows. Section 2 gives the theoretical background of the study, including a presentation of the Triple Bottom Line model. In section 3, we introduce the method of the literature study. In section 4, the results and analysis are presented. Finally, section 5 includes a discussion of the analysis, together with any conclusions and implications.

THEORETICAL BACKGROUND

Sustainable development has no single universally accepted definition; indeed, it has mostly been operationalized in accordance with the relevant context or discipline: for example, in frameworks utilized to carry out sustainability studies of natural resource management systems, such as the Pressure-State-Response (PSR) framework; the framework based on indicators for natural resource management evaluation (MESMIS, *Spanish acronym*) and the Quantitative Analysis of Land Use Systems (QUALUS) framework (Ridaura, 2005). In this study, we have adopted the definition of sustainable development put forward by the Brundtland Commission of 1987, in which sustainable development was defined as 'the development that meets present needs without compromising the ability of future generations to meet their needs'(IISD 2012). This definition is general in nature and widely accepted; thus, it serves our purpose. In order to provide a more domain-related definition, we also used Kanungo's (2004) definition of sustainable investments as 'those whose benefits keep continuing into the future'.

Several theories and models have been used in sustainability research (Loukola & Kyllönen, 2005). Some models exist for the study of sustainability in different systems; for example, the three-legged sustainability stool, circles of sustainability and the GREENSOFT Model for studies of software. In general, two models of sustainability are referred to more often than others. Firstly, some models are based on the Triple Bottom Line (TBL) conception; for example, the three ring circus, three pillar model

Figure 2. The triple bottom line's model

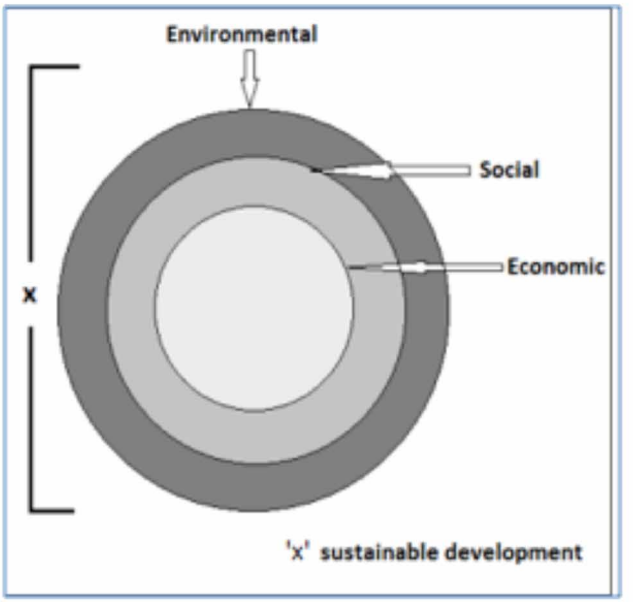


or Venn diagram, as shown in figure 2. The second is the Russian doll model or three nested frequencies, as shown in figure 3. The Russian doll model incorporates the environment as a pre-condition for the other two dimensions of sustainability. The pillar of sustainability or three ring circus model, on the other hand, defines sustainability as the intersection of three dimensions. Several studies of sustainability invoke the idea of sustainable development by using the three ring circus model (Levett, 1998). In this study, we used the three ring circus model that is based on the TBL conception because it incorporates all dimensions of sustainability equally, unlike the Russian doll model, which focuses on the environmental aspect. The three ring circus model is the one most often utilized for sustainability studies. According to Dao et al. (2011), it is used by 68% of the top 250 global companies on the Fortune 500.

