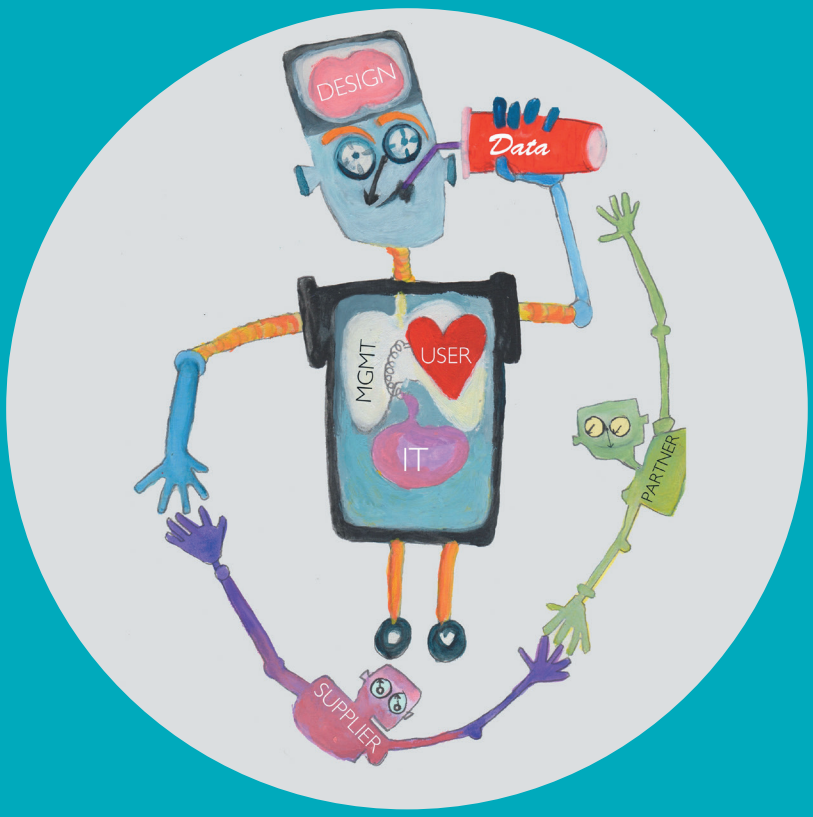
Department of Information and Service Economy

Design Framework for Performance Management Systems: An Ensemble Approach

Heikki Lempinen



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Abstract

Businesses and public sector organizations rely increasingly on fact-based management and decision making. Performance management systems enable these activities by helping organizations to derive "business intelligence" from a rapidly expanding amount of digital data. Moreover, performance management systems are designed to provide users with essential performance information through effective visualizations. To this end, the developers of performance management systems are faced with implementing increasingly complex technological solutions in organizational contexts that are governed by various information needs and often-conflicting interests of multiple stakeholders. The thesis focuses on these important questions to which the existing body of scientific knowledge on information systems design has not yet provided comprehensive explanations.

To address the knowledge gap, the present thesis establishes a research framework to study the key design challenges and essential managerial issues in the development of performance management systems. To populate the framework, empirical evidence is drawn from multiple system development projects through qualitative inquiry. Participative action-based research and qualitative case study research are adopted as the main research methods to gain in-depth knowledge of the associated organizational phenomena.

Overall, the thesis proposes that an "ensemble" approach is needed to uncover the complex interrelated organizational and technological factors that affect the design of performance management systems. Furthermore, guidance is given on how to overcome these issues to gain satisfactory outcomes in system implementations. To this end, the key findings point towards three essential design efforts: 1) designing the performance measurement model and metrics, 2) designing the procedures for capturing, storing, and processing data, and 3) designing the process and system for delivering performance information to the users. In addition, the results highlight that success in system development initiatives is heavily influenced by contextual factors and especially the interaction of essential stakeholders throughout the design process.

The study contributes to the existing body of theoretical knowledge on information systems design. In addition, it provides empirical insight on the design of novel IT artifacts and the principles that are deemed effective for developing performance management systems. Furthermore, the study provides a better overall understanding of the relevant kernel theories that inform the design knowledge and help to explain the associated organizational phenomena. The practical contribution of the study builds upon the guidance provided to system designers and managers through several frameworks, IT artifacts, and management practices for information systems design processes.

Keywords design research, ensemble artifact, case study, performance management systems, performance measurement, business intelligence, dashboard, action design research, agency theory, IT service

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Tekijä
Heikki Lempinen

Väitöskirjan nimi
Viitekehys suorituskyvyn hallintajärjestelmien suunnitteluun monen toimijan kokonaisuuden näkökulmasta

Julkaisija Aalto-yliopiston kauppakorkeakoulu

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Tutkimusala Tietojärjestelmätiede

Tiivistelmä

Yhä useammassa organisaatiossa pyritään tekemään päätöksiä tosiaikaiseen faktatietoon perustuen. Suorituskyvyn hallintajärjestelmät (performance management systems) auttavat päätöksentekijöitä muodostamaan niin kutsuttua liiketoimintaälyä alati kasvavista tietoaineistoista ja visualisoimaan organisaation määrittämiä tunnuslukuja ja mittareita. Tällaiset järjestelmät ovat teknologisesti yhä monimutkaisempia ja niiden suunnittelu edellyttää syvällistä tuntemusta organisaatiokontekstista joihin niitä sovelletaan. Tässä väitöskirjassa keskitytään edellä mainittuun problematiikkaan. Erityisenä tutkimuksellisena mielenkiinnon kohteena on se, kuinka teknologiset ratkaisut muokkautuvat eri toimijoiden, prosessien ja muiden järjestelmien vaikutuksesta organisaatiokontekstissa. Aikaisempi kirjallisuus ei ole riittävässä määrin kyennyt selittämään tätä kompleksisuutta.

Kyseisen tietämysaukon täyttämiseksi väitöskirjassa esitetään suunnitteluviitekehys, joka vetää yhteen keskeiset teknologiset ja organisaatiokontekstiin liittyvät haasteet joita järjestelmän suunnittelijoiden ja tietohallintojohdon tulisi kyetä ratkaisemaan. Aiemman kirjallisuuden lisäksi viitekehykselle saadaan tukea tutkimuksen empiirisestä aineistosta, jota on kerätty useasta organisaatiosta tulkitsevan laadullisen tutkimuksen menetelmin. Päätutkimusmenetelminä käytettiin toimintatutkimusta ja tapaustutkimusta, jotka mahdollistivat syvällisen aineiston keruun kohdeorganisaatioissa.

Väitöskirjatyön keskeisimmät tulokset nojautuvat suunnitteluviitekehyksen monen toimijan kokonaisuuden (ensemble) näkökulmaan, jonka mukaan yhteen kietoutuneita suunnitteluhaasteita tulee käsitellä organisaatiokontekstissa liiketoiminnallisena ja teknologisena kokonaisuutena. Viitekehys auttaa jäsentämään monimuotoisen suunnitteluprosessin mielekkäisiin osakokonaisuuksiin ja osoittamaan kussakin suunnitteluprosessin vaiheessa relevantit tehtävät. Tutkimuksen empiiristen havaintojen perusteella suunnittelun haasteet voidaan ryhmitellä kolmeen pääkategoriaan. Näitä ovat: käyttäjälle relevantin mitattavan tiedon tunnistaminen, tarvittavan tietoaineiston tuottaminen ja kokoaminen eri tietolähteistä, sekä tiedon jalostaminen käyttökelpoiseen muotoon ja sen saattaminen käyttäjien ulottuville. Lisäksi tilanne- ja yrityksen ulkopuoliset tekijät ja se kuinka monen toimijan yhteistyötä ohjataan vaikuttavat osaltaan suunnittelun onnistumiseen.

Väitöskirja tuottaa uutta teoreettista ymmärrystä suorituskyvyn hallintakäytännöistä ja niitä tukevista järjestelmistä. Tutkimuksen pääasiallinen kontribuutio on järjestelmien suunnittelua ohjaavaa. Väitöskirjassa esitetään tutkimuskontekstin ulkopuolelle yleistettäviksi tarkoitettuja suunnitteluperiaatteita (design principles) jotka huomioimalla organisaatiot voivat lisätä menestymisen mahdollisuutta vastaavanlaisissa järjestelmäkehityshankkeissa.

Avainsanat suunnitteluttutkimus, artefakti, tapaustutkimus, suorituskyvyn hallintajärjestelmä, suorituskyvyn mittaaminen, liiketoimintaäly, mittaristonäyttö, agenttiteoria, tietohallintopalvelu

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The choice I made to pursue a doctoral degree still surprises me. As I was finishing my master's thesis four years ago I got the most intuitive feeling that research was something that I wanted to explore further. After only a few months at a new job outside the university, I suddenly found myself at the university again, on a new career path that I never could have seen myself taking. Looking back, the past four years have provided me with the ultimate learning experience. I believe in the power of collaboration and surely the thesis would not have been completed as a solo performance. Now it is high time to thank the people who have helped me along the way.

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The thesis comprises four research papers to which several people contributed notably. I want to thank Assistant Professor Katri Karjalainen for the pleasant co-authorship in the first paper. I learned much from you especially during the writing process. I owe a great debt of gratitude to my co-author in the fourth paper, Assistant Professor Risto Rajala, from whom I also received invaluable advice with the thesis manuscript. I wish to express my gratitude to Dr. Oana Velcu-Laitinen and Doctoral Candidate Jussi Ruuskanen for collaboration in the previous versions of the fourth paper, particularly in assisting with data collection.

One of the key strengths of my thesis is perhaps (and according to the pre-examiners' statement) the way it blends theoretical and practical concerns. In this respect, I want to give my most humble thanks to the people who contributed to the empirical segment of the thesis. I am most grateful to the people at the case organizations for opening their doors, and for sharing their valuable ideas and time with me. Hansel Ltd has been an instrumental partner in cooperation for my research. I would like to thank especially CFO Kirsi Koivusaari for the support and for allowing me to participate in many extremely interesting projects. I am also indebted to Manager Sasu Laitinen for an excellent idea for the first paper. Big thanks to CEO Markus Hakala, CFO Oskari Gestrin, and everyone else at Activeark Ltd.

