Extending the IT Service Quality Measurement Framework through a Systematic Literature Review

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Abstract Continuous improvement of service quality results in enhanced customer satisfaction, increased efficiency and maximisation of business value of the service within the company. Decision-making on the course of service quality improvement is based on the current status of the measurable service quality attributes. The aim of the paper is to describe the IT service quality attributes that could be measured to improve IT service quality. We report on a systematic literature review of IT service quality measurement. The review was based on 134 relevant journal articles related to IT service quality management. Of these, 91 articles were selected for analysis. We propose a detailed and comprehensive quality measurement framework for IT services using the results of the systematic literature review to extend previous work. The framework presents six common issue areas with their associated measurement categories, measures, and indicators. IT service providers can choose the measures to satisfy their specific information needs from the proposed IT service quality measurement framework. We conclude that IT service quality improvement efforts could benefit from considering the internal IT service quality attributes from the viewpoint of the value the provided IT service could bring to both the customer and the provider.

Keywords: IT service quality; IT service quality improvement; IT service quality measurement; IT service quality measurement framework; systematic literature review.

1 INTRODUCTION

Service quality is an abstract and elusive construct because of the nature of services - their intangibility, heterogeneity, and inseparability of consumption and production. It is necessary for businesses to continuously improve service quality to enhance customer satisfaction and survive in the market (Lin et al. 2011).While the importance of service quality has become more widely recognized, its conceptualization and measurement remains understudied (Kang et al. 2002).

A widely accepted conceptualization of service quality is grounded in the work of Zeithaml, Parasuraman and Berry who posit that service quality is determined by the service customer and not the service provider (1990). Walker et al. (2006) concur with this view and add that quality and value of a service offering may be assessed from at least two perspectives: that of a service provider (the intrinsic quality of the design of what is offered and how it is managed) and that of the customer (the extrinsic quality about what is provided to and experienced by the customer). Lin et al. (2011) support this view of service quality being composed of various attributes: some serve to fulfil the minimum customer requirement while others provide additional value, where value can also be defined as something intrinsic to the design of what is offered and how this is managed (Walker et al. 2006). Kang et al. (2002) similarly differentiate services into a) the service/information the customers want, and b) the service through a personal relationship with IT service providers. In other words, services have two inherent characteristics: a) the intrinsic attributes that make up the service offering, and b) the people providing/delivering the service. In order to improve services and service quality, the service provider should understand the intrinsic properties of the design of the service offered, which consequently define and shape the service provided, or capability of the customer to appreciate the service (Walker et al. 2006). In the research literature, the latter has been described in great detail with various domain applications of the SERVQUAL model to measure the satisfaction of customers (Kang et al. 2002; Ladhari 2009; Parasuraman et al. 1991; Pitt et al. 1995; Watson et al. 1998; Zhu et al. 2011), while little is said in the literature about the intrinsic attributes of a service.

Despite these intrinsic attributes being closely related to the customers' perceptions and expectations, they need to be measured to support the efforts of managers to deal with the "right things", and thus reach the strategic targets (Enquist et al. 2011). Surveys of business clients to assess their level of satisfaction with IT service quality provide useful indicators, but cannot be easily used to prescribe solutions because managers need to know how internal functioning affects customer evaluation and satisfaction (Jia et al. 2011). While we fully agree that the ultimate goal of any service provider is to satisfy its customers, we propose that proactive service improvement by a service provider will positively impact customer satisfaction measures. This paper focuses on proactive service improvement that is referred to here as an improvement of the service offering prior to customer feedback, after which the service improvements can be viewed as reactive. Proactive service improvement requires understanding the intrinsic service quality attributes that comprise the service offering as described by Walker et al. (2006), Lin et al. (2011), Enquist et al. (2011) and Kang et al. (2002).

Definitions. We adopt a simple definition from Alter (2008) for the term *services*: "acts performed by one entity for another, including the provision of resources that another entity will use". *IT services* are services provided by an IT service provider to one or more customers. IT services are based on the use of IT to support or enable business processes (Spath et al. 2011).

The two objectives of this paper are: i) *to report on a systematic literature review to establish the current understanding and practices of IT service quality measurement*; and ii) *to enhance the quality measurement framework for IT services established in Lepmets et al. (2011)*. Based on the literature review, the framework is updated with new measures and indicators.

After the research setting is introduced, the paper has two major parts as shown in Figure 1 - the summary of the reviewed literature, and the extended IT service quality measurement framework. The discussion proposes an updated measurement framework and the conclusion provides an agenda for future research to operationalize the proposed framework.

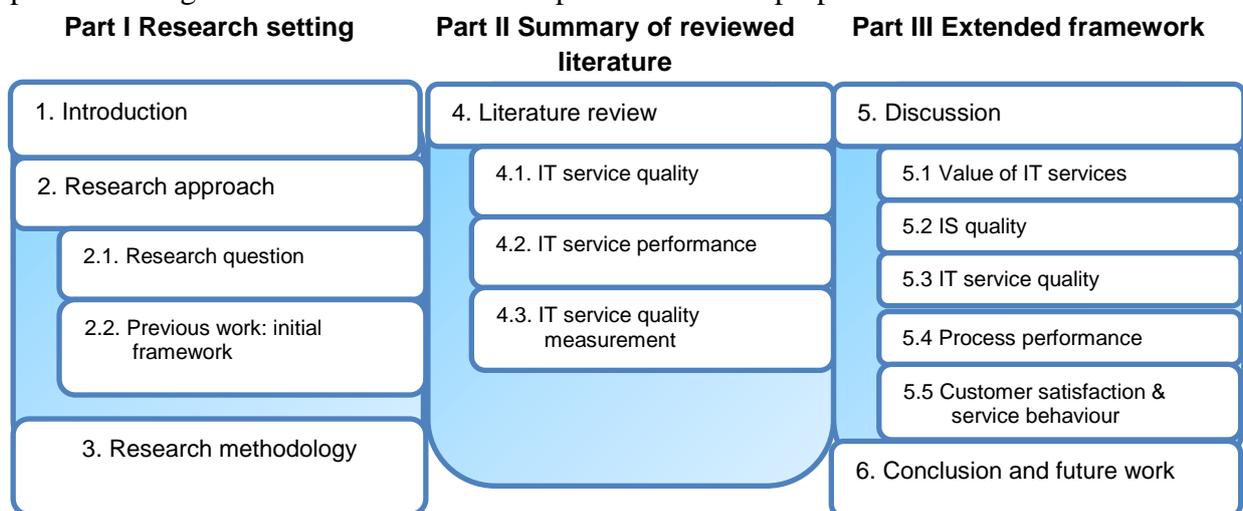| Part I Research setting	Part II Summary of reviewed literature	Part III Extended framework
1. Introduction	4. Literature review	5. Discussion
2. Research approach	4.1. IT service quality	5.1 Value of IT services
2.1. Research question	4.2. IT service performance	5.2 IS quality
		5.3 IT service quality
2.2. Previous work: initial framework	4.3. IT service quality measurement	5.4 Process performance
		5.5 Customer satisfaction & service behaviour
3. Research methodology		6. Conclusion and future work

Figure 1 – Paper outline

2 RESEARCH APPROACH

In order to improve service quality, it is necessary to have a comprehensive view of service offering – the intrinsic and extrinsic quality attributes that contribute to customer satisfaction. Service providers need to know the internal functioning of the attributes that comprise the services offered. To decide upon the course of improvement, managers need the analysed data about the intrinsic service quality attributes. Our study responds to the recommendation of Seth et al. (2005) that calls for further studies on the measurement of service quality: how to quantify and measure the quality of service, focusing primarily on the intrinsic service quality attributes.