Like Viet et al. (2011) and Mitrea et al. (2010), we adopted the Triple Bottom Line's (TBL) model for our perspective on sustainability (Slaper & Hall, 2011). The Triple Bottom Line's model for sustainable development has also been referred to as the three pillar model and the three ring circus. We adopted the Triple Bottom Line's model in order to categorize the concepts; in turn, this enabled us to compare data. Whilst the Triple Bottom Line's model can be used to quantify the concepts, we only used it to categorize them. Data on the sustainability of e-services was categorized according to environmental, social and economic dimensions (Slaper & Hall, 2011). Figure 2 shows the Triple Bottom Line concept of sustainable development. In this model, the three dimensions of sustainability are interdependent. The overlapping (grey filled) areas in figure 2 show the interdependence of the sustainability dimensions, while the intersection of all three dimensions gives 'X', which can be defined as sustainable development.

- **The Environmental Dimension:** An environmentally sustainable system must maintain a stable resource base, avoiding the overexploitation of renewable resource systems or environmental sink functions, and depleting nonrenewable resources only to the extent that investment is made in adequate substitutes. This includes the maintenance of biodiversity, atmospheric stability, and other ecosystem functions not ordinarily classed as economic resources (Harris, 2003, p. 1).

Figure 3. The Russian doll model



- **The Economic Dimension:** An economically sustainable system must be able to produce goods and services on a continuing basis, to maintain manageable levels of government and external debt, and to avoid extreme sectoral imbalances, which damage agricultural or industrial production (Harris, 2003, p. 1).
- **Social Sustainability:** A socially sustainable system must achieve fairness in distribution and opportunity, adequate provision of social services, including health and education, gender equity, and political accountability and participation (Harris, 2003, p. 1).

According to the TBL concept, the sustainability aspects of e-services can be initialized. In the model, the three dimensions of sustainability can be related to e-services in much the same way as researchers relate them to other technologies, such as ICTs.

Table 1 shows research covered by the three TBL sustainability dimensions. The need for e-service sustainability is indicated by the number of examples of sustainable ICT cases discussed in scientific papers, as proposed by Mitrea et al. (2010). E-services utilize ICTs and other technologies according to the adopted TBL concept (Mitrea et al., 2010). Thus, it is acknowledged that ICTs have both positive and negative impacts on sustainable development (Hilty et al., 2006).

Starting with the negative *environmental impacts* of ICTs, it has been found that annual emissions amount to approximately 0.86 metric gigaton per year, which is equal to about 2 per cent of global carbon emissions. This percentage is expected to double by 2020, especially for technologies such as mobile telephones (Dunn, 2010). In the US, ICTs alone make up 2.5 per cent of carbon emissions and this share is expected to increase to 2.8 per cent by 2020 (GeSI, 2008). Thus, carbon emissions from ICTs are equal to or are greater than the total carbon emissions generated by the airline industry.

The negative *economic impacts* of ICTs can be exemplified by considering a recent study, which has shown that new high-tech technologies use gold and silver in the produc-

Table 1. Focus of ICT research according to sustainability dimensions (Mitrea et al., 2010)

Economic Dimensions and Importance of ICT Development	Environmental Dimensions of ICT Development	Social/Cultural Dimensions of ICT Development
Increase in productivity	Traffic reduction optimization	Support for community networks
Basic infrastructure for the digital economy and for the functioning of other sectors	Increased energy efficiency	Optimization of cooperation, participation and solidarity
Innovation basis outside the ICT field	Efficient information systems for environmental management	Support for new forms of political and civic participation and engagement
Controversial relationship between ICT and economic growth, dependent on the existence of the institutional setting that sustains the mutual reinforcement of the free market and ICT innovation	Environmentally-friendly production modes	Open source as appropriate
Potential and risks arising from the acceptance of 'appropriate technologies in developing countries'		Technology for global education
		Optimization of family-work life through teleworking
		New working time models/agendas
		Multimedia support for new forms of health care and education

tion processes that are valued at more than 21 billion US dollars. Currently, only 15 per cent of that figure can be recovered, with the remaining 85 per cent, amounting to $21 billion, lost as e-waste (GeSI, 2012a).

With regard to the negative *social impacts* of ICTs, it is relevant to consider a case mentioned in a referenced study, which described how the unregulated production of gold from e-waste led to the death of 100 children in Nigeria (Mobbs, 2010). Also documented are the huge quantities of e-waste that are imported by the developing world for various purposes (UNU-ISP, 2011).