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Helsinki, May 2013

Heikki Lempinen

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2. Lempinen, H. & Tuunainen, V.K. (2011) “Redesigning the Supplier Reporting Process and System in Public Procurement – Case Hansel”, *International Journal of Organisational Design and Engineering,* 1(4), pp. 331-346. (Special Issue on “Organizational Design and Engineering Challenges for Inter-Organizational Collaboration and Competition”)

3. Lempinen, H. (2012) “Constructing a Design Framework for Performance Dashboards”, In *Nordic Contributions in IS Research,* LNBIP 124, C. Keller et al. (Eds.), Springer-Verlag, Berlin, Heidelberg, Germany, pp. 109–130. (*Best Student Paper award in the Scandinavian Conference on Information Systems (SCIS) 2012, Sigtuna, Sweden).

4. Lempinen, H. & Rajala, R. (Unpublished) “Multi-actor Interplay in IT Service Management”.

Prefix: Key concepts

Information systems (IS) consist of software, hardware, people, data, and procedures (Silver et al. 1995). Different types of information systems include transaction processing systems, decision support systems, database management systems, and knowledge management systems, to name a few. Critical to most information systems are information technologies (IT), which are typically designed to enable humans to perform tasks for which the human brain is not well suited, such as handling large amounts of information, performing complex calculations, and controlling many simultaneous processes. Information systems also refer to an academic and professional field that bridges business and computer science. Activities within the discipline include IS strategy, IS management, and IS development, among others.

Business intelligence (BI) refers both to the information that is valuable for managing a business and to the technologies and actions that make it possible to process the information to support decision making (Jourdan et al. 2008). The technologies on which BI is primarily based are relational databases, data warehouses and data marts that store organizational data. In addition, BI relies on real-time operational data found in enterprise resource planning systems, customer relationship management systems and supply chain management systems. Furthermore, BI combines internal data with data from external sources, including the web and inter-organizational systems. BI allows gathering all relevant data together and transforms the data to a usable format for the purpose of generating meaningful information to managers and other decision makers in organizations.

Business performance management (BPM) can be defined as "a series of business processes and applications designed to optimize both the development and execution of business strategy" (Ariyachandra & Frolick 2008). More specifically, BPM facilitates the creation of strategic goals of an organization, and supports the management of performance towards those goals through performance measurement and activities for taking corrective action (Turban et al. 2007). BI provides the "technical scaffolding" to BPM in the form of technologies that enable the implementation of the BPM processes (Eckerson 2010).

Performance measurement systems (PMS) lie at the heart of BPM processes (the processes by which the company manages its performance). A performance measurement system is mainly perceived as a set of metrics used to quantify both the efficiency and effectiveness of actions and as the reporting process that gives feedback to employees on the outcome of actions (Franco-Santos et al. 2007). It is supported by information systems that integrate the needed information and enable closed loop deployment and feedback (Kueng et al. 2001).

Executive information systems (EIS) are computer-based information systems that support decision making of executives (Rai & Bajwa 1997). EIS is thereby a common organizational decision support system (DSS). EIS has similarities with performance measurement systems, but EIS and PMS also have some distinct differences. PMS focuses on performance from a multi-dimensional perspective beyond the EIS focus on critical success factors. PMS considers a holistic and balanced view of the organization and includes data from important multiple stakeholders and competitors, whereas the information output from EIS is more internally focused (Marchand & Raymond 2008).

Performance management systems combine processes, metrics, and technical architecture to optimize both the development and execution of the strategy of an organization (Franco-Santos et al. 2007, Ariyachandra & Frolick 2008, Eckerson 2010). Performance management systems implement business performance management processes and performance measurement systems in organizations on the IT infrastructure and applications provided by BI (Ariyachandra & Frolick 2008). More specifically, a performance management system comprises a business architecture and technical architecture. Business architecture consists of strategy, resources, stakeholders, semantics and metrics. The technical architecture consists of data sources, integration platforms and processes, data stores, applications, and displays (Eckerson 2010).

Performance dashboard is a specific type of performance management system that enables organizations to effectively measure, monitor, and manage business performance (Eckerson 2010). The dashboard terminology in the organizational context originates from the vehicle

dashboard, which reports the few metrics that the driver needs to know (Yigitbasioglu & Velcu 2012). Technologically, dashboards consist of a computer interface and a business intelligence platform (Clark et al. 2007). The main task of dashboards is to help visualize large amounts of data in a condensed representation to identify trends, patterns, and anomalies for effective decisions. Multiple vendors such as Business Objects, Cognos, Hyperion, QlikView, MicroStrategy, and QPR Software offer dashboard technology solutions.

1. Introduction

This chapter provides an overall introduction to the thesis. First, the research background and motivation are discussed, based on which the key objectives and research questions of the thesis are presented. The chapter concludes with a description of the structure of the thesis.

1.1 Background and motivation

Information intensity in business and society has increased at explosive rate with the development of information and communications technology (ICT). Consequently, organizations are faced with an expanding amount of data that may be used for fact-based decision making. Part of the data is generated in organizations' internal processes and systems, but an increasing share of data comes from outside sources such as web platforms and inter-organizational systems. At the same time, competitive environments, industry changes and public regulation impose increasing pressures on organizations to seek ways to utilize this data in performance management. Hence, many organizations implement performance management systems to aid them in this endeavor. A performance management system is essentially a combination of processes, metrics, and technical architecture designed to optimize both the development and execution of the strategy of an organization (Franco-Santos et al. 2007, Ariyachandra & Frolick 2008, Eckerson 2010).

Technology improvements coupled with organizational needs for decision support and control have caused performance management systems to evolve from simple management accounting activities and financial reports to advanced business intelligence (BI) systems and applications (Clark et al. 2007). Business intelligence is an umbrella term for the information that is valuable for managing a business and the technologies and actions that

make it possible to process the information to support decision making (Jourdan et al. 2008). BI platforms capture, store and transform raw data into usable formats (Watson & Wixom 2007). Performance management systems are an integral part of business intelligence as they process the source data into relevant information and provide it to organizational decision makers (Eckerson 2010).

However, the development of technology, organizations, and competitive environments impose new challenges to the *design* of performance management systems. System designers and managers are faced with the challenge of implementing increasingly complex technological solutions, as performance management systems need to store and process increasing amounts and varieties of data and produce effective visualizations of information to the users. In addition, a variety of organizational issues beyond the technology dimension need to be addressed, including what data and which measures are used and how does their use impact organizational behavior, systems, and processes (Folan & Browne 2005, Clark et al. 2007).

The existing body of scientific literature provides several viewpoints to designing performance management processes and related systems in organizations. In the information systems literature, design and development of decision support systems in organizations have been studied widely over the past decades (Clark et al. 2007), but the identification of the information needs of executives and other decision makers remains a perennial challenge for IS scholars (Watson & Frolick 1993). Respectively, investigating how to measure organizational performance has gained considerable interest in a variety of management studies (Neely 2005). However, an often-reported challenge in performance measurement and management literature is associated with implementing performance measures within organizations' IT systems (Nudurupati et al. 2011). There is also a growing body of literature dealing with the design of BI-based performance management systems, but thus far, most of it has been targeted at a practitioner audience (Malik 2005, Few 2006, Eckerson 2010). Although the topic has gained much research interest in IS and other disciplines, there is lack of research that comprehensively addresses how organizational performance management, its processes, and supporting IS, are designed as a whole (Marchand & Raymond 2008, Salleh et al. 2010).

In the organizational sphere, there are several issues that bring new challenges to the design of performance management systems. Decision

making is reallocated to multiple organizational levels away from top executives as organizations are characterized by flat hierarchies, empowered workers, self-governing teams, and heavy use of temporary structures (Borgatti & Foster 2003). The change in organizational structures calls for new approaches to design systems for multiple user groups and roles. Moreover, the design of organization-wide systems is influenced by different needs and often-conflicting interest of several actors and is therefore increasingly difficult to manage (Peppard 2003). Furthermore, as organizations become interlinked with other organizations, there is a need to manage inter-organizational performance in supply chains, networks, and ecosystems (Folan & Browne 2006, Nudurupati et al. 2011). This creates pressures to develop information sharing and integration capabilities across organizations in order to gain access to performance information from multiple partners and actors (Pardo et al. 2006).

The present thesis is concerned with how to overcome these challenges in the design of performance management systems. In particular, the thesis builds on the argument that previous literature has not captured how the technology artifact emerges from interaction with the organizational context during the design process. Design science in information systems (Hevner et al. 2004) is implemented as the overall research paradigm. Design science research positions IT artifacts at the core of the IS discipline (March & Smith 1995). In this thesis, the "ensemble" view of the IT artifact (Orlikowski & Iacono 2001) is pursued. According to this view, system design must address issues beyond the technological dimension, since the result is affected by interaction of design efforts and contextual factors throughout the design process (Gregor & Jones 2007). This approach is rooted in the socio-technical perspective of IS, which underscores that designing and managing IT is less about technology implementation than it is about managing the organizational issues and change that accompanies its deployment (Markus 2004, Orlikowski & Hofman 1997, Peppard & Ward 2005, Hirschheim et al. 1991). More specifically, the impact of different technological and organizational issues to the design of performance management systems, and involvement of several stakeholders in the design process are examined in the thesis. Particular emphasis is given to how performance management systems are designed in inter-organizational contexts.