We start by reviewing literature on IT service quality and IT service performance with the goal to discover the most fine-grained level of IT service measures – the measurable indicators as defined in Lepmets et al. (2011). IT service quality is generally improved in order to increase business performance of the service provider, in particular the efficiency of financial, technical, process, and human performance (Spath et al. 2011). Due to the intimate connection between service quality and service performance measurement, and the way these terms have been used synonymously in service management literature, we review literature using both of these terms.

As a result of the systematic literature review, we extend the measurement framework of IT service quality (illustrated in Section 5) that was initiated in Lepmets et al. (2011). The framework will be validated in industry through case studies in the next stage of the project.

2.1   Previous Work - Measurement Framework for IT service quality

In previous work we described a quality measurement framework for IT services which categorizes IT service quality measures and indicators into four common issue areas: IT service quality, information system quality, process performance, and customer satisfaction measures (Lepmets et al. 2011). The measures of the original framework are based on widely used standards and frameworks drawn from the software engineering and IT service domains: Practical Software and Systems Measurement (PSM 2000), Software product Quality Requirement and Evaluation, i.e. SQuaRE (ISO/IEC 25010 2009), IT Infrastructure Library (ITIL) (Lloyd et al. 2007), SERVQUAL (Parasuraman et al. 1991) and IT Service Management - Process Reference Model (ISO/IEC 20000-4 2010). The categorization of measures followed the SQuaRE standard and the measurement process elements were derived from the PSM approach, which provides generic elements for quality measurement. The measurable attributes of IT service quality of the original framework were based on IT service management literature. Many of the basic concepts of PSM have been formalized in ISO/IEC Standard 15939 – Software Measurement Process and are closely related to other measurement approaches, such as the Goal/Question/Metric approach (Basili et al. 1994). The PSM measurement specification guidance is designed to simplify the mapping of project issues to applicable measures.

We extend the use of the PSM measurement elements depicted in Figure 2, by applying them to the service quality domain. Service managers, similarly to IT project managers, require detailed information about the service to make informed decisions and achieve effective communication throughout the organization that provides the service. The PSM process is adapted to meet these *information needs*. *Common issue areas* are derived from management information needs about a service. Issues are areas of concern that may impact the achievement of a service objective. An *indicator* is a measure or combination of measures that provides insight into an issue or concept. Most indicators compare actual values with baselines. *Measurement categories* define groups of related measures. A measure is the quantification of a characteristic of a process, service, or a product. Each *indicator* in the PSM is related to a common issue area, measurement category, and measure. An indicator is the most fine-grained measure and is derived from other measures (Garcia et al. 2006).
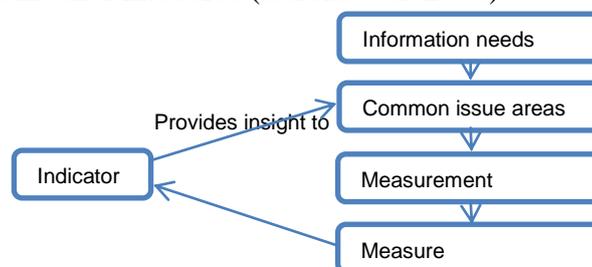

Figure 2. PSM measurement process elements (PSM 2000)

The original quality measurement framework for IT services described in Lepmets et al. (2011) categorizes IT service quality measures into two groups: a) intrinsic measures (with sub-categories of common issue areas on IT service quality, information system quality, and

process quality); and b) extrinsic measures (common issue area of customer satisfaction). The intrinsic measures impact the customer experience of the IT service but they can only be measured and improved by the IT service provider. The extrinsic measures relate to customer satisfaction (e.g., through customer satisfaction surveys). This paper extends the intrinsic measures of the original framework based on the literature review. Section 5 presents a detailed description of the extensions to the framework.

3   RESEARCH METHODOLOGY

In order to reach the goal of the study (to extend the measurement framework of IT service quality), a systematic literature review was conducted to establish the current understanding and practices of IT service quality measurement. To ensure that we found the relevant literature, we specified the search criteria, search terms, and practical screening criteria (Fink 2005).

In this iteration of the literature review we limited the search criteria to bibliographic databases and peer-reviewed journals in the IT Service Management domain. Four Online databases were queried: Scopus (include IEEE and ACM) – physical sciences; Web of Knowledge (Thomson Reuters); Springer; and Science Direct (Elsevier).

In addition, the following five journals on Service Research were searched: Journal of Service Research (Sage publications); International Journal of Quality and Service Sciences (Emerald); Journal of Service Management (Emerald); International Journal of Service Science, Management, Engineering and Technology (IGI Global); and Journal of Service Science and Management (SciRP).

The following search terms were used to select articles of interest:

a) "IT service" and quality - for finding new common issue areas for the IT service quality measurement framework
b) "IT service" and performance – for articles where *quality* keywords have been replaced with *performance* indicating the focus on internal functioning of services attributes
c) "IT service" AND (measurement OR metric OR measures OR measuring) – for the fine-grained measurable indicators to complete the IT service quality measurement framework.

For service research journals we only used the search terms: "IT service quality" AND (measurement OR measure OR metrics OR measuring) to restrict our selection to articles related to IT service quality measurement.

In terms of practical screening criteria, we included articles on IT service and IT enabled services (e.g. HR and web services), written in English language, published from 2001 until the end of September, 2011. Publications on service research in domains other than IT, in languages other than English, and service-oriented research were excluded from our collection of research articles.

4   LITERATURE REVIEW OF SELECTED ARTICLES

A summary of the number of original articles retrieved after applying the practical screening criteria is presented in Figure 3. Every subsequent search with the next search term and source returned a large number of publications that were already retrieved by previous searches. Figure 3 illustrates the number of all the retrieved articles ("all") and the non-duplicate articles ("initial" and "non-duplicate"), i.e. the additional articles to previous searches, after applying the practical screening criteria.

Only "IT service quality measurement" related works were sought in the journals, as the goal of the research is to primarily understand IT service quality measurement.