In addition to the negative environmental, economic and social impacts exemplified above, there are, of course, the huge positive impacts of ICTs. These are probably perceived to be more significant than negative impacts, because the field is continuously growing. However, this study is mostly concerned with the existing state of knowledge of e-service sustainability, regardless of the type of impact.

METHOD

This study used a literature and document review method that is based on the concept centric approach put forward by Webster and Watson (2002). The core idea of the concept centric approach is to organize the study from central concepts either deductively or inductively or both. We also adopted and considered concepts of analysis from Grönlund and Andersson (2006), who focused on the quality of e-government research. The criterion and categories of this study were adopted to evaluate research papers on e-service sustainability. Following the consideration of a study by Islam and Scupola (2011), a literature review was designed specifically for researching services. The study was organized as shown in Figure 4.

Initial Literature Review

An initial literature review was performed in advance of the formation of the research question. The goal of this pre-study was to

identify current basic knowledge with regard to sustainability, and current and past efforts in sustainability practices related to ICT. The initial literature review included sustainability reports and articles. The outcome of the initial literature review provided explanations of required key terms and a knowledge background to formulate the research question. The initial study also provided a knowledge background to specify the domain and scope of the study.

Keywords and Search Process

The keyword formation process and selection was performed according to the requirements of the research question (Webster & Watson, 2002). We searched using combinations of *sustainable/ sustainability* and (singular and plural forms of) *e-service/eservice/electronic service* and *government/ egovernment/e-government/ICT*. These combinations were used in the search process using Google Scholar and Summon, a search engine that includes several other search engines, such as ACM Digital Library, Scopus, ABI/Inform, IEEE Explore, LISTA and Web of Science. The search was limited to papers published between January 2000 and September 2012. The start of the period was chosen because the number of research papers that target e-services began to increase at that time.

The paper search process started with a search of renowned journals in the domain of Information Systems (Webster & Watson, 2002). In our case, we selected journals from an AIS senior scholars' basket of journals (Islam & Scupola, 2011): Management Information Systems Quarterly (MISQ), European Journal of Information Systems (EJIS), Information Systems Journal (ISJ), Internet Research(IR), Electronic Journal of Electronic Government (EJEG), Journal of Information Technology (JIT), Government Information Quarterly (GIQ), Journal of Strategic information systems (JSIS), Journal of Association for Information Systems (JAIS), and e-Services Journal (eSJ).

In the tables below, Keyword 2 (Kw2) is the most important search key. Nonetheless, we included three more searches in order to be able to make comparisons.

Table 2 shows the number of paper hits for the selected keywords against the journal names, respectively. For example, there were 160 paper hits for the keyword "sustainability e-services". In the result we included synonyms and homonyms that are made up of all possible combinations of words that are grouped together to form keywords.

The second source of the paper search are databases and scientific search engines. During this process, the following databases were accessed: Web of Science, Scopus, Summon, Inspec, IEEE *Xplore*, ERIC, Google Scholar, Scirus, SwePub and ACM Digital Library. Most of these databases are multidisciplinary, because of the nature of Information Systems (IS) papers (Webster & Watson 2002). In addition to the selected keywords, our search process also included synonyms and homonyms that are made up of all possible combinations of words that are grouped together to form keywords. Table 3 shows the names of the search engines and the number of paper hits for the keywords, respectively.

With regard to the 66 hits for Keyword 2 (Kw2), most of the papers (43) were accessed from the ACM digital library. Comparing the number of hits for keywords 1 (Kw1), 3 (Kw3) and 4 (Kw4) with those for Kw2 gives a glimpse into sustainability efforts in general, compared with e-service sustainability in particular. Kw2 has only 66 hits, compared with Kw1, which has 1,572,895 hits; the same trend can be observed by comparing the remaining keywords with Kw2.

