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Towards an e-service knowledge system for improving the quality and adoption of e-services

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Abstract

The purpose of this article is to highlight the limitations and drawbacks of existing knowledge about e-service quality and e-service user acceptance. To overcome these limitations we will propose some solutions. An extensive review of relevant literature has shown that a lot of research has already been conducted in this field. However, there is still a gap between the percentage of existing e-services and the percentage of those that are actually being used. We believe that existing knowledge could be better used by e-service researchers and especially by e-service providers, if they would have a knowledge system that would be capable of synthesizing the existing knowledge and presenting it in a more people-friendly format. The practical outcome of this article is a proposal for an e-service knowledge system, which could be used to improve the quality and user acceptance of e-services.

Keywords: e-service, e-service quality, e-service acceptance, knowledge system, e-service knowledge system

1 Introduction

The rapid and ongoing development of the Internet is already transforming our economic and social world. In our professional and personal lives, the importance of the

Internet has been continuously accelerating. Information and Communication Technologies - ICTs continue to be a major driver of economic and social modernization. The Internet is changing business models in the software market. The software market is setting a trend where ICTs – in the form of software services – are becoming more pervasive thanks to the Internet’s infrastructure. Service and service-oriented software, e.g. Software as a Service (SaaS) and Service Oriented Architecture (SOA), is now a significant driver of growth. According to the i2010 Mid-Term Review (European Commission 2008), businesses in the EU today devote 20% of investment to ICTs, and the sector accounts for 26% of overall research expenditure.

From the data collected by Eurostat (European Commission 2009) we can see that a large percentage of enterprises have broadband Internet access (see Figure 1). We can also see indications that EU enterprises are quite familiar with e-government services, e.g. for obtaining information, forms, returning filled in forms, etc. Enterprises are also quite familiar with the usage of on-line banking and financial services. However, it is apparent that enterprises in the EU are not fully exploiting the potential of e-commerce, which can be seen through the indicators of the percentage of enterprises having made purchases on-line. The percentage of enterprises having received orders over the Internet is also alarming high.