Based on the practical screening criteria specified earlier, we identified 134 articles for analysis. All articles were read and text describing common issues areas, measurement categories, measures, and indicators were extracted by one researcher.
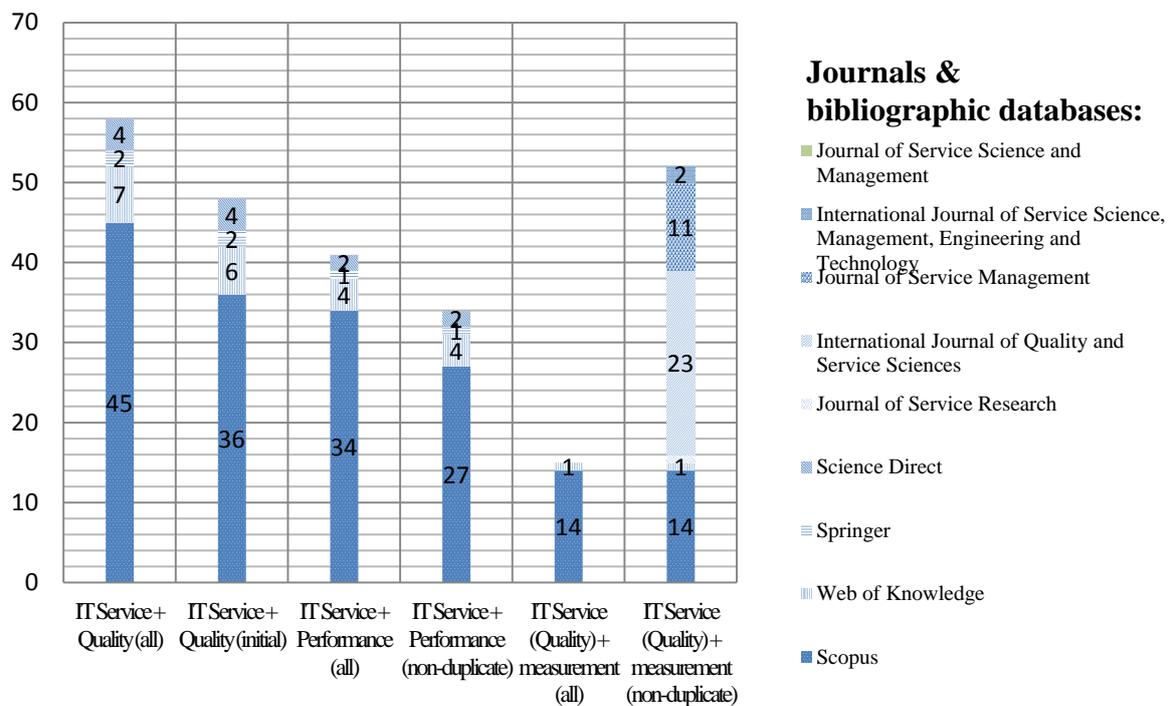

Figure 3. Number of retrieved (all) and selected (initial and non-duplicate) articles per search term

The extracted text segments were then mapped to the elements of the original quality measurement framework. Extracted text segments that did not match the elements of the original quality measurement framework were identified as candidates to extend the framework. The articles were then categorized per search term into six valid categories, and one category for irrelevant papers as summarised in Table 2.

Table 2 –Number of research articles by common issue areas for review

Common issue areas	Included for analysis		Excluded
	Intrinsic	**Intrinsic & Extrinsic**	

Search terms	IS quality	IT service quality	Process quality	Value	Customer satisfaction & service behaviour	Irrelevant
IT service quality (34)	5	6	11	1	11	9
IT service performance (12)		1	9	2		21
IT service quality measurement (45)	1	6	10	5	23	7

The categories represent the four common issue areas of the original quality measurement framework (the intrinsic measures of IT service quality, information system (IS) quality, process quality; and the extrinsic measures of customer satisfaction), and two new common issue areas that were added based on the new knowledge gained from the systematic literature review process. One of the new common issue areas describes the intrinsic measures of value – the value offered that resides in, and therefore is attributable to, the intrinsic qualities of a service design (Walker et al. 2006). This area is highly relevant to IT service quality as it provides an understanding of the value defined by the customer and the value provided by the supplier in the context of a service delivery. If customers cannot create value out of a service, they will not be prepared to pay the price but will demand a lower price or stop buying altogether (Grönroos et al. 2010). The second new common issue area deals with the intrinsic measures of service behaviour gathered through employee satisfaction surveys. Despite being included for analysis based on their keywords, there were still articles that were clearly not related to services or service quality, and were irrelevant to the current study and therefore excluded, resulting in 91 articles for the analysis. The rest of the grouping followed the common issue areas described above – the intrinsic measures of information system quality, IT service quality, and process quality with the new categories of value and service behaviour; and the extrinsic measures of customer satisfaction.

We began by searching for literature on IT service quality and IT service performance with the aim of finding new service quality attributes to make our original framework more comprehensive for the measurement of IT service quality. The reviewed literature is categorised based on the main focus area of the article, i.e., all IT service quality articles describe the impact on customer satisfaction yet many of them describe different service quality attributes that impact the customer satisfaction.

4.1 Overview of IT service quality literature

This section provides a summary of the IT service quality articles using the six pre-defined common issue areas of information system quality, IT service quality, process quality, customer satisfaction, service behaviour, and value. With the exception of customer satisfaction measures, all the groups illustrate the intrinsic measures that comprise an IT service offering. In total, 34 articles on IT service quality were reviewed. Five of the articles focused on information system quality, six on IT service quality, eleven on process quality, and one article covered the overall issues of value production in an organization.

4.1.1 Intrinsic measures of information system quality

Information system quality measures have been addressed in service science (Choi et al. 2009), software assurance (Markl et al. 2010), Enterprise Resource Planning (ERP) systems (Dwyer 2006), Application Service Providers (ASP) (Kim 2010) and Healthcare (Winter 2009).

In service science most research activity has been conducted on improving productivity, efficiency, and customer satisfaction of IT service, but there is a lack of research on software assurance (Choi et al. 2009). Choi et al. identify a correlation between service quality and customer satisfaction, "if any software application or module in IT service behaves incorrectly, service quality, and customer satisfaction will decrease significantly" (2009). In order to solve such problems, they propose a system for the improved software assurance focusing on security flaws and vulnerabilities in software.

The importance of information system quality has also been identified by Dwyer (2006) who argues that the real value of ERPs is to have alignment between the direction of the business and their business partners – both customers and suppliers. This corresponds to the concept of mutual value creation described by Grönroos et al. (2010).

To assist service providers develop better ASP services to improve the quality of experience of the users, Kim (2010) proposed a framework based on SERVQUAL to measure and analyse clients' demands (voice of customers and service agreements) and essential functional elements (voice of engineers and engineering characteristics) for quality improvement.

In the healthcare domain Winter et al. (2009) discuss information systems and the importance of service quality in medical informatics. They conclude that there are challenging research topics concerning information management, IT service management in small health care units, reference models, trustworthy architectures, and service-oriented architectures in the multidisciplinary field of medical informatics that require exploration.