Paper Inclusion and Exclusion Criteria

The outcome of the whole search process with Kw2 produced a total of 226 papers, i.e., 160 from Table 2 and 66 from Table 3, retrieved by keyword search only. These papers were initially analyzed by reading the title, abstract and keywords for inclusion or exclusion in the second analysis. After the first analysis, papers

Table 2. Number of hits for AIS senior scholars' basket of journals, Jan 2000 – Sept 2012

Sr.no	Journal	Kw1	Kw2	Kw3	Kw4
1	MISQ	10	0	3	0
2	EJIS	0	0	2	19
3	ISJ	17	2	3	17
4	IR	15	15	4	3
5	EJEG	11	11	55	160
6	JIT	0	3	7	3
7	GIQ	77	67	39	83
8	JAIS	25	16	4	54
9	JSIS	56	46	10	8
10	eSJ	0	0	0	4
	Total	211	160	127	351
Kw1 = sustainability. Kw2 = sustainability e-services					
Kw3 = sustainability ICT. Kw4 government e-services					

that contain information relating to e-service sustainability in their title, abstract or keywords were selected for further research; otherwise, they were excluded from the study. With regard to table 2, all of the papers (351) were analyzed for inclusion or exclusion. However, as for table 3, only papers that included hits of keyword Kw2 were analyzed. The outcome of this whole process was a total of 20 papers that include information related to e-services sustainability. These papers were then selected for conceptual analysis.

Data Analysis

The outcome of the process described above is a selection of papers that have been initially filtered to ensure they relate to e-service sustainability. Firstly, the selected articles were categorized according to the Triple Bottom Line (TBL) concept of sustainability, i.e., environmental, social and economic dimensions, as represented in table 4 of the results section. Secondly, each of these papers was analyzed in order to classify them into one of two interrelated concepts of sustainability: *C1: sustainability of e-services themselves* and *C2: sustainability enabler effects of e-services*. The aforementioned processes were carried out through a detailed and systematic analysis of titles, keywords and abstracts. This process ended with a final selection of papers, as presented in table 5. The selected papers were further analyzed using rigor and relevance criteria in order to identify the research trend and the maturity of the field. The criteria utilized for this analysis process was adopted from the study by Grönlund and Andersson (2006), which elicited the type of approach, type of method, publishing domain and research topic. The first two categories were used to find out the maturity of the field. The publishing domain states how much was published in journals and conference proceedings, respectively. The topic aspect reveals research trends and focus. Table 6 shows the result of this final step.

RESULTS AND ANALYSIS

The papers identified during the previous process were categorized into concepts using TBL sustainability dimensions - the major entities analyzed in the study - as units of analysis; see Table 4 (Webster & Watson, 2002). The sustainability dimensions were selected as

Table 3. Number of hits for selected databases, Jan 2000 - Sept 2012

Sr.no	Database/Search Engines	Kw1	Kw2	Kw3	Kw4
1	Web of Science	564	2	179	156
2	Scopus	2,545	4	13	351
3	Summon	929	0	1	42
4	Inspec	2,072	11	5	27
5	IEEEXplore	1,609	3	87	87
6	ERIC	2,759	0	28	6
7	ACM Digital Library	2,119	43	457	15
8	SwePub	1,901	0	43	66
9	Scirus	829,397	2	408	693
10	Google Scholar	729,000	1	139	554
	Total	1,572,895	66	1,360	1,997
Kw1 = sustainability. Kw2 = sustainability e-services.					
Kw3 = sustainability ICT. Kw4 government e-services.					

concepts that can be compared over time; in our case between 2000 and 2012. In table 4, two categories (C1 and C2), show the inter-related concepts of e-service sustainability. C1 represents the sustainability of the e-services themselves, whilst C2 represents the enabler effects of e-services.

Table 4 shows the number of papers that refer to e-service sustainability during the selected period of time. No papers were found which cover C1, whilst 20 papers were found which cover C2.

Table 5 shows the title, author name and year of publication for the 20 selected C2 papers categorized by the TBL dimensions. These 20 papers include one that is related to the environmental factor of e-services, 11 papers for the social dimension and eight related to the economic dimension of e-services. The papers were further analyzed for rigor and relevance according to the criteria and categories put forward by Grönlund and Andersson (2006).