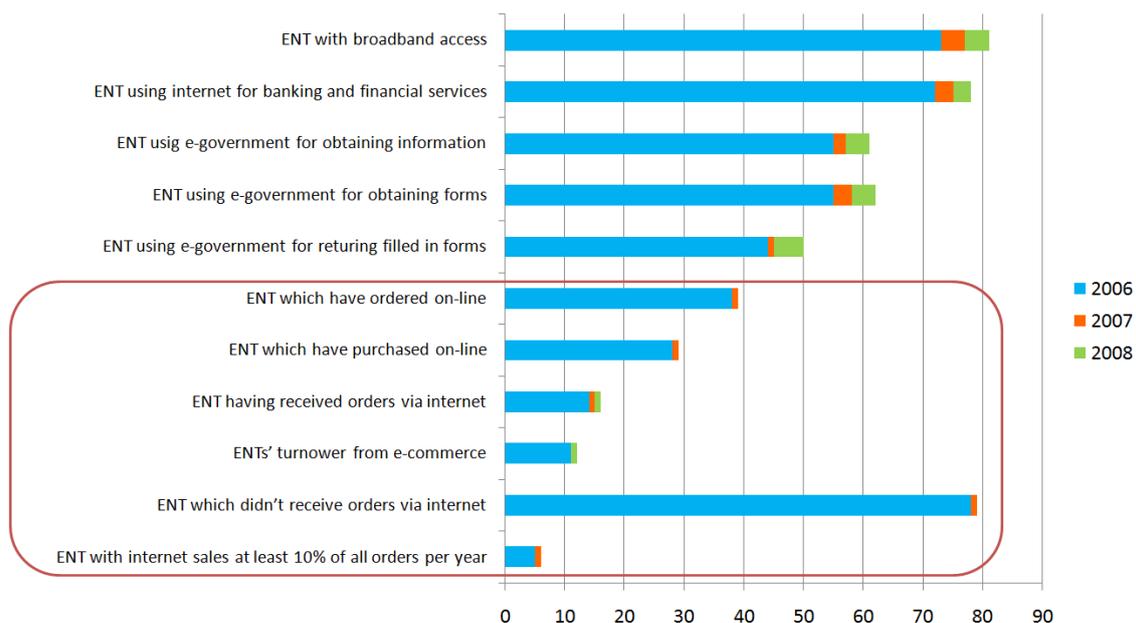


Figure 1: ICT use in Enterprises; data source: Eurostat (European Commission 2009)

The provision of high quality public services is one of the keystones of the i2010 programme “A European Information Society for growth and employment.” Public services play an important role on the road to an inclusive European Society. In the i2010 Mid-Term Review (European Commission 2008) it is noted that 60% of basic public services are fully available online. From the same review it is evident that there is a significant gap between the large amount of available e-services and the low percentage of actually used e-services.

E-service quality and e-service user acceptance are therefore important issues, both for e-service providers as well as for e-service users. Compared to “traditional” services, e-services raise some expectations, including: (1) increased productivity (2) reduced costs for producers and consumers of e-services and (3) increased accessibility. Despite the large number of already existing e-services, users are facing significant problems concerning the level of quality. We can search for the reasons in various aspects, ranging from cultural and social (such as language or preference to doing business with known and trusted partners) to uncertainties about the legal and regulatory environment, to the security of on-line transactions and the electronic systems that support them. There are known and unknown drawbacks for e-services, which impact potential e-service users when used or not. In order to understand e-service experiences it is necessary to go beyond the studies of e-service quality dimensions and to also take into account the inherent characteristics of e-service delivery and the factors that differentiate one service experience from another (Rowley 2006). In the development of e-services, certain cost factors are significantly more important than others in relation to certain benefit factors (Lu & Zhang 2003).

A lot of research has already been performed in the area of e-service quality and e-service acceptance, commonly resulting in conceptual models, which demonstrate the causal dependencies between different e-service related factors. It is obvious that despite the existing research, there are still open issues in the field of e-service adoption, which subsequently raises the following research question: “How to improve the quality, adoption and continued use of e-services considering the results of existing research activities?” We believe that causal models presented in existing research have great potential for e-service related stakeholders. The knowledge that these causal models already contain could be better used in developing more user-oriented e-services. In this paper, we will propose the idea of an e-service knowledge system that would be capable of capturing knowledge from existing research data and building e-service development guidelines with appropriate data synthesis and processing algorithms.

This paper is organized as follows: in the next chapter we are going to provide an analysis of existing research in the field of e-service quality and e-service adoption. In the following chapter, we will propose our idea about an e-service knowledge system and in the last chapter we will conclude with a discussion about our future research and development activities.

2 Analysis of existing research

In order to answer the research question, we began with a systematic review of relevant literature. During the literature review, we focused on identifying existing e-service quality and user acceptance models and theories. We investigated factors within the context of e-services, which are related to e-service quality and e-service adoption. The search space for the literature review encompassed journals managed in the databases: ScienceDirect (www.sciencedirect.com), SpringerLink (www.springerlink.com), Emerald (www.emerald-library.com) and IEEE Xplore (ieeexplore.ieee.org), CiteSeer (citeseer.ist.psu.edu/cs) and SAGE Journals (online.sagepub.com).