The thesis adopts the premise that better guidance in performance management systems design is achieved by increasing the designers' understanding of the relevant technological and organizational issues. In doing so, it undertakes an in-depth investigation of the challenges and opportunities of performance management systems design in organizations through qualitative inquiry. Guidance on how to overcome the associated challenges in performance management system design is important because design activities have considerable impact on the resulting system, and consequently its implementation and use. The study is motivated by the recognition that while BI and performance management are currently among the top information systems (IS) initiatives for practitioners across industries and the public sector, recent industry reports show that they suffer from low adoption rates among organizational users. The estimated adoption rates are even as low as 30% overall, due to the fact that the systems are often difficult to use, slow to respond, and deliver content of limited relevance (Gartner 2011). The guidance provided in this thesis is set to help organizations provide increasingly relevant and timely information to users, increase adoption rates of the resulting systems, and eventually enable better decision making.

1.2 Objectives and research questions

The objective of this thesis is to produce new knowledge on performance management systems design that both gives usable advice to designers and managers, and contributes to existing theory. More specifically, the principal objective is the following:

To provide guidance for the effective development of performance management systems through better understanding of how their design is impacted by the complex interaction between:

- technological and organizational components of the IT artifact,
- actors in inter-organizational settings, and
- the essential stakeholders in the design processes

The overall research question of the thesis can be formulated as follows:
RQ: How to design performance management systems?

To do this, this thesis investigates the design of performance dashboards, a popular performance management application, in multiple case settings. Performance dashboards were selected as the focus of this study because their use is organization-wide, and their design exemplifies the above-mentioned objectives related to technology, organizational needs, and several stakeholder groups' involvement.

In order to achieve the objective, the overall research question can be divided into sub-questions that address different viewpoints to the multi-faceted problem:

RQ(i): How do technological advancements and organizational behavior influence the design of performance measurement and data capture in inter-organizational settings?

(Addressed in the thesis through*: How to measure contract compliance in centralized procurement in cases of low spend visibility?* (paper 1) and *How to build an inter-organizational system for effective and efficient supplier reporting in centralized procurement?* (paper 2))

RQ(ii): What are the overall technological and organizational design challenges for performance management systems, and how are they embodied in the design process?

(Addressed in the thesis through: *How to build performance dashboards?* (paper 3), and *How IT organizations manage stakeholder interplay in multi-party service systems?* (paper 4))

1.3 Structure of the thesis

The thesis comprises two parts. The first part provides a general overview of the topic and a research framework, within which a summary of findings and contributions of the thesis are presented. The second part consists of four separate research papers that constitute the empirical segment of the work.

Short definitions of those information system types that are essential in the thesis were listed for the purpose of clarification in the prefix. This introduction chapter described the background and motivation for the thesis, after which the research problem and research questions were

formulated. The next chapter presents the positioning of the study in relation to the existing literature on performance management and information systems. Furthermore, the chosen research approach is described in more detail. In the third chapter, the essential theoretical perspectives of the thesis are presented within an overall research framework. The fourth chapter is concerned with methodology. In that section, the methodological approach deployed in this thesis is positioned within other methodologies used in IS research. The research methods used in the thesis are reviewed individually, followed with a description of the data collection and analysis processes in each of the research papers. Chapter five provides an overview of the key results found in the individual research papers. In the final chapter, conclusions are drawn from the research findings. Furthermore, the theoretical contribution and the practical implications of the thesis are presented. The final chapter concludes by stating the known limitations of the thesis and by suggesting avenues for future research.

2. Positioning of the research

In this chapter, the thesis is positioned within the existing literature on performance measurement and management, and information systems. The latter part of the chapter describes the chosen research approach and positions it within research paradigms in the information systems discipline.

2.1 Performance measurement and management

Measuring the performance of businesses and organizations has long been of central interest to researchers in various fields such management accounting (Otley 1999), operations management (Neely 2005), and marketing (Ambler et al. 2004). A performance measurement system can be defined as a set of metrics used to quantify both the efficiency and effectiveness of actions (Neely et al. 1995). Performance management, in turn, refers to processes and applications designed to optimize both the development and execution of business strategy (Ariyachandra & Frolick 2008). Performance management both precedes and follows measurement and thereby gives context to the existence of performance measurement (Folan & Browne 2006).

Performance measurement in organizations has evolved from pre-industrial cost accounting techniques to modern management accounting, and eventually, to the use of "balanced" performance measurement frameworks. Performance measurement developed significantly in the post-industrial era along with the growth and evolvement of organizations (Bourne et al. 2003), but remained largely unchanged until the 1980s (Neely 2005). Then, it was noticed that the traditional financially based, internally focused, and backward looking measurement systems led to dysfunctional behavior, inefficient management and inaccurate decisions

(Bourne et al. 2003). As a consequence, interest grew towards developing balanced performance measurement systems that included measures beyond the financial dimension (Bourne et al. 2003).

Several balanced measurement frameworks were developed throughout the 1980s and 1990s, including the Performance measurement matrix (Keegan et al. 1989), the Performance pyramid (Lynch & Cross 1991), the Balanced Scorecard (Kaplan & Norton 1992), and the Performance Prism (Neely et al. 2001). These frameworks are based on an underlying assumption that the realization of business strategy can be evaluated as a combination of financial performance and other performance dimensions, such as process efficiency, customer satisfaction, and the effectiveness of marketing activities. The overriding purpose of the frameworks is to identify relevant measurement dimensions, and guide the design of concrete metrics for those dimensions in a specific organizational setting. The composition of recommended performance dimensions, in turn, differs between the frameworks. Several performance measurement design processes were also presented (e.g. Neely et al. 1997, Kaplan & Norton 1993, Kaplan & Norton 1996), to show how to actually implement the measurement frameworks in practice, and integrate performance measurement into the management of business (Neely 2005). Scholars discussed the design, implementation and use of the balanced measurement frameworks from several perspectives during the 1990s and early 2000s (Neely et al. 2000, Bourne et al. 2000, Bourne et al. 2003), after which the focus turned to more conceptual work, such as defining the key characteristics, features and purposes of performance measurement and management (Franco-Santos et al. 2007, Nudurupati et al. 2011).

While the peak of research activity in performance measurement seems to have been in the mid and late 1990s (Folan & Browne 2005), the challenges posed by performance measurement are still enduring (Neely 2005). Along with the shift of focus from internally focused performance measurement frameworks to performance management, researchers acknowledge that better understanding is needed regarding how the use of performance measures impacts and is impacted by organizational culture, systems, and processes (Folan & Browne 2005). There is also an increasing interest towards inter-organizational performance measurement and management (Folan & Browne 2005, Nudurupati et al. 2011). This interest has yielded research on performance measurement in supply chains partnerships (Gunasekaran & Kobu 2007, Gunasekaran et al. 2004, Ho 2007) and other

collaborative environments, such as in extended enterprises (Bititci et al. 2005, Lehtinen & Ahola 2010). Despite these initiatives, the challenges and opportunities of inter-organizational performance management are not yet fully understood. Particularly, contributions from the IS discipline are needed to better understand the role of information systems in these settings. Furthermore, performance measurement and management in public sector organizations (Van Helden et al. 2008, Van Dooren et al. 2012), public-private partnerships (Grossman 2012), and non-profit organizations (Moxham 2009) have caught the interest of researchers.

In this thesis, performance management systems design is investigated in both, intra- and inter-organizational settings. In the first two papers, the focus is on developing performance measurement systems and processes in a specific inter-organizational context. The two subsequent papers deal mainly with intra-organizational measurement but underscore general design and management challenges rather than investigating specific underlying issues. The case organizations include both, public and private sector actors, and for-profit and non-profit organizations.

2.2 The role of information systems in performance measurement and management

The role of information systems has been instrumental in the evolution of performance measurement (Eccles 1991) as IS provides the technical architecture for performance measurement systems and related management processes (Ariyachandra & Frolick 2008). Such technical architecture includes data sources, integration platforms and processes, data stores, applications, and displays (Eckerson 2010). Owing to the variety of different systems and technologies that are deemed necessary for the implementation of performance management, related research is found in multiple IS research streams.

IS literature has dealt with the design and development of various types of decision support systems (DSS) in organizations extensively over the past decades (Ackoff 1967, Keen & Scott Morton 1978, Sprague 1980, Eom 1995, Clark et al. 2007). Performance management systems have co-evolved with a specific type of DSS, executive information systems (EIS), which refers to a system designed mainly to support the decision making of top executives. EIS gained considerable research interest particularly during the 1980s and 1990s (Eckerson 2010). A variety of EIS issues were investigated, including

design (Walls et al. 1992, Watson et al. 1991, Watson & Frolick 1993), adoption (Rai & Bajwa 1997, Poon & Wagner 2001), and the impacts of system use on organizational decision making (Lederer & Smith 1988, Leidner & Elam 1995). The emergence of business intelligence in the late 1990s changed the emphasis of EIS to more enterprise-wide decision support (Arnott & Pervan 2005, Marx et al. 2011). With the evolution of IT, performance measurement could be enriched with new functionalities, which allowed enhanced support for decision making in organizations (Marchand & Raymond 2008). Through the use of applications such as dashboard interfaces and scorecards, the new BI-based performance management systems enable several users throughout the organization to make decisions in a timely manner by consolidating and analyzing a broad variety of data (Clark et al. 2007).

Literature that is relevant to performance management systems can also be found in several other streams of IS research. Data management research has been centered on issues in gathering, storing, and transforming data through data warehousing and related applications, processes, and models, particularly in the era of BI (Wixom & Watson 2001, Shanks & Darke 1999, Wixom & Watson 2010, Goodhue et al. 1988). Furthermore, a prominent stream of research in the information systems literature has dealt with the design of user interfaces for decision support systems. These studies have investigated the relationships between different information presentation formats, cognitive and task characteristics, and decision making performance (DeSanctis 1984, DeSanctis & Järvenpää 1989, Järvenpää 1989, Vessey 1991, Dilla et al. 2010, Kelton et al. 2010). Moreover, the literature regarding inter-organizational systems is relevant in the performance management context, as organizations need to gain access to performance information from multiple partners and actors (Barrett & Konsynski 1982, Pardo et al. 2006, Chengalur-Smith et al. 2012).