Table 6 depicts the basis for the analysis process in terms of rigor and relevance. Column 1 shows the coded acronyms for papers that relate to the *TBL categories* of environmental, economic and social sustainability: En, Ec and So, respectively. Columns 2 to 6 show the research types as coded acronyms, TG, TT, D, P, TH, which refer to 'theory generation', 'theory testing', 'descriptive', 'philosophical' and 'theoretical', respectively (Grönlund & Andersson, 2006). Column 7 represents the *source of the paper*, either (J)ournal or (C) onference. This column also shows the papers' scientific domains in parentheses; for example '(IS)'. Column 8 shows the *research topics* and column 9 the *research methods* covered by the selected papers. Similar approaches to the analysis of a research field have been carried out by Alavi and Carlson (1992), and Islam and Scupola (2011).

Research types (columns 2 to 6) demonstrate the maturity of a field by identifying the type of research carried out. The analysis shows that, out of the 20 papers, 11 belong to the TG (Theory Generating) category. This number indicates a certain degree of immaturity of the research field, because it presupposes an absence of theories (Grönlund & Andersson, 2006). This claim is supported by the low number of theory-testing papers.

Source of paper (column 7) shows where the research was published. This can ultimately

Table 4. Categorization of e-service sustainability, Jan 2000-Sep 2012

Sustainability Concept / Years	Papers Relating to Knowledge of e-Service Sustainability						
	C1			C2			
	Environ	Social	Economic	Environ	Social	Economic	Total
2000				1			1
2001						1	1
2002							
2003							
2004						1	1
2005					2	1	3
2006							
2007					3		3
2008					1	1	2
2009					2	1	3
2010					2	2	4
2011					1		1
2012						1	1
Total	0	0	0	1	11	8	20
Note. C1 = Sustainability of e-services themselves. C2 = e-services as enabler of sustainability							

indicate if there is an established set of forums for the focused research. Out of the 20 papers, 10 were published in journals and 10 at conferences. Column 7 shows that the majority of conference papers relate to an IEEE conference, which is another indicator of research field maturity. Moreover, most of the papers from the journal category were published in IS journals, particularly the eSJ (e-Services Journal). The fact that a journal dedicated to e-service research has only published two papers that focus on sustainability indicates a low level of maturity.

Research topics (column 8) shows the topics that are focused on in each paper. The only paper that relates specifically to the environmental category explains the benefits of e-services in relation to the centralization of environmental reporting systems. Of the eight economic dimension papers, four focus on the impact of e-services, whilst the rest discuss models and the integration of models for the economic analysis of e-services. The modeling papers also discuss relational cost benefits connected with e-services. In total, 11 articles can be seen to relate to the social dimension, with six of them relating specifically to user satisfaction. In all, 8 papers are concerned with modelling. In the same way that theory generation and explorative approaches can be interpreted as a sign of an immature field, the number of modelling papers may also indicate the same level of immaturity (Alavi & Carlson, 1992).

Research methods (column 9) shows how the choice of methods is affected by whether theories, models and sets of concepts exist in the field of e-services sustainability. This can, in turn, indicate the maturity of the field. If the field is well established in terms of theories, models and sets of concepts, it is likely that more experimental than explorative approaches will be found. Explorative approaches such as grounded theory, ethnography and case studies are necessary to define a field in terms of theories, models and sets of concepts. Descriptive