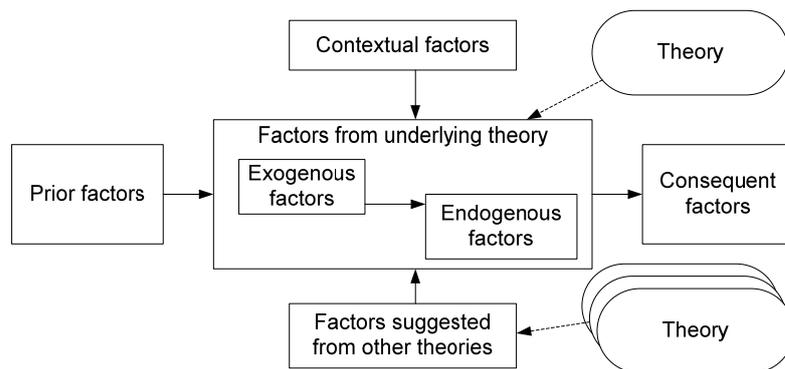


Figure 2: The model for an analysis of existing research

According to Figure 2, the focus of performed literature review was on identifying research that is based on causal models. Within those models, we identified underlying theories (if any) and eventual extensions of a theory into one of the following areas: (1) factors that are specific to the investigated context (e-services), (2) factors that are prior to the theory factors, (3) eventual consequent factors or theory implications and (4) factors that combine the focal research theory with other theories.

A database was designed to record causal dependencies identified in the research articles we found in the aforementioned databases. We inserted data that is important for the interpretation of the impact of individual factors specified in the proposed research quality and user acceptance models. Every record in the database holds these data attributes:

- keywords,
- research type (survey, empirical study, experiment, literature review, etc.),
- context (e-services general, e-commerce, e-banking, etc.),
- the size of research sample,
- independent variable,
- dependent variable,
- effect size,
- significance and
- empirical validation.

After a comprehensive review of existing literature, our database contained 2,816 data records about different causal dependencies for various e-service contexts. In the following subchapters, we will summarize the knowledge gained during the literature review within the scope of e-service quality and e-service acceptance models.

2.1 E-service Quality

E-service quality can be defined as overall customer evaluations and judgments regarding the excellence and quality of e-service delivery in the virtual marketplace

(Santos 2003). In searching for an e-service quality definition, researchers and e-service providers try to answer very common questions about what factors may help increase customers' visitation to a site, what factors may influence customers to actually make a purchase, what factors increase traffic flow to a site and what factors increase customer retention (Madu & Madu 2002). A common question for e-tailors, for example, is what attributes increase consumer perceptions that online shopping is easy, useful, fun and safe (Ha & Stoel 2008).

Table 1 provides examples of literature in the field of e-service quality we found in the literature review. Due to space limits, all relevant results are not included. When pinpointing e-service quality models and factors, researchers usually rely on quality models for traditional software and services and use them as a basis for identifying the factors related to e-services. One interesting finding is that we could not find a general e-service quality model that would be applicable to any type of e-service. Researchers have already identified a large number of quality models for various e-service contexts. From reviewing the literature, it is clear that there is still a need for further research activities in this area.

Table 1: Examples of quality factors discovered in literature review

Author/s	Context	Quality factors/characteristics
(Van Riel, Liljander, & Jurriëns 2001)	web portals	the core services, facilitating services, supporting services, complementary services, user interface
(De Ruyter, Wetzels, & Kleijnen 2001)	general	organizational reputation, relative advantage, and perceived risk on perceived service quality, trust and behavioral intentions of customers
(Madu & Madu 2002)	general	performance, features, structure, aesthetics, reliability, storage capability, serviceability, security and system integrity, trust, responsiveness, product/service differentiation and customization, web store policies, reputation, assurance, empathy
(Zeithaml, Parasuraman, & Malhotra 2002)	web sites &	Information availability and content, ease of use or usability, privacy/security, graphic style and fulfillment
(Van Iwaarden et al. 2003)	web sites	tangibles, reliability, responsiveness, assurance, empathy
(Lu & Zhang 2003)	general	cost, benefit, functions and development
(Santos 2003)	on-line shopping, e-commerce	ease of use, appearance, linkage, structure and layout, content, reliability, efficiency, support, communication, security and incentive
(Van Riel, Semeijn, & Janssen 2003)	online flight reservation	design of the user interface, responsiveness, reliability, customization, security