4.1.2 Intrinsic measures of IT service quality

The reviewed literature highlights the importance of measuring IT service quality and describes measures as well as methods for assessing IT service quality. A method to assess *service availability* that automatically generates availability models, based on the service/process description and technical infrastructure is proposed by Milanovic et al. (2011). The importance of availability in service management is also described by Radhakrishnan et al. (2008), as they propose taking a holistic view of high-availability service management (availability of critical IT and IT enabled business services).

IT service quality can be measured by evaluating the effect of demand heterogeneity (variance in quantity and quality requirement across users) using an analytical model for a price-penalty scheme developed by Sen et al. (2009). Focusing on the requirements specification in device-oriented management, Rodosek (2002) developed a specification language QUAL that provides the means for the description of the calculation metrics of quality of service parameters enabling a direct mapping to device-oriented service level management tools, dealing with quality of device parameters.

Web services have to address requirements such as quality of service (QoS), availability, security, reliability, and cost (Purcarea et al. 2008).

4.1.3 Intrinsic measures of process quality

Research demonstrates how intrinsic measures of process quality can be used to improve service quality. Organisations implementing ITIL in the context of a wider organizational change, improve the quality of their services through better IT service management processes (Dumitriu 2008). IT service management improvement can also be achieved through modelling the assets that constitute the IT service management design in Enterprise Architect's Business Process Model (Zhao et al. 2008). A self-assessment methodology underpinning business excellence models and the Six Sigma techniques has been used in government agencies to improve IT services (Edgeman et al. 2005). A repeatable and objective basis for improvement of IT service quality can be achieved through baselines using ITIL service management processes and the international standard ISO/IEC 15504 (Barafort et al. 2002). An alternative method of analysing current IT service management processes relies on identifying process characteristics of optimal processes to establish criteria for high process quality that can be organized into a catalogue and subsequently computed with a numerical quality rating (Brenner et al. 2002). Another alternative entails implementing ITIL or ISO/IEC 20000 processes through an effective collaboration with CobiT based KPIs that can be used to measure and enhance the processes (Sharifi et al. 2008). This closely relates to the IT service customers' expectation of process integration, co-registration or co-certifications, i.e., that their service providers have implemented multiple standards rather than one (Hickey et al. 2008). The importance of requirements, strategic IT policies, risk management, pragmatic considerations, the managed exploitation of experience and the managed adoption of new technologies are described as drivers of configuration management by Martin (2003).

The use of applications to support the integrated monitoring of ITIL processes such as incident management, change management, configuration management, problem management, and release management is described by Sakurai (2007) and similarly in the context of availability, capacity and service level management by Ishibashi (2007). Applications can also help manage service level agreements using an integrated framework of knowledge representation concepts to define and automatically enforce large numbers of SLAs based on generic derivation rule engines (Paschke et al. 2008).

4.1.4 Extrinsic measures of customer satisfaction and intrinsic measures of service behaviour

The review identified 11 articles focused on people involved in IT service delivery and they can be divided into two groups: a) articles describing the extrinsic measures of customer satisfaction using SERVQUAL (Huberman et al. 2005; Kim et al. 2011; Lin et al. 2009; Pietsch 2005; Yoon et al. 2008; Zhu et al. 2011); and b) others covering the intrinsic measures of IT service climate, employee satisfaction, and service behaviour (Ahn et al. 2009; Jia et al. 2008; Jia et al. 2011; Liu et al. 2010; Saunderson et al. 2002).

IT service climate is defined by Jia et al. (2011) as IT employees' shared perceptions of the practices and behaviours in their workplace that support the provision of IT service to business customers. The authors conducted survey studies and found that the IT service climate (of the service provider's organization) is highly influential on client evaluation of service quality, even more so than factors such as technical competency of the IT workforce. "While technical competency of IT employees accounted for 15% of the variance in clients' ratings of IT service

quality, IT service climate explained an additional 27% of variance, demonstrating excellent explanatory power beyond technical competency". The authors identified IT climate service dimensions giving emphasis to a higher order goal (the service vision) as a motivating force and alignment of personnel assessment with service performance (the service evaluation) while similarly highlighting the importance of leadership (the service leadership).

4.1.5 Intrinsic measures targeting issues of value production

Though lean principles are generally well established and have broad applicability, their extension from manufacturing to IT support services is only just emerging. In a study focused on the identification and categorisation of waste/non-value added activities in IT support services environment, Kundu et al. (2011) discuss the application of lean principles to IT service systems. This is useful for IT services organisations pursuing continuous process improvement using lean principles.

4.2 Overview of IT service performance literature

This section provides a summary of IT service performance literature. Retrieved articles are arranged into three groups: IT service quality, process quality, and issues targeting business-driven service design and governance. In total, 21 articles were retrieved on IT service performance: one described IT service quality, nine focused on process quality and three on the issues concerning value in terms of service performance. No additional articles to the ones already retrieved from the previous search describing information system quality, customer satisfaction, or service behaviour were found.

4.2.1 Intrinsic measures of IT service quality

Tian et al. (2009) discussed increasing efficiency of web-delivered services through service analytical technology. The authors proposed a three-tier analytical framework to improve the service provider's business performance through service improvement that will ultimately improve the business performance of the service end-users. They also described the fundamental challenges of service analytics technology that include a) how to satisfy data availability, quality and privacy requirements at the start-up phase; and b) how to include the *time dimension* and *economic environment* to study the dynamics and evolvement of service ecosystems.

4.2.2 Intrinsic measures of process quality

Managers' judgements often form fundamental inputs into organizational functions such as providing project status updates to senior executives and informing decisions on resource allocation, budget revision, and staff hiring (Ramachandran et al. 2010). As Ramachandran et al. contrasted objective measures of IT outsourcing process performance with subjective managerial judgements of process performance obtained from managers of recently completed projects they came to the conclusion that managers should pay close attention to the inputs they use to form their performance judgements and be sensitive to the objectiveness of inputs to the task at hand.

Galup et al. (2009) provided an overview of IT service management processes and six additional articles discussed the performance of various IT service management processes such as service level management (Gao et al. 2010; Sauvé et al. 2005), portfolio and risk management (Kotani et al. 2008), service delivery (Kumaran et al. 2007), service design

(Brocke et al. 2011), knowledge management (Chang et al. 2009) and incident management (Bartolini et al. 2010).

A dynamic service level management system, where service level objectives are adaptively maintained, can increase the reliability of the service system and optimize the resource utilization of IT infrastructure (Gao et al. 2010). Service level agreements should also be designed from the business perspective according to Sauvé et al. (2005) who suggested that higher-revenue business processes deserve better infrastructure.

Similarly, process improvement initiatives should be aligned with business goals and the organization's core values for receiving organizational support as Chang et al. (2009) concluded after investigating the key factors for implementing knowledge management processes. A decision support tool is proposed by Bartolini et al. (2010) for the performance improvement of the incident management function simulating the effect of corrective measures before their actual implementation, enabling time, effort, and cost saving.