Table 5. Authors and articles for C2

Economic	Costopoulou & Tambouris (2004) One-stop eServices for the forest sector. Ranerup (2005) Motives in the Design of Public E-services. The Example of Quasi-Markets for Education. Zhang et al. (2010) Interactions, Competition and Innovation in a Service-Oriented Internet: An Economic Model. Nath et al. (2001) Bankers' Perspectives on Internet Banking. Cellary (2008) Strategic Impact of e-Government on Economy and Society Tutorial and Workshop. Taipale (2012) The use of e-government services and the Internet: The role of socio-demographic, economic and geographical predictors. Skielse & Perjons (2009) Improving E-Government through Benefit Analysis and Value Modeling. Zdravkovic & Ilayperuma (2010) A Model-driven Approach for Designing E-Services Using Business Ontological Frameworks.
Environ-mental	Karatzas et al. (2000) Development of a hierarchical system for the teletransmission of environmental and energy data.
Social	Carter & Bélanger (2005) The utilization of e-government services: citizen trust, innovation and acceptance Factors. Seyal (2011) Customer Satisfaction with Internet Banking in Brunei Darussalam: Evaluating the Role of Demographic Factors. Hwang & Li (2009) Conquer Web 2.0 Motivational Challenges from Social Context Evolution. Jun (2009) Research on E-Service Quality, Customer Relational Benefits and Customer Satisfaction. Liao et al. (2007) Theory of planning behavior (TPB) and customer satisfaction in the continued use of e-service: An integrated model. Cyr et al. (2007) The role of social presence in establishing loyalty in e-Service environments. Sheibani et al. (2010) A Novel Approach to Satisfaction Framework for Social Issues via E-Services. Asgarkhani (2005) The Reality of e-Service in the Public Sector: A Local Government Perspective. Alter (2010) Integrating Sociotechnical and Technical Views of e-Services. Grundén (2008) Evaluation of eGovernment Implementation from a Social Perspective. Löfstedt (2007) Social Systems Design as a Vehicle Towards Local Public e-Services for and by Citizens.

studies and surveys are more likely to be built on existing and accepted concepts and constructs. Experiments and tests ultimately need theories or models if they are to be executed. This way, the methods used can assess the maturity of a field (deBruin et al., 2005). Interpretive studies are most often inductive case studies (Walsham, 1994; Walsham, 2006), something that supports the conclusion that interpretive studies are more common in a less mature field. Of the 20 papers, 17 were classified as more or less explorative.

An indicator of public e-service maturity is the number of papers published per year during the studied period. As shown in Figure 5, 15 of the 20 papers were written between 2005 and 2010. The fact that only two papers were published in 2011 and 2012 may be a coincidence; certainly, the overall frequency is too low to be the basis for trend analysis.

DISCUSSION AND CONCLUSION

The major finding of this study is that no research has been carried out with regard to the sustainability of e-services themselves. This finding is represented as variable C1 in the paper. Only a few research studies have sought to examine the sustainability enabler effects of e-services, as represented by variable C2 in this paper. These findings are in line with observations made by Bengtsson and Ågerfalk (2011) and by Klischewski and Lessi (2012). A literature review was carried out, which identified 20 selected papers relating to e-services sustainability. Thus, the frequency of research in the studied field can be seen to be rather modest. It should be noted that there is not a complete shortage of papers that analyze sustainability in the e-Government domain. However, we

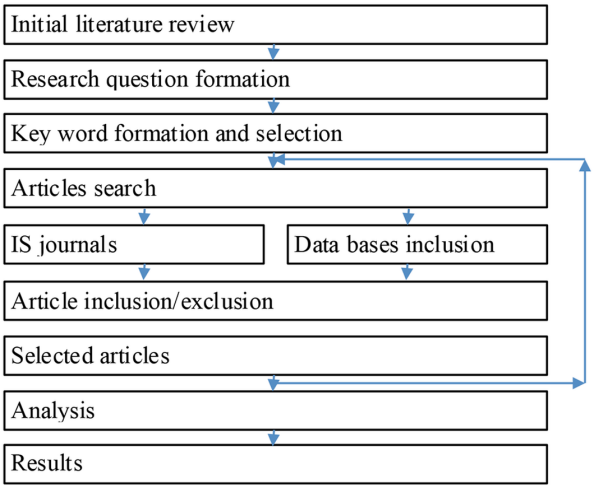
Table 6. Categorization of papers after rigor and relevance analysis