	s	
(Ancarani 2005)	web sites, public e-services	information, interaction, two-way interaction, transaction
(Kuo et al. 2005)	web portals	convenience, empathy, ease of use, information quality, fun, reliability, responsiveness, accessibility, other criteria
(Lee & Lin 2005)	on-line shopping	web site design, reliability, responsiveness, trust and personalization
(Semeijn et al. 2005)	general	navigation, e-scape, responsiveness, customization, assurance, accuracy, online value, online joy, satisfaction, loyalty
(Fassnacht & Koese 2006)	general	environment quality (graphic quality, clarity of layout), delivery quality (attractiveness of selection, information quality, ease of use, technical quality), outcome quality (reliability, functional benefit, emotional benefit)
(Rowley 2006)	general	site features, security, communication, reliability, customer support, responsiveness, information, accessibility, delivery and personalization
(Halaris et al. 2007)	e-government	back office performance layer, site technical performance layer, site quality layer, customer's overall satisfaction
(Behkamal, Kahani, & Akbari 2008)	b2b applications	<i>functionality</i> (suitability, accuracy, interoperability, security, traceability), <i>reliability</i> (maturity, fault tolerance, recoverability, availability), <i>usability</i> (understandability, learnability, operability, attractiveness, customizability, navigability), <i>efficiency</i> (time behavior, resource utilization), <i>maintainability</i> (analyzability, changeability, stability, testability) and <i>portability</i> (adaptability, install ability, co-existence, replace ability)
(Ha & Stoel 2008)	online shopping	web site design, customer service, privacy/security, atmospheric/experimental
(Sahadev & Purani 2008)	job portals	efficiency, fulfillment, system availability and privacy

2.2 E-service Adoption

The focus of reviewing literature pertaining to e-service adoption was on identifying research that is based on causal models. Within those models, we identified any underlying theories (if any) and eventual extensions of the theory. We searched for factors that existed prior to the underlying theory, and factors that were identified for eventual extensions of the underlying theory in different e-service contexts. Most of the

e-service adoption models are built using Technology Acceptance Model - TAM (Davis 1989) and its extensions. Table 2 provides examples of e-service acceptance research we found in the literature review.

Table 2: Examples of e-service acceptance research discovered in literature review

Source	Focal theory	Focal Factors	Other factors
(Chen & Tan 2004)	TAM	perceived usefulness perceived ease of use attitude behavioural intention actual use of virtual stores	product offerings information richness usability of storefront perceived service quality perceived trust compatibility
(Lee, Cheung, & Chem 2005)	TAM	perceived usefulness perceived ease of use attitude behavioural intention	perceived enjoyment
(Ha & Stoel 2008)	TAM	ease of use usefulness attitude intention to e-shop	privacy, web site design customer service atmospheric trust enjoyment
(Brown 2002)	TAM	perceived usefulness perceived ease of use	ease of finding ease of understanding self efficacy computer anxiety
(Rotchanakitumnuai 2005)	TAM	perceived usefulness perceived ease	information quality accessibility flow control

(Carter 2008)	TAM	of use perceived usefulness perceived ease of use intention to use	trust of the internet trust of the government computer self-efficacy
(Alam et al. 2007)	IDT	relative advantage compatibility complexity trialability observability security/confidentiality adoption	
(Horst, Kuttschreuter, & Gutteling 2007)	TAM	perceived usefulness of e-government perceived usefulness of e-services intention to adopt	perceived behavioural control subjective norm worry about e-government trust in e-government risk perception personal experiences trust in governmental organizations
(Featherman & Pavlou 2003)	TAM	perceived usefulness perceived ease of use intention to adopt	perceived risk, overall risk, performance risk, financial risk, privacy risk, time risk, psychological risk, social risk
(Kamaljeet Sandhu 2008)	TAM	perceived usefulness perceived ease of use acceptance	experience, motivation, continued use

At this point we are performing a qualitative research in order to organize data in aforementioned database. Table 3 contains approximately one third of all variables identified in the literature review and summarizes the number of appearances of individual factors/variables that appear as independent and/or dependent variable in reviewed research models.