Although the new BI technology and related applications have shown potential to improve performance measurement and management in organizations (Watson & Wixom 2007), frequently the implemented systems fail to meet expected benefits. Industry reports estimate that overall, BI applications are adopted by less than 30% of users in organizations (Gartner 2011). Congruent, some researchers have found that 70% of attempts to implement performance measurement fail (McCunn 1998). The reason behind lack of adoption is that the systems are perceived

to be difficult to use and they fail to deliver relevant information to the users at the time it is needed (Gartner 2011).

There can be multiple causes for the observed problems from the information systems perspective. A major challenge in many IS initiatives is the difficulty of aligning organizational needs with IT, which is evident also in the design of performance management systems. Such problems may occur when users are not involved in system design and implementation, and furthermore, when information system specialists do not have adequate knowledge or awareness on the requirements of business (Watson & Frolick 1993, Nudurupati et al. 2011). In other instances, problems may be associated with the notion that information usually resides in several systems and processes, and therefore generating, gathering, storing, and disseminating data that is needed for the realization of measurement is difficult (Prahalad & Krishnan 2002).

In order to provide a holistic view on how to design performance management systems in organizations, in this thesis organizational performance management and supporting information systems are investigated in conjunction. The research framework builds on a synthesis between, as well as critical examination of, existing scientific literature in IS, and performance measurement and management. The thesis builds on the socio-technical perspective of IS which acknowledges that the involvement users and other stakeholders in their organizational and environment contexts influence the outcome of IS design and development processes (Hirschheim et al. 1991, Lyytinen & Newman 2008).

2.3 Research approach

Hevner et al. (2004) suggest that two complementary paradigms in IS research, behavioral science and design science, help us in acquiring further knowledge concerning the management, use, and application of information technology in human organizations. Behavioral science aims at developing and verifying theories that explain or predict human or organizational behavior, and design science extends the boundaries of human and organizational capabilities by creating new and innovative artifacts (Hevner et al. 2004). Design science and behavioral science research are complementary processes in the overall IS research framework. Within this framework, IS research pursues its dual mission of producing scientific contributions and assisting in solving practical

problems in two phases; relevance cycle and rigor cycle (Hevner et al. 2004). In the relevance cycle, the role of IS research is to produce solutions to problems in real-life organizational settings. The phenomena of interest are situated in an environment consisting of people, organizations, and their existing or planned technologies (Silver et al. 1995). The goals, tasks, problems, and opportunities in this domain define organizational needs, as they are perceived by people within the organization, and the "problem", as perceived by the researcher (Hevner et al. 2004). In the rigor cycle, IS research both utilizes existing scientific knowledge to solve the practical problems and attempts to build and develop this knowledge further. The knowledge base consist of foundational theories, frameworks, instruments, constructs, artifacts, and methodologies from prior IS research and reference disciplines. These include both *descriptive* theoretical knowledge, including behavioral and natural science theories, and *prescriptive* design knowledge created through building and evaluating of artifacts designed to meet the identified business need (Hevner et al. 2004).

To be more precise, theories under the descriptive and prescriptive categories can include several types of theories. Gregor (2006) categorizes theories in the IS discipline to five types: theories for analyzing, theories for explaining, theories for predicting, theories for explaining and predicting, and theories for design and action. Two types of theories – theory for *explaining* and theory for *design and action* – best characterize the theories used and developed in this thesis. Following the classification by Hevner et al. (2004), theories for explaining belong to the descriptive knowledge base, as they aim at explaining *how and why* some phenomenon occurs, while theories for design and action belong to the prescriptive knowledge base as they attempt to give guidance on *how to* build new and innovative artifacts (Gregor 2006).

In this thesis, design science is adopted as the overall paradigm, and the research framework of the thesis is constructed through the design science approach. Importance of design is well recognized in the IS literature, as many work activities performed by IS practitioners – in development, implementation, operation, and maintenance of IT systems – relate to design either directly or indirectly (March & Smith 1995), and due to the acknowledgement that IS research aims at practical relevance in addition to theoretical rigor. Chapter 3 describes the theoretical foundations of the thesis in the design science frame of reference. Theorizing in design science research is associated with both, descriptive and prescriptive knowledge.

Information systems design theory (ISDT) is a prescriptive theory integrating normative and descriptive theories into design paths intended to produce more effective information systems (Walls et al. 1992). These kind of theories are needed because design science research in IS addresses what are considered to be 'wicked problems' (Hevner et al. 2004); problems that are poorly formulated, confusing, and permeated with conflicting values of many decision makers or other stakeholders (Pries-Heje & Baskerville 2008). Information systems design theories can help to unravel this complexity by restricting the range of allowable system features and development activities to a more manageable set, thereby increasing the reliability of development and the likelihood of success (Markus et al. 2002). ISDT aims at providing a "complete package of guidance for designers facing particular sets of circumstances", while building theoretical knowledge (Markus et al. 2002).

An information systems design theory consists of three interrelated elements: a set of user requirements derived from kernel theory, principles governing the design of a system and its features, and principles governing the development process (Walls et al. 1992, Markus et al. 2002). Kernel theories may include a single, or a collection of academic theories, and/or "practitioner theory-in-use" (Markus et al. 2002). The results of design research include not only innovative artifacts but also design principles, referring to knowledge about creating other instances of artifacts that belong to the same group (Markus et al. 2002, Walls et al. 1992, Pries-Heje & Baskerville 2008). Furthermore, design can refer to both, a product and a process (Walls et al. 1992). The design product is the artifact, articulated in the form of a set of necessary requirements and design characteristics. Design process is composed of the steps and procedures taken to develop the artifact. Design science as a problem-solving paradigm continuously shifts perspective between the design processes and designed artifacts for the same problems (Hevner et al. 2004).

Artifacts can be constructs, models, methods, or instantiations (March & Smith 1995). Following Simon (1996), the term artifact refers to something that is artificial, or human-constructed, as opposed to something that occurs naturally. According to the ensemble view of the IT artifact, artifacts are bundles of material and cultural properties packaged in some socially recognizable form such as hardware or software (Orlikowski & Iacono 2001). More specifically, Orlikowski and Iacono (2001) found four variants of ensemble IT artifacts. All four focus on the dynamic interactions between

people and technology but employ different perspectives and levels of investigation. The foundation of this thesis comprises elements from all four variants. The "technology as development project" variant is concerned with the roles of key stakeholders in IS development projects and how such roles create conflict, power moves, and symbolic acts between the actors. The "technology as a production network" variant focuses on the supply side of technology particularly on the industry and nation-level, and covers inter-organizational collaboration aspects in the production networks. The "technology as embedded system" variant, in turn, sees artifacts as evolving systems that are embedded in a complex and dynamic social context. In the "technology as structure" variant, technology is seen to embody similar social structures (sets of rules and resources), which presumably have been built into the technology by designers during its development and which are then appropriated by the users as they interact with the technology. Design of ensemble artifacts therefore considers issues far beyond the technological dimension. More specifically, it is affected the interconnectedness of design efforts and contextual factors throughout the design process (Gregor & Jones 2007). Although this approach acknowledges that success of any design activity is governed by the context within which the IT artifact is implemented, the purpose is not to give guidance for every specific context. Design science research that employs the ensemble view rather aims at developing general and abstract knowledge by taking contextual variables into account (Carlsson et al. 2011).

This thesis is concerned with both generating solutions for practical problems and contributing to theory in the context of performance management systems design. The investigation concerns both the design product and process. Furthermore, the ensemble view of the IT artifact is adopted. The elements of information systems design theory (Walls et al. 1992, Markus et al. 2002) are used to illustrate the theoretical foundations and contributions of the thesis. The next chapter is concerned with the theoretical foundations by presenting the relevant kernel theories, user requirements, and key design challenges for performance management systems within an overall research framework. Section 6.1, in turn, is concerned with the contributions by presenting general design principles for performance management systems based on the findings from the individual papers and their theoretical implications. Both design science and behavioral science paradigms are pursued in the individual papers. The

first paper is an action research study that implicitly adopts the design science approach. Papers two and three report action design research (ADR) studies and are thereby explicitly based on the design science research paradigm. The fourth paper is a case study and can be characterized as behavioral science research.

3. Research framework and theoretical foundations

This chapter presents the theoretical foundations of the thesis. The foundational theories are presented and discussed within the design science research paradigm. Section 3.1 provides an overview of the research framework. A detailed description of the construction of the framework, including kernel theories, user requirements, design challenges and design process description follows in section 3.2.

3.1 Overview of the research framework and positioning of the papers

Figure 1 presents the research framework and illustrates how the different papers are positioned within the framework.

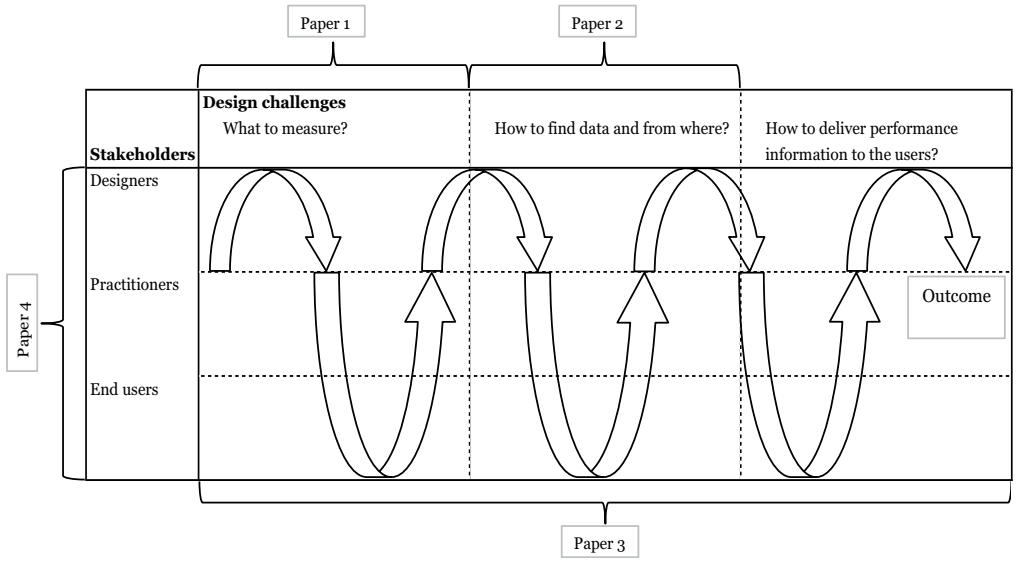


Figure 1 Research framework

The research framework is constructed in five phases. First, by following the approach of Markus et al. (2002), and Ngai et al. (2012), a kernel theory is formulated on the theory-based characterization of performance management in organizations and their environments. Second, user requirements for systems that support these activities are derived from the kernel theory. Third, three general design challenges for performance management systems are formulated on the basis of the requirements. Fourth, the design challenges are placed in sequence to outline the design process structure. More specifically, the design challenges constitute the horizontal axis of the research framework that illustrates a temporal (still iterative) sequence of key process phases. Fifth, the essential stakeholder groups are integrated to the vertical axis of the framework. The groups include system designers (in-house IT, software suppliers, and action researchers), practitioners (management and decision makers in organizations), and end-users (users of the system, including top management, department heads, financial personnel, process and project managers, and other employees). These groups' interaction influences how the product-related design challenges are met as an outcome of the design process. The curved arrow running through the framework illustrates how the interaction of the stakeholders may proceed during the design process. The purpose is, however, not to make a normative description of the process that applies to all cases.