Kotani et al. (2008) suggested adding a risk-return model and risk-tolerance paradigm to an integrated portfolio management model that will improve the decision-making process and the performance of the entire corporation.

New customer-oriented service propositions (Brocke et al. 2011) and new IT service workflow automation tools (Kumaran et al. 2007) could better support the heterogeneity and collaboration between the service provider and its customer.

4.2.3   Intrinsic measures of business-driven service design and governance

IT can provide a means to meet business challenges, thus not formally taking business requirements into account is a major weakness (Sauvé et al. 2009). Business-driven IT management should formalize the linkages between IT infrastructure, the services it provides and the business it serves. In service level management, these requirements are expressed formally in service level agreements where service level indicators and service level objectives are described in great technical detail. Sauvé et al. claimed that business managers do not know how to translate their business needs into these technical measures. The authors suggested using the approach of business-driven IT management to understand the client's language – business measures – when discussing service quality and business impact. Business loss has two causes – service unavailability and service performance degradation but neither one is always a dominant cause. Whenever resources are saturated, service unavailability tends to be the more crucial source of problems. They also discovered that a business-oriented service design is superior to ad hoc design as it can provide a design that has lower overall financial impact on the business, regardless of the particular availability and response time measures provided by the service.

Spremić (2009) described how IT and information systems may contribute towards the efficiency, productivity and competitiveness improvements of both inter-organizational and intra-organizational systems, and more specifically how analytical IT governance mechanisms such as IS auditing and IT risk management based on CobiT help measure the actual performance and quality of information systems and the business value of IT governance initiatives.

4.3 Overview of IT Service quality measurement literature

When we examine the publications in six groups – process quality, information systems quality, IT service quality, customer satisfaction, service behaviour, and value, we see that in service management, the majority of articles describe the customer satisfaction and service behaviour areas. This is logical since service management is all about satisfying the customer of a service. For an organization that wants to improve the quality of that delivered service the customers will not provide the insight on how they can do it – this is something the organizations will have to decide themselves based on the measurement data they gather about the delivered service together with the expectation and perception the customer has about that service.

Table 3 provides a grouping of the reviewed articles into six common issue areas shown in the left columns (major focus of an article is marked as "+" and other topics discussed in that article are marked as "(+)"). The columns to the right of the article references indicate the level of detail of the measurement elements suggested in the articles in the context of the focused topic of that article (common issue area, measurement category, measure, or indicator).

Table 3 – IT service quality measurement articles by common issue area and measurement element

Common Issue Area						Article Reference	Measurement Element			
Process Quality	IT Service Quality	IS Quality	Value	Customer Satisfaction	Service Behaviour		Issue Area	Measurement Category	Measure	Indicator
(+)	+			(+)	(+)	(Al-Hawari et al. 2009)		+		
+						(Bhamidipaty et al. 2009)			+	
	+					(Brandl et al. 2007)		+		
+						(Coes et al. 2009)	+			
(+)			+	(+)		(Donko et al. 2009)				+
				+		(Essén 2009)	+			
	+					(Hosseini et al. 2006)				+
+						(Keller et al. 2007)			+	
+						(McNaughton et al. 2010)				+
	+			(+)	(+)	(Nazimoǧlu et al. 2010)				+
+						(Pollard et al. 2009)			+	
+						(Sauveć et al. 2008)			+	
			(+)	+		(Longbottom et al. 2011)				+
	(+)	+				(Edvardsson et al. 2010)	+			
	+					(Barrutia et al. 2009)	+			
	+					(Chiou et al. 2009)		+		
+						(Pauley 2010)		+		
				+		(Cassab et al. 2009)				+

			+		(Ding et al. 2011)	+			
			+		(Guenzi et al. 2009)				+
			+		(Ladhari 2009)	+			
			(+)	+	(Liu et al. 2011)				+
(+)			(+)	+	(Michel et al. 2009)	+			
			+		(Noone et al. 2009)				+
			+		(Ramseook-Munhurrun et al. 2010)		+		
			+		(Sultan et al. 2010)		+		
			+		(Teehan et al. 2010)		+		
			+		(Vauterin et al. 2011)		+		
			+		(Geum et al. 2009)		+		
			+		(Roos et al. 2009)		+		
			(+)	+	(Cesarotti et al. 2009)		+		
			(+)	+	(Furtmueller et al. 2011)		+		
			(+)	+	(Jiang et al. 2009)				+
			(+)	+	(Lanjananda et al. 2009)			+	
			(+)	+	(Poujol 2009)			+	
			(+)	+	(Punjaisri et al. 2009)			+	
			(+)	+	(Trivellas et al. 2009)			+	
				+	(Slatten 2011)			+	
+					(Diao et al. 2006)		+		
+					(Suarez-Barraza et al. 2009)		+		
+					(Dallaway 2010)		+		
		+			(Enquist et al. 2011)		+		
	(+)	+			(Camén 2010)		+		
		+			(Grönroos et al. 2010)				+
		+			(Indounas et al. 2009)		+		

In the next sections we provide an overview of the IT service quality measurement literature in each common issue area and a more detailed description of the findings are given in case they contribute new measures, categories, or common issue areas to a more comprehensive IT service quality measurement framework.

4.3.1 Intrinsic measures of IS and IT service quality

Of the 45 articles on IT service quality measurement, only 12 described IT enabled services (Al-Hawari et al. 2009; Bhamidipaty et al. 2009; Brandl et al. 2007; Coes et al. 2009; Donko et al. 2009; Essén 2009; Hosseini et al. 2006; Keller et al. 2007; McNaughton et al. 2010; Nazimoǧlu et al. 2010; Pollard et al. 2009; Sauvećetal. 2008). We therefore analysed the quality measurement of the 45 articles to understand the possible similarities to transfer the knowledge from service management to IT service management. Of the 45 articles only one article described the link between the extrinsic measures of customer satisfaction and the intrinsic quality attributes (Longbottom et al. 2011). The study by Longbottom et al. (2011)

indicated that services should be designed from the value perspective of the customers and staff while integrating and promoting interdependence within the service provider's organization.

In light of the essential role of information systems in enabling the delivery of IT services, it was surprising to find only one article described the intrinsic measures of information system quality in greater detail (Edvardsson et al. 2010). There are seven articles that describe the intrinsic quality attributes of IT service (Barrutia et al. 2009; Camén 2010; Edvardsson et al. 2010; Hosseini et al. 2006) with three of them focusing on the security and privacy issues of these IT services (Al-Hawari et al. 2009; Chiou et al. 2009; Pauley 2010). This is also disturbingly little research considering that decisions about the quality of a service are made based on the measurement data gathered on the quality of these services – how can services be improved without having the data about their current quality?