Table 3: A brief review of literature review

Variable	Independent	Dependent	Together
Satisfaction	171	332	503
Intention	17	284	301
Loyalty	10	143	273
Trust	130	114	273
Quality	155	92	247
Usefulness	100	130	230
Attitude	64	126	190
Ease of use	111	54	165
Behaviour	38	92	130
Service Quality	65	54	119
Value	74	38	112
Ability	75	13	88
Risk	43	37	80
Adoption	7	59	66
Security	45	10	55
Usage	14	41	55
Performance	14	36	50
Enjoyment	31	17	48
Commitment	13	32	45
Access	22	23	45
Privacy	36	8	44
Price	29	15	44
Control	30	14	44
Efficiency	23	14	37
Success	3	30	33
Subjective norm	21	9	30

Disconfirmation	7	18	25
Information Quality	19	5	24
Responsiveness	18	3	21
Capability	20	1	21
Internet Use	0	21	21
Complexity	18	3	21
Internet Access	2	18	20
Accessibility	14	5	19
Benefits	12	6	18
Playfulness	11	7	18
Use	1	17	18
Reliability	17	0	17
System Quality	15	2	17
Intangibility	2	3	16
Communication	15	1	16
Convenience	13	2	15
Information Usefulness	1	6	7
Anxiety	7	0	7

The literature review resulted in a remarkable amount of literature, which is related to the stated research problem. Therefore, we believe that other researchers are already well acquainted with e-service quality and adoption problems. However, there are some limitations related to existing knowledge about e-service quality and adoption. Some of the limitations are given in the next subchapter.

2.3 Limitations of current e-service knowledge

There are several limitations of current e-service knowledge affecting e-service researchers as well as e-service providers. From a scientific point of view, these limitations are:

- there is no overview of all research results,
- there are overlaying concepts in existing researches,
- sometimes research results contradict other research results,
- some factors are better/more poorly investigated than others or are not investigated at all,
- it is hard to compare different research, because they are usually performed for different e-service domains,
- there is no way to identify non-validated or missing relationships between concepts,

- it is difficult to identify laws or theories in the field of e-service,
- different research samples,
- different research methods and
- different data analysis techniques.

There are also some limitations that affect e-service providers whereby the practical employability of existing e-service knowledge is questionable. These limitations are for example:

- existing knowledge is dispersed/published on various databases (e.g. ScienceDirect, SpringerLink, IEEE Xplore, ACM, etc.).
- limited access to existing knowledge – sometimes research articles are not publically accessible via search engines (e.g. Google)
- research results are usually presented in scientific “language” - impossible to understand by e-service providers, who are usually not scientists

We believe that existing research results could be better employed in the e-service domain, especially by e-service providers. To bypass the limitations listed above, we propose to build an e-service knowledge system, which will be described in the next chapter.

3 E-Service Knowledge System

In this chapter we will propose the idea of building an e-service knowledge system with data synthesis and processing capabilities of knowledge about e-service quality and user acceptance. The e-service knowledge system would be a tool for researchers - especially for e-service providers that we believe would benefit the most from it.

3.1 Overview

Figure 3 provides an idea about e-service knowledge system and the way e-service researchers and providers would use it. The whole process of exchanging knowledge between e-service researchers and e-service providers is presented in Figure 4 using Business Process Modeling Notation (BPMN).

The E-service knowledge system would be a great starting point for e-service researchers, where they could use it for gathering information about research that has already been performed. E-service researchers could use the knowledge system to find information about: what factors have already been investigated, non-validated or missing relationships between concepts, laws and theories that were used in existing research, etc. After their research has been performed, researchers could then use this e-service knowledge system to share their findings. On the other hand, e-service providers would benefit from the knowledge system by gaining development guidelines generated from existing knowledge data. These development guidelines would be of exceptional importance in the process of building e-services.