As for the positioning of the papers, paper 1 deals mainly with the first *product-related* design challenge, "What to measure?" while paper 2 investigates the challenge "How to find data and from where?" in more detail. Paper 3 lays the foundations for the whole research framework by identifying and discussing all three design challenges and investigating their linkages and interplay as a process. The *process-related* challenge of managing stakeholder interplay in system development is investigated in paper 4.

Several theories and theoretical perspectives constitute the foundations of this thesis. Agency theory (Eisenhardt 1989) is used to investigate underlying issues in the design of inter-organizational performance management systems in papers 1 and 2. Information processing theory, contingency theory, and cognitive fit theory are used as background theories to further inform the construction of the research framework and design challenges as posed above. The interplay between essential stakeholders in the design process, in turn, is investigated as a socio-

technical process (Newman & Robey 1992), within the theoretical framework of social action (Hirschheim et al. 1991). In the next sections, these theoretical perspectives are discussed with regard to the characteristics of performance management in organizations (3.2.1) and in the context of the stakeholder interplay in the design process (3.2.3).

3.2 Constructing the research framework

This section describes five key characteristics (C#1-C#5) of organizational performance management and their theoretical underpinnings. Together they form the suggested kernel theory based on which four user requirement categories (R#1-R#4) for performance management systems are formulated. To meet the user requirements, three design challenges (DC#1-DC#3) are presented that illustrate the key issues concerning the design of such systems. Table 1 summarizes how design challenges are formulated based on the kernel theory and user requirements.

Table 1 Kernel theory, user requirements and design challenges

Characteristics of performance management in organizations		User requirement categories		Design challenges
C#1: Data as a crucial asset to organizations		R#1: Information scoping		DC#1: What to measure?
C#2: Information overload		R#2: Data management		DC#2: How to find data and from where?
C#3: Complexity of performance information		R#3: Functions		DC#3: How to deliver performance information to the users?
C#4: Time-sensitive, unstructured and dynamic decision making processes		R#4: User interface		
C#5: Decision makers in many organizational levels and functions				

3.2.1 Kernel theory - characteristics of organizational performance management

Characteristic 1: Data as an increasingly important asset for organizations

Organizations operate in an economic and societal environment that builds increasingly on the generation and exchange of information. In these circumstances, organizations engage in fact-based management rather than managing on the basis of intuition. In this regard, decision makers are essentially faced with two problems: the lack of relevant information, and an over abundance of irrelevant information (Ackoff 1967).

The role of information systems according to the first assumption, the lack of relevant information, is to supply relevant information through data generation, storage and retrieval (Ackoff 1967). Data is generated in internal processes and systems and exchanged with external actors in organizational networks. Data is often stored in different systems and departments, and updated by several people (Nudurupati 2011). Generating data and gathering information from different sources are often burdensome and time-consuming tasks (Prahalad & Krishnan 2002). In addition to the mere workload that data generation and storage imposes on organizations, the processes of data generation and sharing entail concerns related to the quality of the resulting information. Some of the data that is generated outside the organization is subjective and is often inconsistent with the objective data available within the company (Van der Stede et al. 2006, White 1996). Moreover, machine-generated data can be incorrect due computing errors and poor technical infrastructure.

However, in this thesis, more emphasis is given to how organizational behavior affects the processes of data generation and inter-organizational exchange. This is due to the recognition that data is in many cases generated by and exchanged between organizational actors that are represented by human beings. Hence, the completeness and correctness of data is dependent on the actors' abilities and willingness to comply with these data processes in the expected manner. This particularly creates problems in cases where the incentives for the actors to follow a given process is not strong enough and when it is difficult to control how they behave.

Agency theory (Eisenhardt 1989) can be used to explain this kind of organizational behavior. Generally speaking, agency theory investigates the behavioral dynamics of organizational relationships in which a principal

hires an agent to do work on its behalf. Agency problems may arise due to incomplete and asymmetric information between the principal and the agent, when the desires or goals of the two actors conflict, and when it is difficult or expensive for the principle to verify the behavior of the agent. Additionally, different risk preferences of the principal and agent may cause agency problems. Originally agency theory has been used to describe how incentives and information affect the behavior of individuals in an organization in terms of the imposed contractual relationships that exist between principals and agents, such as between the board and the CEO of a company (Eisenhardt, 1989). However, the approach has also been applied to wider organizational contexts to explain behavior between different units and actors (Gurbaxani and Whang, 1991).

This thesis focuses particularly on how the behavior of actors impacts an organizations' access to performance information in inter-organizational settings. Information asymmetries may cause efficiency losses in inter-organizational principal–agent settings, which are found, for example, in supply chain interactions (Voigt & Inderfurth 2012). Similarly, relevant information is lost in third-party reporting processes that rely on "voluntary compliance" (Niu 2011). Voluntary compliance refers to an assumption or principle that, for example, taxpayers will comply with tax laws and, more importantly, report their income and deductions accurately and honestly. An agency problem arises when the agents (tax payers) do not have a strong enough incentive to share information with the principal (tax office). In paper 2, a new process and inter-organizational system is designed to overcome a similar type of problem in the public procurement context.

Characteristic 2: Information overload may lead to disregard of information and to inaccurate decisions

Organizations face enormous quantities of data from various sources due to the digitalization of businesses and governments. Decision makers suffer, consequently, from an over abundance of irrelevant information as Ackoff's (1967) second assumption suggests. Furthermore, data is increasingly time-sensitive and comes in both, structured, and unstructured formats (McAfee & Brynjolfsson 2012). Information processing theory posits that the human brain can only process a fraction of all available information for making a decision (Neumann et al. 2008). Having too much (or wrong) information can lead to severe problems in decision

making, such as to situations in which managers routinely ignore certain information or make inaccurate decisions based on the data (Ittner & Larcker 2003). Clark et al. (2006) notes that a common problem in information processing is that individuals do not use the breadth of information available, but instead favor information that reinforces preexisting bias.

Hence, a key purpose of performance management is to narrow down the amount of information given to the decision maker. This is what management literature has been dealing with during the past decades in the attempt to find the "right" performance measures for organizations (Neely 2005). Contingency theory implies that there is no best way to manage an organization, but instead the appropriate management practice depends on contingencies surrounding a particular organization. A central contingent variable is the strategy and objectives that an organization decides to pursue (Otley 1999). Hence the choice of performance measures for an organization is driven by its strategy and related goals. In this vein, the role of filtration and condensation functions in information systems is also crucial (Ackoff 1967).

In addition to the purpose of providing information that is intended to be useful to managers in performing their jobs, performance management is set to assist organizations in developing and maintaining viable patterns of behavior. Goal-setting and performance evaluation against those goals are key managerial activities since "what gets measured, gets done" (Otley 1999). Performance evaluation influences behavior (Boss et al. 2009) by motivating and directing behavior toward desired end results (Monczka et al. 2005). In this statement, it is implied that actors within organizations and in inter-organizational settings are at risk of behaving in ways that are not in the best interest of the organization they serve or interact with. Congruent with the previous section, agency problems may arise when the expectations or goals of the principal and the agent conflict and it is difficult or expensive for the principal to verify the agent's behavior (Eisenhardt, 1989). To safeguard his or her interests, the principal can reduce the information asymmetry by investing in monitoring systems to constrain the agent's opportunity to behave in undesired ways (Lassar & Kerr, 1996). In paper 1, agency theory is used as a foundational theory to inform the design of performance measurement to obviate related agency problems in an inter-organizational setting.

Characteristic 3: Performance information is increasingly complex

Organizations face increasingly competitive business environments and restructuring in the public sector due to which they have to find effective ways to meet varying demand of customers and citizens with a more efficient use of resources than before (Nudurupati et al. 2011). Consequently, decision makers need to evaluate performance against competing goals and make trade-offs between different criteria. Performance management, hence, relies on a multi-dimensional view instead of financial performance only. As a consequence, decision makers face increasingly complex combinations of performance information that need to be dealt with simultaneously. One proposed aid for decision support in these circumstances is information visualization, which aims at amplifying human cognition as it helps to efficiently digest complex information (Dilla et al. 2010, Yigitbasioglu & Velcu 2012).

Information visualization has been studied extensively in the IS literature (DeSanctis 1984, DeSanctis & Järvenpää 1989, Järvenpää 1989), with its primary focus on the efficacy of alternate information presentation formats and decision making performance (Dilla et al. 2010). A following stream of research found that cognitive fit between the task and representation (Vessey 1991), and between decision maker characteristics and representation (Shaft & Vessey 2006) supports more efficient information acquisition and more accurate decisions. Information presentation format, including text, graphs, line drawing, and other visual elements, is the method used to disseminate information to users (Kelton et al. 2010).