TBL cat	TG	TT	D	P	TH	C/J (Domain)	Topic	Method
En1	X					J(IS)	Use of e-services	Experiment
Ec1		X				J(IS) (eSJ)	Impacts of e-services	Ethnography
Ec2	X					C(IEEE)	Benefit analysis and modeling	Grounded Theory
Ec3		X				J(IS)	Impacts of e-services	Product descript
Ec4		X				C	Impacts of e-services	Product descript
Ec5			X			C(IS)	Impacts of e-services	Case study
Ec6			X			J	Factors affecting use	Ethnography
Ec7	X					C(IEEE)	Benefit analysis and modeling	Experiment
Ec8	X					C(IEEE)	Benefit analysis and modeling	Case study
So1	X					J(IS)	Modeling and user satisfaction	Interpretive
So2			X			J(IS) (eSJ)	User satisfaction	Ethnography
So3	X					C(IEEE)	Social context evaluation	Case study
So4	X					C(IEEE)	Modeling and user satisfaction	Ethnography
So5	X					J	Modeling and user satisfaction	Interpretive
So6	X					J	Modeling and user loyalty	Interpretive
So7	X					C(IEEE)	Modeling and user satisfaction	Interpretive
So8					X	C(IEEE)	Factors for e-service adoption	Ethnography
So9					X	J(IS)	User participation in system design	Literature study
So10	X					J(IS) (eSJ)	Modeling and sociotechnical views	Grounded theory
So11			X			C	User satisfaction	Interpretive
Total	**11**	**3**	**4**		**2**	**10 C + 10J**		
=	**14**		**6**			**20**		

En = Environmental. Ec = Economic. So = Social. TG = Theory generating. TT = Theory testing.
D = Descriptive. P = Philosophical. TH = Theoretical. C = Conference. J = Journal.

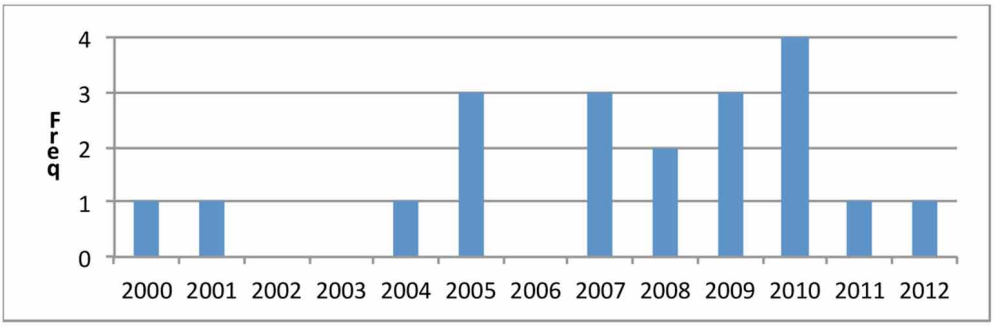
only included papers that explicitly analyze sustainability in e-services, either within the e-services themselves or as enablers. We also used all relevant kinds of conjugations of the terms "e-service" and "sustainability" in order to avoid missing relevant papers. Further on we have excluded papers that analyze sustainability and e-government in general, because their connection to e-services is implicit and does not provide any substantial contribution to the understanding of the sustainability of e-services. We also excluded papers in which

Figure 4. The research process



e-services and sustainability are just mentioned but not analyzed. Finally, we excluded papers in which sustainability and e-government are discussed in terms of sustainable development. We consider sustainable development to be something that is not explicitly related to e-services. Sustainability is a homonym, which is used in many contexts and can have several meanings whereas the sustainability of the e-services themselves, is not explicitly studied yet. Another notable reason for the lack of research into e-services sustainability could be the conceptual vagueness or lack of clarity of the terms 'sustainable development' and 'sustainability'. As mentioned previously, whilst this study analyzed the sustainability of e-services, few papers relate to the sustainable development of e-services, i.e., where sustainable e-services are explained in terms of constancy. In addition, the term sustainability is sometimes utilized or presented as the meaning of constancy or fixed state of the system (ECLAC, 2001). However, presenting sustainability in this way can also lead to a certain vagueness in the research. The

Figure 5. Papers per year



standard explanation given for 'sustainable development' and 'sustainability' is debatable. According to one quote, "sustainable development is the pathway to sustainability" (circular ecology, 2014). As mentioned previously, this study referred to the Brundtland definition for sustainable development and utilized the Triple Bottom Line model for the categorization of sustainability dimensions.