There are several challenges for presenting the existing e-service knowledge to relevant stakeholders. First, e-service researchers usually investigate specific e-service sub-types, where it is unknown, how different sub-types and their characteristics are interrelated. So, we believe that a common taxonomy of e-services is required for organizing e-service properties, their instances, which can then place different e-service research into an appropriate e-service context.

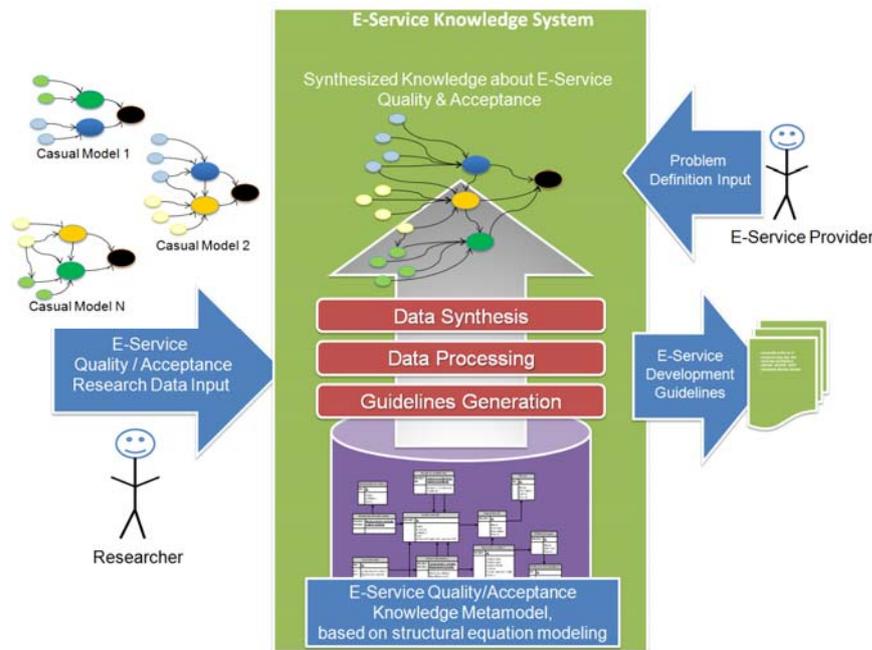


Figure 3: E-Service Knowledge System

Secondly, we believe that the causal models, which represent the focal point of e-service research, are not suited for e-service providers because: (1) the research results are usually published in scientific papers, which are managed by specific document bases with limited access; and (2) the results are scientific and therefore difficult to understand. We believe that a better way of presenting knowledge to e-service providers would be to transform the knowledge into a more human-oriented guidelines, composed of structured or plain text.

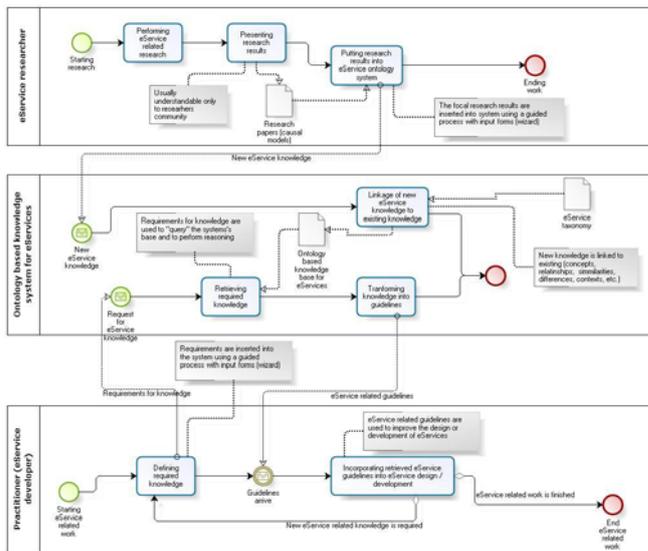


Figure 4: The knowledge exchange process between researchers and e-service providers using the E-Service Knowledge System