Performance management systems produce informative graphical presentations of information (Asemi et al. 2011). However, designing effective and efficient visualizations is not a trivial task. Visualization is effective when perceived data quantities and relationships between data reflect the actual data. Visualization is efficient if the maximum amount of data is perceived in a minimum amount of time (Yigitbasioglu & Velcu 2012). Furthermore, a good balance between visual complexity and information utility is required. Visual complexity can be defined as the degree of difficulty in providing a verbal description of an image (Heaps & Handel 1999). User interface design is identified as one of the three general design challenges in the suggested design framework for performance dashboards in paper 3.

Characteristic 4: Decision making processes are time-sensitive, unstructured and dynamic

Organizations operate in environments within which change happens quickly and is difficult to foresee. Decision making processes are consequently unstructured, and fast feedback is needed when decision makers look for the optimal solutions for problems in data sets that are increasing in size and variety (Asemi et al. 2011). Decision making is increasingly time-sensitive because of the constant increase in the velocity of data, referring to the rate of change in how fast the data is generated and transferred within information systems (McAfee & Brynjolfsson 2012). This is manifested in the development of "real-time" decision support applications in certain industries, such as in aviation (Watson et al. 2006). Importantly, if the performance measures are not linked properly to data sources, the time-delay of information may become excessively long, based on which the decision maker cannot make confident decisions (Prahalad & Krishnan 2002).

In addition to the support provided by well-integrated source systems and databases, interactive visualization may further improve decision making performance in these settings by allowing the decision maker to navigate and restructure complex data sets dynamically (Lurie & Mason 2007). Decision makers process information by structuring problem spaces and searching those spaces until a goal is achieved. A problem space includes a set of possible solutions for a given problem and the space search is limited by the human attention span (Yigitbasioglu & Velcu 2012). Interactive visualization tools give decision makers increased control over the flow of information, allowing them to restructure the information environment, and lower the cognitive cost of restructuring information (Dilla et al. 2010). Lurie and Mason (2007) argue that managers using interactive visualization tools rather than static representations are more likely to consider multiple factors, and thus use more compensatory processing strategies to make more accurate decisions. On the downside, interactive visualization tools also have the potential to bias decisions by focusing attention on a limited set of alternatives and encouraging inappropriate comparisons.

Characteristic 5: Decision makers reside in all organizational levels and several organizational functions

Organizations are now flatter and less hierarchical than before. New organizational characteristics include empowered workers, self-governing teams, heavy use of temporary structures (such as project teams and task forces), lateral communication, and knowledge-based work (Borgatti & Foster 2003). Due to these changes, some of the decision making power is reallocated from top executives to several organizational levels. At the same time, web-based IT services enable easier "on-demand" access to data from anywhere and anytime. The lack of effective communication of the right information to the right people at the right time is a considerable challenge in these circumstances (Nudurupati et al. 2011). Performance management systems offer information accessibility for different user groups and individuals in order to provide support to a variety of different tasks at different times. The accessibility issue has important implications to the design of these systems due to the varying tasks, roles, skill levels, and information requirements of the different user groups.

3.2.2 User requirements and key design challenges for performance management systems

The characteristics presented in the previous section can be articulated in the form of user requirements for systems that support performance management in organizations. Marx et al. (2011) identified four categories of requirements for executive information systems, which are modified in this thesis to apply to the performance management systems context. The four general level user requirements (R#1-R#4) for performance management systems can be formulated as follows:

Requirement 1: Information scoping. The purpose of performance management systems is primarily to provide information that is intended to be useful to managers and other organizational actors in performing their jobs. Furthermore, performance management systems are set to assists organizations in developing and maintaining viable patterns of behavior (Otley 1999).

Requirement 2: Data management. Performance management systems in organizations should be able to store, process, and retrieve large amounts of data of various types (Asemi et al. 2011, Marx et al. 2011). Data is generated in and captured from both internal and external sources

(Nudurupati et al. 2011). Furthermore, data needs to be complete, reliable and available at the right time (Watson et al. 2006).

Requirement 3: Functions. Performance management systems should support the interpretation of complex performance data through appropriate functions, such as filtration and condensation (Ackoff 1967). Changing the level of abstraction in data representation from an overview to details is particularly important in performance management systems (Dilla et al. 2010).

Requirement 4: User interface. Performance management systems should offer visual representation of the data to the users to help them digest complex information in an efficient and effective way. A "dashboard" is such a dissemination device (Clark et al. 2006). Instead of static visualization, performance management systems should enable interactive visualization to aid unstructured decision making processes (Lurie and Mason 2007).

In order to outline what is needed to satisfy the requirements presented above from the designers' perspective, three general design challenges (DC#1-DC#3) are formulated. These design challenges represent the areas of organizational and technological issues and choices that need to be considered when designing a performance management system. To offer more detailed guidance for the system designers, the design challenges are discussed in the individual papers from different perspectives. An overview of the design challenges together with related considerations are provided in Table 2.

Table 2 Design challenges for performance management systems

Design challenge	Issues to consider
Design challenge 1: What to measure?	- How to find the "right" performance measures for an organization? Who is responsible for identifying them? - How to encourage hoped-for organizational behavior through performance measurement?
Design challenge 2: How to find data and from where?	- Is data readily available for the chosen metrics? Where is the data located? - Does the organization have access to the source systems? Is the data in a consistent format and available at the right time? - What to do if some actors are omitting information either inside or outside the organization?
Design challenge 3: How to deliver performance information to the users?	- How to build the functional and visual features of the system? - For whom to give access to the information? Does the user interface need to be personalized for different users? - Interactive visualization: what is the role of the user as a producer of information?

3.2.3 Stakeholder interplay in design processes

Information systems design theories aim at giving advice to system designers in the form of effective development practices, in addition to the guidance regarding the requirements and features of the system solution (Markus et al. 2002). These development practices characterize design as a process. The involvement of multiple stakeholders governs the development of systems that are intended for organization-wide use. Furthermore, in many organizations the IT function is assigned with the task of managing these projects on behalf of the organization's management and decision makers. Within this framework, the IT function essentially provides IT solutions as a service to multiple organizational users. Furthermore, as information systems are no longer produced in-house by the organization, the IT function consumes the services of external suppliers of hardware, software, and services (Mathiassen & Sørensen 2008, Peppard 2003). In this view, the management of IS development processes becomes a task of managing a multi-party *service system* (Maglio & Spohrer 2008). A service system refers to a configuration of people, technologies, organizations, and shared information that focuses on creating and delivering services that realize value for both provider and

consumer (Maglio & Spohrer 2008, Qiu 2009). The integration of needs, resources, information, and objectives among the providers and users stimulates service *co-creation* processes in the frame of the service-dominant logic (Qiu 2009, Badinelli et al. 2012).

In adopting the service orientation, it is acknowledged that the knowledge and capabilities of the essential stakeholders is key to the effective realization of system development, and hence the IT function is assigned with the task of integrating and coordinating knowledge that is distributed organization-wide (Peppard 2003). In considering the problems experienced in such circumstances from a knowledge integration perspective, a processual account takes as its starting point that all human knowledge is developed, transmitted and maintained in social situations (Berger and Luckmann 1966). From this perspective knowledge is not a resource that can be simply transferred (Barney 1991), nor is it simply embedded in organizational processes (Winter 1987). Rather it is seen to emerge as people interact recurrently in the context of established routines and procedures (Newell et al. 2004). These interactions embed not only the knowledge and competencies, but also by the different expectations and requirements of the associated parties towards the service delivery process and its outcomes (Peppard 2003; Mathiassen & Sørensen 2008).

More specifically, in this thesis it is acknowledged that complexity in systems development is caused by human activity between involved stakeholders (Hirschheim et al. 1991), particularly because services are co-created between the provider and consumer in socially constructed encounters (Qiu 2009). According to the social action perspective presented by Hirschheim et al. (1991), systems development is governed by the social interplay of multiple actors, who attempt to make sense of their and others' actions largely through the medium of language. Each dyadic interaction between the stakeholders defines an episode of social action. In these episodes, the stakeholders create consensus (agreement), resistance, or conflict (disagreement) through power, knowledge, subjective meanings, and human interests of the associated parties. According to this perspective, the success of a project is dependent upon managing a social process in terms of the quality and outcome of the episodes (Hirschheim et al. 1991). The socio-technical process model (Newman and Robey 1992), in turn, explains how and why outcomes are generated as a result of these episodes and their sequence in systems development projects. The model highlights that episodes consist of a stable set of activities over a longer

period of time while encounters are events that take place at a specific point in time. Encounters precede and succeed episodes. Furthermore, the socio-technical process is influenced by certain antecedent conditions that need to be made explicit (Newman and Robey 1992). In paper 4, the socio-technical process model and social action framework are used to investigate the stakeholder interplay in two performance dashboard development projects.

4. Methodology

The empirical part of this qualitative thesis draws from performance management systems design projects in multiple case settings. To be more specific, the fieldwork was carried out by investigating and taking part in the design of performance dashboards, a popular performance management application, in both public and private organizations. These studies are reported in the four individual research papers that form the body of this thesis. This chapter reviews the chosen methodological approach, presents the research methods used in the individual papers, and provides an overview of the research process and details regarding the data collection and analysis in each paper.

4.1 Qualitative research in IS

Over the past decades, there has been a general shift in IS research away from technological to managerial and organizational issues, due to which there is an increasing interest in the application of qualitative research methods (Myers 1997). Qualitative research aims at generating in-depth knowledge of the phenomena under investigation and is thereby a suitable approach particularly for exploratory work on topics that are new and for which much previous scientific knowledge does not exist (Myers 2009). However, the case study approach has not always been recognized as a proper scientific method, due mainly to the argument that case studies provide little basis for scientific generalization (Yin 1994).