4.3.2 Extrinsic measures of customer satisfaction and intrinsic measures of service behaviour

The analysis of the 45 IT service quality measurement articles revealed 18 articles which described the extrinsic measures of customer satisfaction (Al-Hawari et al. 2009; Cassab et al. 2009; Ding et al. 2011; Donko et al. 2009; Edvardsson et al. 2010; Guenzi et al. 2009; Ladhari 2009; Liu et al. 2011; Longbottom et al. 2011; Michel et al. 2009; Nazimoǧlu et al. 2010; Noone et al. 2009; Ramseook-Munhurrun et al. 2010; Sultan et al. 2010; Teehan et al. 2010; Vauterin et al. 2011). Two articles analysed customer choice (Geum et al. 2009) and customers' emotional stability (Roos et al. 2009) in the context of service delivery. In addition, there are 14 articles on service behaviour and employee behaviour, 12 of which described its impact on customer satisfaction (Al-Hawari et al. 2009; Cesarotti et al. 2009; Edvardsson et al. 2010; Furtmueller et al. 2011; Jiang et al. 2009; Lanjananda et al. 2009; Liu et al. 2011; Michel et al. 2009; Nazimoǧlu et al. 2010; Poujol 2009; Punjaisri et al. 2009; Trivellas et al. 2009), and two articles on innovation (Essén 2009; Slatten 2011).

Successful service recovery needs integrated action from a company to re-establish customer satisfaction and loyalty after a service failure (customer recovery), to ensure that failure incidents encourage learning and process improvement (process recovery) and to train and reward employees for this purpose (employee recovery) (Michel et al. 2009). Also the way a company handles problems, accuracy of records, usability, and scalability – the four service interface factors, strongly affect customer trust and loyalty (Cassab et al. 2009). Al-Hawari et al. (2009) explored the significance of service quality factors on customer retention describing four dimensions of service quality: a) employee service quality (friendly, inquiry responses, feel safe and secure, served promptly, best interest at heart, right service, queues), b) process service quality (hassle-free, minimum time, simple, fool-proof), c) tangible service quality (pleasant environment, physical design, well decorated, easily accessible) and d) customer retention (saying positive things, recommending your supplier, encouraging friends to consider your supplier, remaining with the same supplier if costs increase). Chiou et al. (2009) similarly concluded that customer loyalty towards both the service and service provider are a part of a customer behaviour that is based on the customer satisfaction. Jiang et al. (2009) aimed to measure the quality of service providers through service behaviour (of software developers and project managers), service provision (the quality of the work done by programmers, testers,

designers, and project managers) and the quality of the final product (the software or system) (Jiang et al. 2009). Liu et al. (2011) generalized the model described by Jiang et al. to fit any object under evaluation, proposing more attributes but describing less how to actually measure these.

4.3.3   Intrinsic measures of process quality

The intrinsic measures of process quality in service management were described in 11 articles: one on general process performance (Al-Hawari et al. 2009), three on process compliance (Bhamidipaty et al. 2009; Dallaway 2010; Pauley 2010), two on process efficiency and effectiveness (Donko et al. 2009; McNaughton et al. 2010), one on critical success factors in ITIL implementation (Pollard et al. 2009), two on process complexity (Diao et al. 2006; Keller et al. 2007), one on continuous process improvement (Suarez-Barraza et al. 2009) and one on risk management (Sauvé et al. 2008).

McNaughton et al. (2010) provided a holistic multi-dimensional framework with both objective and subjective means of assessing ITIL benefits from a variety of perspectives. Their framework measures three types of metrics in the process level – effectiveness, capability, and efficiency from four perspectives: management, technology, user, and IT employee, where the first two perspectives are collected by gathering available metrics on the basis of a set goal achievement and the latter two based on survey questions. The service culture is also evaluated – the effect of ITIL implementation on IT employees as a "proper implementation of ITIL processes may to a degree lead to improvement in customer satisfaction but the overall philosophy of ITSM requires complementary efforts other than just process level improvement" (McNaughton et al. 2010).

ITIL implementations in industry were studied by Pollard et al. (2009). They compared the critical success factors (CSFs) with ones described in related literature. The new CSFs discovered were process- and ITIL-friendly culture in the organization, and customer-focused metrics.

Bhamitipaty et al. (2009) proposed three metrics for fully automated processes: a) Process Policy Compliance Index (PPCI) – a compliance score of a set of execution traces of a process model against the set of clauses of a single policy; b) Multi-PPCI – an aggregated function that operates on the PPCIs of each process-policy pair, weighting each process and policy suitability; and c) Organizational Compliance Index (OCI) – an aggregation function that recognizes the context in which multiple processes occur. OCI takes the organizational hierarchy and distribution of processes and policies into account to compute a summarizing score for each business unit.

4.3.4   Intrinsic measures targeting issues of value

A new possible common issue area is suggested by Enquist et al. (2011) who described value proposition and its measurement in a service organization, and the concepts and measurement of mutual value creation offered by Grönroos et al. (2010). Camén (2010) described service quality from the organization's goal alignment perspective and the financial dimension in service measurement and its relation to service strategy is described by Donko et al. (2009) and Indounas (2009).

Service logic implies that all activities and processes of a supplier that are relevant to its customer's business are coordinated with the customer's corresponding activities and processes into one integrated stream of actions. This coordination aims to support the customer's processes and eventually the business outcome (Grönroos et al. 2010). Mutual value creation stems from the principles of service logic where value is a mutually created phenomenon since the value a supplier can create in a business engagement with a customer is dependent on the value that this customer can create from being involved in the same relationship. Mutual value creation requires two models – one for the customer's value-creating process (value for the customer) and one for the supplier's value creation processes (value for supplier). These two processes are connected, because value is generated for both parties from the same business engagement and due to the joint-productivity gains that can be achieved. Grönroos et al. (2010) proposed a model for measuring the mutual value creation and productivity gains in terms of revenue growth. This information will help companies determine whether gearing their activities and processes towards supporting the customer's practices generates productivity gains that can be shared as value to the customer and value to the provider.

Enquist et al. (2011) proposed a model to govern a loosely coupled value network based on values rather than rules, where a more dynamic approach is required to define, design, and deliver the service solutions than in a value chain (Enquist et al. 2011).

Camén (2010) studied how service quality is described and used in three different management levels where the service provider is in complex business settings and contractors aim to control the service by contractual means as they are ultimately responsible for providing the service to end-users. Although the service quality factors and characteristics have been described in contracts at all levels – rhetoric, strategic and operational, the alignment between these levels is not implicit. The rhetoric level expresses the visions and missions, and should be the level that affects or is the base for the other two levels yet there is no obvious definition, description, or guidance about how to meet the goals of the rhetoric level. There is also no indication if achieving the goals at the rhetoric level can be achieved by fulfilling the goals at the other two levels.

Measuring service effectiveness should focus on customer-defined quality, continual improvement, employee empowerment, and measurement-based management where metrics are developed based on the priorities of the strategic plan that provides the key business drivers and criteria for metrics (Donko et al. 2009). For these measurement purposes, the authors proposed an ITIL Service Operation Balanced Scorecard that will help make the service provider more effective and efficient.