3.2 Process view

The process in Figure 4 involves three different sub-processes (two human related processes and a knowledge system), which transform e-service related knowledge “from a scientific view to a practitioner’s view.” The focal task of the researcher is to put the results of their e-service related research into a knowledge system that inter-relates the information with the existing system’s knowledge. The e-service provider (practitioner) “queries” the system for desired information using a guided process. If available, the system returns information in the form of structured, text-based guidelines.

3.3 Data view

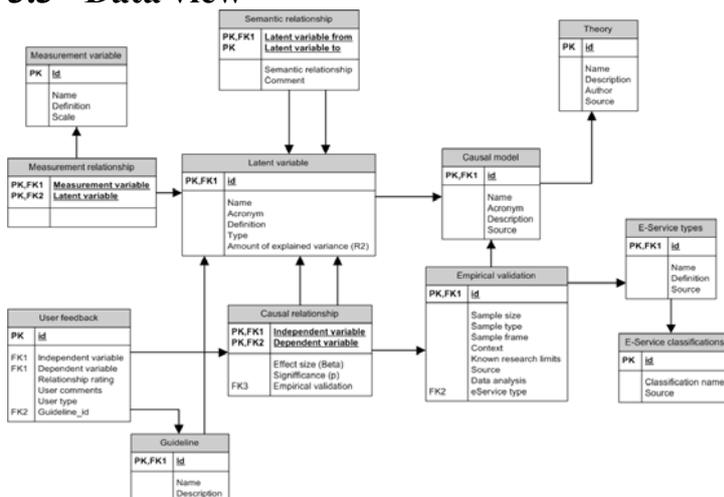


Figure 5: E-service Quality/Acceptance Knowledge Meta-model

Figure 5 shows the knowledge meta-model that we have proposed for an e-service knowledge system. The meta-model has been designed to carry information about causal models, including: latent variables and their relationships (causal, semantic,

measurements), empirical validation and the underlying theory. The meta-model also includes constructs that are not specific for causal modeling but are essential for understanding the e-service context for which the research has been performed. We therefore added to the meta-model entities that can contain information about e-service type and e-service classification. We believe that information about user feedback can also be useful for the generation of improved e-service development guidelines. Therefore, we extended the meta-model with an entity for storing information about user feedback.

4 Future work

While our research is still in its initial phase, we have identified the following hinderances and limits of use. First, the analysis of existing research, which was presented in the article, is still in progress. So, we are only able to present a partial result of literature review, which might not be a representative picture of complete literature or knowledge in the area. Second, the solutions to the stated problem were not analyzed and designed in detail. So, we were not able to present any of the limits for the proposed solutions. In addition, we did not search for similar solutions, which may exist in other fields of science.

Based on this, we intend to carry out the following activities in the future: (1) we plan to perform a complete meta-analysis of existing (causal) knowledge in the field of e-services; (2) based on the meta-analysis we plan to build an e-service knowledge system and (3) perform a case study that would investigate the actual benefits of such an e-service knowledge system.

5 Summary

We believe that research in the field of e-service quality and user adoption is very important because of the gap between the large amount of available e-services and the relatively low percentage of actually-used e-services. In this paper, we have listed some ideas on how to improve the quality, adoption and continued use of e-services.

After the literature review, we are convinced that researchers are already well acquainted with e-service quality and the adoption problem. However, we found some limitations related to existing knowledge about e-service quality and adoption.

We have proposed an e-service knowledge system that would be a good starting point for e-service researchers conducting work in the field of e-service quality and user adoption. The proposed e-service knowledge system would also be a good tool for e-service providers. E-service providers could benefit from the e-service knowledge system by getting development guidelines that would be generated automatically from existing knowledge.

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