Qualitative research methods were developed in the social sciences to enable researchers to study social and cultural phenomena (Myers 1997), through understanding people and the social and cultural contexts within which they live (Myers 2009). Qualitative research methods include action research, case study research, ethnography, and the grounded theory

approach. Data sources, in turn, range from observation and participant observation, interviews and questionnaires, documents and texts, to researchers' impressions and reactions (Myers 2009).

Both quantitative and qualitative research is based on some underlying assumptions, which define what is regarded valid research and govern the choice of appropriate research methods (Myers 1997). These assumptions need to be spelled out in order to build solid foundations for conducting and evaluating qualitative research. The most relevant philosophical assumptions with regard to research methods relate to the underlying epistemology that defines the researcher's assumptions about knowledge and how it can be obtained (Hirschheim 1992). Orlikowski and Baroudi (1991) suggest three categories based on the underlying research epistemology: positivist, interpretive, and critical.

Like all research, qualitative research can be positivist, interpretive, or critical (Klein & Myers 1999). An interpretive stance to qualitative research is adopted in this thesis. Interpretive researchers do not predefine dependent and independent variables, in contrast to positivist research, which is characterized by formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from a representative sample of a stated population (Orlikowski & Baroudi 1991). Instead, interpretive researchers focus on the complexity of human sense making as the situation emerges, and attempt to understand phenomena through the meanings that people assign to them (Klein & Myers 1999). Moreover, interpretive research builds on the assumption that access to reality is only through social constructions such as language, consciousness, shared meanings, document, tools, and other artifacts (Klein & Myers 1999). Interpretive research methods in IS are aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context (Walsham 1993).

Furthermore, research methodologies rely on different knowledge generation strategies. This thesis is based on an abductive approach (Dubois & Gadde 2002). Deductive approaches are concerned with developing propositions from current theory and make them testable in the real world, and in inductive approaches theory is systematically generated from data, such as in grounded theory (Glaser and Strauss, 1967). The abductive approach is different from deductive and inductive approaches, in its continuous interplay between theory and empirical observation

(Dubois & Gadde 2002). The abductive approach stresses research as a process during which the original theoretical framework is successively modified, partly as a result of unanticipated empirical findings, but also of theoretical insights gained during the process. In studies relying on abduction, new combinations are therefore developed through a mixture of established theoretical models and new concepts derived from the confrontation with reality (Dubois & Gadde 2002).

Of the research methods used in the thesis, action research and action design research can be regarded as abductive in nature. In action research, theory is regarded as tentative, applied and then improved by successive cycles of application and reflection until the practitioner-defined problem is adequately addressed (Lee & Baskerville 2003). Action design research, in turn, relies on several cycles of building, intervention, and evaluation of the theoretical and practical outcomes (Sein et al. 2011). The fourth paper is founded on abductive case study research (Dubois & Gadde 2002).

4.2 Research methods

A research method is a strategy of inquiry that moves from the underlying philosophical assumptions to the concrete research design and data collection. The choice of research method influences the way in which the researcher collects data. Specific research methods also imply different skills, assumptions and research practices (Myers 1997). Multi-method research combines several research methods to gain a richer understanding of the research topic and more reliable research results (Mingers 2001). Action research, action design research, and case study methods are used in this thesis.

4.2.1 Action research

Action research attempts to create results of practical value to the client organization while adding to theoretical knowledge (Galliers 1991). It combines theory generation with researcher intervention to solve immediate organizational problems (Baskerville 1999) and is thereby ideally suited to study technology in its human context (Baskerville & Wood-Harper 1996). In action research, the role of the researcher is the one of “involved researcher”, rather than an “outside researcher” carrying out

studies mainly through formal interviews and with no direct involvement in action in the field (Walsham 2006).

Although the method has a long history in various applied fields, action research has not always been accepted as a proper research method in the information systems discipline (Myers 1997). After the emergence of Checkland's (1991) soft systems methodology, however, IS researchers' attention towards action research grew and it has since been regarded by many to be ideally suited to post-positivist social scientific IS research (Baskerville & Wood-Harper 1996).

There are many action research approaches available, and many have been used in IS research. Action research is typically an iterative process based on a working hypotheses refined over repeated cycles of inquiry. The five-phase cyclical process by Susman and Evered (1978) is probably the most dominant approach (Baskerville & Wood-Harper 1996, Lindgren et al. 2004). This canonical action research process consists of five identifiable phases: diagnosing, action planning, action taking, evaluating, and learning. Action research is used as the research method in paper 1.

4.2.2 Action design research

The method chosen to carry out the research projects in papers 2 and 3 is action design research (ADR) introduced by Sein et al. (2011). It is an action research-based method for conducting IS design research. Design research seeks to develop prescriptive design knowledge, sometimes referred to as design principles (Walls et al. 1992), through building and evaluating innovative IT artifacts intended to solve an identified class of problems (Hevner et al. 2004, March & Smith 1995). The dominant design research thinking takes a technological view of the IT artifact while ADR, by incorporating action, posits that the artifact emerges from interaction with the organizational context. In ADR, the research problem is derived from practice and the theory-ingrained artifact is developed iteratively together with the case organization.

Four stages comprise the ADR process. The process starts from the problem formulation stage, within which tasks include determining the initial scope, deciding the roles and scope for practitioner participation, and formulating the initial research questions. Furthermore, the identified problem is formulated as an instance of a class of problems. In the second stage, the IT artifact is developed through several cycles of building, intervention, and evaluation (BIE) with the case organization. The main

difference to previous stage-gate design research methods (e.g. March & Smith 1995, Peffers et al. 2008) is that evaluation of the IT artifact is interwoven with building of the artifact through reciprocal shaping, mutually influential roles, and authentic and concurrent evaluation. Reflection and learning continues throughout the ADR process, emphasizing that the *ensemble artifact* reflects not only the preliminary design but is shaped by organizational use, perspectives and participants. The reflection and learning stage thereby draws on the guided emergence of the artifact. Finally, situated learning is developed further into general solution concepts for a class of similar problems. The final stage aims at formalizing learning through design principles derived from the design research outcomes.

4.2.3 Case study research

Case study research can be defined as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin 1994). Case study research is the most common qualitative method used in information systems (Orlikowski & Baroudi, 1991), and is seen to be well suited to studying information systems in their organizational contexts (Benbasat et al. 1987).

The case study methodology has distinct advantage when a "how" or "why" question is being asked about a contemporary set of events, over which the investigator has little or no control (Yin 1994). Case studies can involve either single or multiple cases, and numerous levels of analysis (Yin 1994). The case study approach is also beneficial since it enables the capture of "reality" in considerably greater detail and the analysis of a considerably greater number of variables than is possible with most quantitative research methods (Galliers 1991). Respectively, the disadvantage is that generalizability of the results from one or few organizations to a wider population is difficult to illustrate (Galliers 1991). It must be noted that the term "case study" has multiple meanings; it can be used to describe a research method or to describe a unit of analysis, such as a case study of a particular organization (Myers 1997).

Case study research can be positivist, interpretive, or critical, depending upon the underlying philosophical assumptions of the researcher (Klein & Myers 1999). Yin (1994) and Benbasat et al. (1987) represent the positivist case study tradition, whereas Walsham (1993, 2006) advocates interpretive

in-depth case study research. Interpretive case study research can help to understand human thought and action in social and organizational contexts and thereby produce deep insights into information systems phenomena (Klein & Myers 1999). In paper 4, an interpretive approach to case study research is pursued as a means to investigate the social action between essential stakeholders in design processes.

4.3 Data collection and analysis

Data collection and analysis periods of the thesis are presented on the timeline illustrated in Figure 2. In abductive research, data collection and analysis are intertwined processes and therefore it is difficult to pinpoint exactly when the data was analyzed in relation to the data collection periods. Instead, data analysis continues throughout the research process in conjunction with data collection. A more detailed account of data collection and analysis in each of the papers is provided next for the purpose of clarification. The background for each of the papers is also shortly outlined to give context to the data collection and analysis descriptions. Furthermore, a concise summary of the research methods and means of data collection is provided in Table 3.

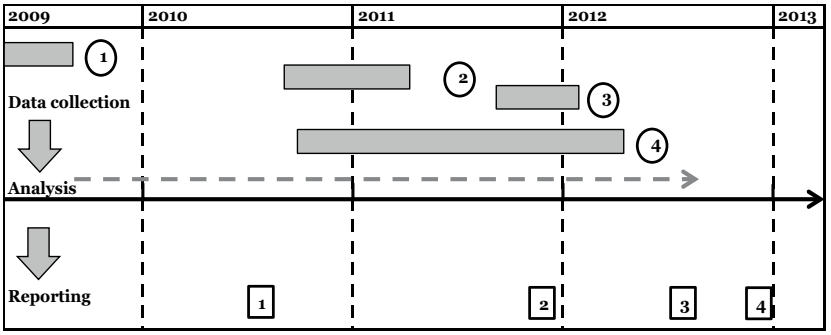


Figure 2 Research process

In paper 1, a new performance measure, contract usage rate, was developed for the case company's performance dashboard as a result of a four-month action research project between May and September 2009. The performance metric and an implementation method together form the suggested measurement model in the paper. The data was collected by interviewing managers at Hansel Ltd, the central procurement agency of the Finnish Government, through several interventions to the case context,

and by evaluating the suggested solutions in iterative cycles. The interviewees included seven procurement category managers, six key account managers, COO, CFO, and IT development manager. All data collected during the interviews and interventions was recorded by means of field notes. It was considered within the research group whether the interviews should be tape recorded, but taking field notes was seen as the most suitable data collection method. The data was collected while taking part in the organization's project activities and consequently, there was a concern that tape-recording might have distorted the real-life setting and made the interviewees less open or less truthful (Walsham 2006, Puhakainen & Siponen 2010). Unstructured and semi-structured interviews were employed to collect the data. Such interviews are built on incomplete scripts in which the researcher may have prepared some questions beforehand, but improvisation is required (Myers & Newman 2007). We also utilized group interviews, in which two or more people are interviewed at the same time by one or more interviewers (Myers & Newman 2007).