5 DISCUSSION AND ENHANCED MEASUREMENT FRAMEWORK

In this section we provide the extensions to the quality measurement framework for IT services. As a result of the literature review we discovered two new common issue areas that give insight to the state of intrinsic attributes of service quality and their possible improvement ideas. An important theme emerging from the literature review is the role of value that provides the business context of the IT service. After value is discussed, the focus of the discussion shifts to other internal measures, and finally to the inter-related areas of customer satisfaction

and service behaviour. Service behaviour is the second new common issue area added to the framework– although it is a part of the service provider's business, it is intimately linked to customer satisfaction affecting customer loyalty towards the service and its provider. All extensions to the framework are marked in *italics* in the Tables 4-9, and are described in greater detail in the following subsections, while the original framework elements have already been defined in Lepmets et al. (2011).

5.1 Intrinsic measures of IT service value

The dynamics and evolvement of a service ecosystem defines the dimensions of time and the economic environment of each service provider. These dimensions impact the strategic business model of that service provider and are used for defining the collaboration relationships and pricing mechanisms between the service provider and its customers (Tian et al. 2009). The strategic business model illustrates the strategic goals of the service provider organization. These strategic goals should influence the service quality factors and characteristics but in reality this alignment is often not established as there is no general knowledge or guidance on how to translate the high level goals to service quality goals (Camén 2010). This alignment can also be referred to as IT governance and it impacts risk management, resource and performance management, business/IT strategic alignment, and value creation and value delivery (Spremić 2009), all highly relevant to service quality and customer satisfaction. The necessity of measuring value creation and delivery has also been stressed by Kundu et al. (2011) and Grönroos et al. (2010) who claimed that value is produced for a service provider only when it is co-created with the customer (Grönroos et al. 2010) and the waste in service activities is eliminated (Kundu et al. 2011). Based on these studies, we have added a new common issue area to our framework that focuses on *value* as shown in italics in Table 4. We believe that value creation is an overarching concept in service management but it has received little research attention to date.

Value is a mutually created phenomenon since the value a provider can create in a business engagement with a customer is dependent on the value that this customer can create from being involved in the same relationship (Grönroos et al. 2010). Grönroos et al. proposed measuring the *mutual value creation* and productivity gains in terms of *revenue growth.* Analysing the financial measures of value helps the provider determine whether gearing its activities and processes towards supporting customer's practices will generate productivity gains that can be shared as value to the customer and value to the provider. An organization's productivity will increase and the IT service management processes continuously improve when the *non-value added activities* in IT support services are identified as *waste* and eliminated according to the principles of lean management (Kundu et al. 2011).

Both value creation and business/IT strategic alignment contribute towards the efficiency, productivity, and competitiveness of inter-organizational and intra-organizational systems. *IS audits* can be used to measure the business value of IT governance initiatives such as *business/IT strategic alignment,* and value creation and delivery (Spremić 2009), where *IT governance* is viewed as a process for controlling an organization's IT resources, including information and communication systems and technology. Table 4 illustrates the indicators that

can be used to measure value production and delivery of the new common issue area of value of IT service in the framework.

Table 4 – Common issue area: value of IT service

Measurement Category	Measure	Indicator
Mutual value creation	*Value co-creation*	*Revenue growth*
Value production	*Waste*	*Non-value added activities*
IT governance	*Business/IT strategic alignment*	*IS audit results*

5.2 Intrinsic measures of information system quality

Information System quality relates to the system's ability to support the IT services delivered. Two new measures are added from the literature to the framework concerning Information System quality as shown in italics in Table 5. Choi et al. (2009) suggested focusing on software assurance and specifically on *software security flaws and vulnerabilities* because if any software application or module of IT service behaves incorrectly, service quality and customer satisfaction decrease significantly. At the same time, the business environment of a service provider changes frequently and it is important to focus on the system's adjustability to the business needs while developing business services, therefore *business customization* is added based on the advice of Kim et al. (2010).

Table 5 – Common issue area: information system quality

Measurement Category	Measure	Indicator
Functional Correctness	Defects	Defect density
	Security flaws and vulnerabilities	
Portability	Standards Compliance	Interface compliance validation
Usability	Problems and Errors	Number of prevented problems daily Number of incidents related to problems daily
Availability – reliability – maintainability	Time to Restore	MTBSI – mean time between system incidents MTBF – mean time between system failures MTRS – mean time to restore system Number of incidents resolved out of all incidents daily
Component capacity	Performance of technical components	Number of system failures related to component performance
	Capacity of technical components	Number of system failures related to component capacity
Scalability	Growth without business disturbance	Incidents related to the speed of growth
Adjustability	Complexity	System complexity
	Business customization	*System adjustability*

5.3 Intrinsic measures of IT service quality

The common issue area of IT service quality describes the measures that support the stability of the IT service, since the constant quality of the service is one of the most important but also one of the most difficult aspects faced by service industry (Polter et al. 2008). Table 6 illustrates the two new measurement categories, two new measures, and eight new indicators

for IT service quality. IT service stability is related to attributes that aim to provide IT service continuously in the way agreed with the customer (Lloyd et al. 2007). Sauvé et al. (2009) examined business impact (the financial loss) imposed by an imperfect IT infrastructure and concluded that business loss has two main causes – *service unavailability* and *service performance degradation*, whereas a business-oriented service design is superior to an ad hoc design as it has lower overall business impact. Nazimoǧlu et al. (2010) also conducted impact analyses discovering that *the delayed solutions* impact all service providers' processes. This finding is also supported by the notion of timeliness in accomplishing service promises proposed by Jiang et al. (2009) and Liu et al. (2011).

IT effectiveness supports service stability and is based on the functionality, availability, and utilization of IT applications for each core business process, where *utilization rate* measures the extent to which the IT service functions provided are actually used indicating their importance to the core business (Hosseini et al. 2006). To provide an IT service the *monetary value of the IT service* will have to be agreed by the service provider and the customer. Both cost and price have to be considered, where *cost* measures the actual cost to the service provider for providing services and *price* measures the actual price the customer paid for received services (Jiang et al. 2009; Liu et al. 2011). In addition to these financial measures, Donko et al. (2009) proposed to measure the *accuracy of service operation functions' forecast* and *competitiveness of the service* to be able to analyse the economy and value of the service management functions.