With regard to the dimensions of the Triple Bottom Line model, most papers relate to the social and economic dimensions. Only one paper was found which relates to the environment dimension. A maturity analysis was carried out, which shows that theory generating and testing are the most common research approaches to e-service sustainability. Most papers were published in high ranking conferences and journals. The lack of published papers shows that research on e-services sustainability is in its infancy.

An analysis of the topics covered by the papers shows that the one most commonly investigated was user satisfaction in the social dimension. In several studies and technology models, social aspects are considered to be important social issues. The environmental aspects of e-services are not yet on the scientific agenda, which we believe is a sign of immaturity.

The findings described above raise several questions that can be addressed by further research. For example, why is there an absence of papers related to the sustainability of e-services? At least two answers to such a question come to mind. It may be that contemporary researchers are not currently interested in explicit studies of e-service sustainability. On the other hand, they may be concerned about sustainability in the same way as this study, for example through a search for research papers. Thus, whilst research has focused on the separate dimensions it has not explicitly related them to sustainability. One can eventually explain or excuse the absence of sustainability research by relating to other IS fields. It is easy to notice that sustainability was not the first area to be researched within usability, systems development, or knowledge management. Consequently, there are also few studies on how e-service sustainability is researched. We found two, which is yet another sign of immaturity.

To elaborate further, e-services, which are a basic component of e-government, are widely accepted and utilized. Indeed, the use of e-services has increased year on year (DESA 2012). In this study, we selected e-services as a point of departure to investigate the sustainability of an important aspect of e-government. In addition to e-services, other dimensions and components of e-government could be considered relevant to sustainability evaluation or research. Currently, a situation exists in which there is an absence of studies on e-service sustainability. However, in this study we also investigated the existence of indirect sustainability research. By raising questions regarding sustainability indicators for e-services, we were able to broaden our research to include other sustainability aspects. For example, what are the indicator protocols and methodology sheets for e-services? This study could be extended to include further questions that address this issue. Sustainability indicators are considered to be basic requirements for sustainability evaluation (DESA, 2007), as are methodology sheets and indicator protocols (DESA, 2007).

A large number of studies have discussed the sustainability enabler effects of ICTs and other technologies. There is immense potential to save energy on a large scale through the use of ICTs. They can reduce carbon emissions and decrease greenhouse gases by up to 15 per cent. Furthermore, ICTs could help to save about 600 billion Euros ($946.5 billion) by 2020 (GeSI, 2012b). ICTs have multiple dimension impacts, including environmental, economic and social aspects. The potential for ICTs to be sustainable has been acknowledged not only by GeSI (2012b), but also by a number of other authors and organizations. For example, the most recent United Nations conference acknowledged the potential of ICTs for promoting sustainable development (UNCSD, 2012). Hence, the role played by ICTs, the Internet and other technologies with regard to sustainability enabler effects is widely acknowledged. Whilst some of this

research might include e-services implicitly, there is a lack of explicit research about the sustainability of e-services.

The practical implications are directed to government officials. As first or second hand representatives of citizens, these officials need to consider the long-term effects of the implementation of e-services. Efficiency and effectiveness have been the major focus so far. Now is the time to explicitly include sustainability.

The scientific implication of this study is a call for more research into e-service sustainability. The importance of sustainable e-services is acknowledged as a requirement for a better future (UNCSD, 2012). The implication for researchers is that they need to focus on e-service sustainability in order to fill the existing gap. For practitioners, it is necessary to include sustainability as a mandatory requirement when developing public e-service applications.

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