Table 6 – Common issue area: IT service quality

Measurement Category	Measure	Indicator
IT Service Availability	Maintainability	MTRS – mean time to restore IT service after failure
IT Service Continuity	Business Impact Analysis (BIA) measures	Business impact on the loss of IT service (financial) Mean time to recovery Incidents related to IT service continuity Changes related to IT service continuity *Business impact on service unavailability* *Business impact on service performance degradation* *Business impact on delayed solutions*
	Management of Risks (M_o_R)	Number of identified risks and threats Weighted average of the impact of aggregated risks
IT Service Capacity	Capacity of operational services	Incidents related to IT service capacity Changes related to IT service capacity
IT Service Performance	Speed of information processing	Incidents related to IT service performance Changes related to IT service performance
IT Service Utilization	*Service importance to business*	*Utilization rate of IT service functions*
Information Security	Confidentiality	Incidents related to information confidentiality Changes related to information confidentiality
	Integrity	Incidents related to information integrity Changes related to information integrity
	Availability	Incidents related to information availability Changes related to information availability
IT Service	Dependability	Incidents, RFCs and problems handled daily

Reliability		Mean time to achieve incident resolution
Monetary value of the IT service	*Financial measures*	*Cost - actual cost for service provider to provide the service* *Price - actual price customer paid for received services* *Accuracy of service operation functions' forecast* *Competitiveness of service*

5.4 Intrinsic measures of process performance

The aim of process performance is to measure process effectiveness, efficiency and compliance using standards vital to the business. Table 7 describes the common issue area IT service management process performance that was updated with one new measure. Based on Bhamidipaty et al.'s (2009) proposed process compliance metrics, we include the *Organizational Compliance Index* to measure the context in which multiple processes occur, taking organizational hierarchy and distribution of processes and policies into account.

Table 7 – Common issue area: performance of IT service management processes

Measurement Category	Measure	Indicator
Process Compliance	Process Audit Findings	Process Audit Results
	Reference Model Rating	Process Assessment Results
	Organizational Compliance Index	
Process Efficiency	Productivity	Historical vs proposed and actual
Process Effectiveness	Defect Containment	Requirements defects discovered after design phase
	Rework	Rework effort

5.5 Extrinsic measures of customer satisfaction and intrinsic measures of service behaviour

The common issue area of customer satisfaction illustrates the measures of perceptions of the IT service from the customer viewpoint (Table 8) described in Lepmets et al. (2011). The study reported here focuses on the improvement of IT service quality not only reactively, after customer satisfaction surveys have been analysed, but also proactively. In other words, we intentionally did not look for new customer satisfaction measures but focused instead on the impacts of these measures. Both employee motivation and IT service management process improvement impact customer satisfaction (Michel et al. 2009), which determines customer behaviour including customer loyalty (Al-Hawari et al. 2009) towards the service and towards the service provider (Chiou et al. 2009).

Table 8 – Common issue area: customer satisfaction

Measurement Category	Measure	Indicator
Customer Feedback	Survey Results	Appearance of physical facilities, equipment, personnel and communications material IT service is provided dependably and accurately IT service provider is willing to help customers and provide prompt service IT service provider conveys trust and confidence IT service provider provides caring, individualized attention Perception of IT service stability

		Perception of IS quality
		Perception of IT service processes' performance
Customer Support	Requests for Support	Total calls per day answered, abandoned
		Average call response time
		Incidents handled daily by service desk

A new and highly relevant aspect for customer satisfaction that service providers can improve, called *service behaviour,* has been identified as shown in Table 9. IT employees' shared perceptions of the practices and behaviours in their workplace that support the provision of IT services to business customers, called *IT service climate*, is highly influential on client evaluation of service quality, even more so than the technical competency of the IT workforce (Jia et al. 2011). Jia et al. distinguished between three categories of IT service climate where *service vision* is a motivating force and alignment of personnel assessment with service performance, the *service evaluation*, while also highlighting the importance of *service leadership*. In order to maintain a certain level of IT service quality, *service system sustainability* of the IT service provider needs to be measured, more precisely the *sustainability of the resource*, *resource quantity*, and *resource quality* (Jiang et al. 2009; Liu et al. 2011).

Table 9 –Common issue area: service behaviour

Measurement Category	Measure	Indicator
IT service climate	IT service provider's employee survey results on: *Service Leadership*	*Work performance goals are regularly discussed with employees* *Employees know how the provided service contributes to better performance of the clients* *Best approach to serve clientsare discussed regularly* *Emphases of daily work are on providing excellent service to clients*
	Service Vision	*Effort is made by the service provider to be a respected partner to clients* *Being flexible when dealing with clients' perspectives* *Frequent communication with clients*
	Service Evaluation	*Recognition and rewards given for providing excellent client service* *Evaluation of how clients were served was a part of the most recent personal performance review* *Customer service is an important criterion of formal performance evaluation*
Sustainability of a service system	*Survey results*	*Saturation and sustainability of resource quantity* *Resource quality - capability and reliability of resource (education level and experience)* *Resource sustainability to maintain certain level of quality*

5.6 Summary of enhancements to framework

Based on the analysed literature, we extend the quality measurement framework for IT services proposed in Lepmets et al. (2011) by adding two new common issue areas, and related measures, and indicators (marked in *italics* in tables 4-9). Although the major target of IT service quality management is to guarantee customer satisfaction, a further goal is to improve IT efficiency and maximise the business value of IT service usage within companies (Praeg 2011). Proactive IT service quality improvement requires understanding the intrinsic IT service

quality attributes that need to be tailored according to the business value the IT service brings to both the customer and the service provider.

6   CONCLUSION AND FUTURE WORK

The two objectives of this paper have been achieved: the literature review established the current understanding and practices of IT service quality measurement; and this was used to extend the quality measurement framework for IT services originally described in Lepmets et al. (2011). The systematic literature review on IT service quality measurement identified 134 relevant journal articles to review. Of these, 91 were selected for analysis. From the review and analysis of these articles, the quality measurement framework for IT services was updated, adding two common issue areas, and related measurement categories, measures and indicators.

In order to improve service quality, a comprehensive view of service offering needs to be established. A service provider can improve the service quality it offers by considering the intrinsic service quality attributes. Proactive service improvement is truly achieved only when both value production and co-creation have been considered with the customer. Having value in mind, the service offering can be improved to respond to the business needs and expectations of its customers. The current situation of service quality has to be analysed to decide upon a course of improvement.

The framework represents an important contribution to practice. It provides detailed and comprehensive guidance for IT service providers suggesting measurable indicators to collect and analyse for IT service quality improvement. The extended framework comprises six common issue areas: value, Information System quality, IT service quality, performance of IT service processes, customer satisfaction, and service behaviour. Each common issue area has associated measurement categories, measures, and indicators.

As in any research project, this study has its limitations. The inclusion criteria of the literature review could be widened for a broader literature review on IT service quality measurement including customer satisfaction measures. Also, other publications such as conference articles, books, and book chapters could be included. The presented framework has yet to be validated in industry. Most importantly, the application of governance and value in IT service provision to IT service quality improvement requires further studies.

To validate the framework and provide a snapshot of current IT service quality measurement in practice, a questionnaire will be designed based on the revised framework and used to survey a large population of IT service managers. In addition, case studies will be conducted with selected IT service providers to determine the impact of IT service management process improvement on various aspects of IT service quality. Such studies can reveal more specific relationships between different elements of the measurement framework. The IT service quality measurement framework can also serve as a base from where IT service providers could select measures to gather and analyse to achieve their specific information needs. In addition to this, further studies are suggested to evaluate the framework's potential to foster value co-creation for service providers and their customers.

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