The interviews were conducted in three rounds. In the first round, three unstructured group interviews were held with the business director, CFO, IT development manager and one category manager to discuss and form the scope of the research project. Based on these sessions, the initial model for estimating contract usage rates was constructed. Guided by the interviews and available literature sources, the average revenue per user (ARPU) method was adopted as the basic principle and the preliminary usage rate estimates were generated through historical purchase data. In the second round of (semi-structured) interviews, the category managers were assigned to evaluate these estimates, based on which the model was refined and adjusted. In the final interview round, the account managers were interviewed and their feedback on the performance evaluation method and the usage rate estimates was collected for the purpose of further improving the model. This expert feedback was used as input in adjusting the model's parameters. After the final modifications, contract usage rate estimates were generated and reported to the case organization.

In paper 2, an action design research project was set up to develop a new system and process for supplier reporting at Hansel Ltd, in order to enable inter-organizational exchange of purchasing data to be used for performance management purposes. A conceptual design of the system and related reporting process is presented in the paper. The study was

commenced by interviewing company management and representatives from related external organizations during a seven-month time period between September 2010 and March 2011. The core ADR team consisted of two researchers, CFO, IT development manager, and a business controller at Hansel. Field notes taken by the first author of the paper was the primary data collection method.

The data collection was conducted in two successive cycles. Within each cycle the suggested process redesigns were refined through multiple iterations (for an exact description of the iterations, see paper 2, p. 339-342). In the first cycle, two group interviews were organized with the CFO, the IT development manager and the business controller to discuss the scope of the project. Based on these sessions, the initial process redesign for supplier reporting was developed. By interviewing other stakeholder groups, including IT vendors, information platform providers, and the state administration, the researchers gained input for readjusting and refining the process and supporting IT system. Considerations in the first cycle focused on how the new concept would fit the overall operating model of the case organization. In the second cycle, the emergent designs were revisited in discussions with most of the interest groups, based on which the final concept for the system and process was formulated. In the second cycle, the design issues were centered more on the technical feasibility of the concept and other considerations, such as how the performance information would be gathered in practice.

In paper 3, a general design framework for performance dashboards was built in an action design research project over a six-month period between August 2011 and January 2012. The empirical context was a performance dashboard development project of a Finnish web design and marketing agency Activeark Ltd. An ADR team was established to coordinate the project and the related research effort. The core ADR team consisted of the author and the CFO of the company, who was also assigned as the project owner. Other project stakeholders included the executive team (lead by the CEO), responsible managers for each performance category (COO, Resource manager, CAO, Head of HR), users of the system, the company's IT department, and a software vendor. These groups were in part overlapping but treated as separate because of the different roles through which the people contributed to the project.

For the purpose of coordination, the project was conducted in three consecutive phases after planning and initiation. This division was made based on three general design challenges identified through analyzing the empirical problem setting and related scientific literature. In addition to the data that was collected from the encounters with the stakeholder groups, the ADR team had access to the source data as well as current reporting systems at all times during the project, which was deemed particularly helpful in mapping the antecedent conditions for the development effort. In the first phase, the considerations focused on what information was needed from the new system. This was done through unstructured interviews with the executive team and one of the ADR team members. In the second phase, the identified metrics were investigated in more detail in a series of semi-structured interviews with the responsible managers. The performance measurement record sheet (Neely et al. 1997) was used as the interview guideline. Finally in the third phase, the issues of integrating the metrics with data sources and user interface design were considered together with the ADR team, the IT manager, and the chosen IT vendor's representatives.

In paper 4, two case studies were conducted in organizations that recently adopted a performance dashboard, in order to examine in-depth how social action took place in system development processes and associated service systems. The first case study was undertaken during October 2010 – June 2011 in a procurement agency, while the second case study was carried out in a North European university during January – March 2012. In the procurement agency, the dashboard implementation had been a successful project, while the university faced more challenges in the implementation.

The data was collected through eleven face-to-face, semi-structured interviews with key persons in the system development projects at both case organizations. The interviews were taken pair wise by two authors. They were recorded and transcribed before the data was analyzed. Although data was collected widely regarding the factors that had an effect on the development and implementation of dashboards, this paper focused specifically on the interplay between the IT unit and the other stakeholders involved. At the university, the interviewees included IT staff, financial controllers, and an IT manager. At the procurement agency, the interviewees included the CEO, CFO, IT development manager, category managers and account managers. The interviewees were selected through a

"snowballing" procedure in which the previous interviewee was asked to name potential people for further interviews in the organization.

The research was carried out during a lengthy data collection period, during which the theoretical approach evolved characteristically to abductive research (Dubois & Gadde 2002). The data analyses consisted of interpretation of the data during the interviews, and in-depth familiarization of the transcripts thereafter. Investigator triangulation was pursued employing two researchers, who analyzed the data. That is, two researchers grouped the findings from each case study individually, and compared the findings of the two cases jointly. More specifically, the researchers searched through the data for evidence that was consistent with or disconfirmed preliminary themes identified by the researchers. Such a search for disconfirming or negative evidence is suggested to be an effective way to carry out triangulation in interpretive qualitative research (Miles & Huberman 1994).

Table 3 Summary of data collection in each paper

Paper	Research method	Case organizations	Data collection procedures	Data sources
1	Action research	Hansel Ltd.	3 unstructured group interviews, 12 semi-structured interviews	7 product category managers, 6 key account managers, COO, CFO, IT development manager
2	Action design research	Hansel Ltd.	15 unstructured or semi-structured interviews & unstructured group interviews	Case organization management & other IOS stakeholders (e-invoice operators, financial services center, state treasury)
3	Action design research	Activeark Ltd.	20 unstructured or semi-structured interviews & unstructured group interviews	Case organization management (CFO, COO, CEO, HR manager, Resource manager), IT department, IT vendor
4	Case study	University, Procurement Agency	11 semi-structured interviews	University: IT staff, financial controllers, IT manager. Procurement Agency: CEO, CFO, IT manager, Category manager, 2 Account managers

5. Results

The purpose of this chapter is to describe the overall key results and findings of the thesis, and summarize the findings of each of the individual papers. The final part of the chapter is concerned with evaluating the results by discussing the validity and relevance of the findings.

5.1 Summary of the findings

Overall, the key findings of this thesis underline that the design of performance management systems entails complex inter-product and inter-party linkages, and that the effective development of these systems is affected by the interaction of multiple *design efforts* and *contextual factors* throughout the design process. Careful consideration and management of the identified design efforts and contextual factors are needed in order to meet the organizational and technological challenges of designing performance management systems. The results suggest that the design efforts are centered on three essential challenges; 1) What to measure?, 2) From where and how to find data?, and 3) How to deliver performance information to the users? Meeting these challenges successfully is considered to be a key organizational concern. Each challenge entails multiple organizational and technological issues that must be addressed when designing performance management systems. Outlining the design efforts itself gives value to the findings of the thesis, but its value is also the identification of specific underlying issues that are considered new and unique to the phenomena under investigation.

To this end, the observations underline a key differentiator between performance management systems and traditional management support systems, such as EIS: Performance management systems aim at providing organization-wide decision support and therefore failing to meet the varying needs and expectations of several user groups during any phase in

the design process may result in low adoption rates after the system has been implemented. From the technological perspective, the results underscore that open web-based technology platforms enable new process innovation in inter-organizational performance management. More specifically, the shift from point-to-point systems (such as EDI) towards the use of many-to-many platforms (such as e-invoicing) provides tremendous potential to improve data capture processes in these circumstances. However, the design and development of these systems is not trouble free, as they often comprise complex inter-organizational configurations. Furthermore, the findings highlight the importance of organizational processes for data generation and sharing beyond the technological view. In particular, the thesis highlights that such processes are heavily influenced by the behavior, motives, and objectives of internal and external organizational actors. Placing emphasis on the design and management of these processes is a key aspect of successful performance management systems.

Finally, the findings indicate that the design process is influenced by the interaction of several stakeholders within the multi-actor service system through which IT is provided and consumed in organizations. More specifically, social action between essential stakeholders - users, organizational decision makers, and external service providers - entails potential conflicts and resistance in the realization of IT solutions. Hence, the pursuance of consensus between the actors involved, supporting knowledge sharing and the promotion of mutual interests among the participants, and solving potential power conflicts between the stakeholders, become key managerial concerns. Importantly, the results point out the need for a new management approach in IT services which builds on network leadership and governance capabilities. By doing so, it draws IT management's attention towards important contextual factors in addition to the system-specific design efforts.

5.1.1 Paper 1: Applying average revenue per user model to estimate contract usage rates in cases of low spend visibility

A key issue in the development of performance management systems is determining the relevant information to be placed on the screen. In other words, organizations need to consider "What to measure?" The first paper investigates this design challenge in the Finnish governmental procurement context. The study serves two purposes: the first is to introduce and argue

for a focal performance measure, contract usage rate, for centralized purchasing organizations. The second purpose is to show how contract usage can be measured in cases of low spend visibility, referring to a common situation in which all of the required purchase data is not directly available. By doing so, the paper creates new knowledge on performance management systems design in inter-organizational settings.

The rationale for measuring contract usage rates in centralized procurement stems from a problem specific to this area - off-contract, or maverick, buying. Organizations seek efficiency gains and lower purchasing costs through purchasing centralization. These savings are not realized if the contracts are not used to the full. Hence, monitoring contract usage rate is a key performance management task for such procurement arrangements. An agency problem arises, however, when it is difficult to verify that all actors who are supposed to utilize the contracts are actually doing so. In this study, a new way for monitoring off-contract buying in a setting with low visibility of purchase information is developed. The suggested solution is based on comparing the performance of the different buyer organizations in a specific procurement category, and determining an "ideal" user organization for that category, which then becomes a benchmark for other buyer organizations.

The findings indicate that the new performance measure is useful for a central procurement agency in revealing areas where compliance to contract usage is low (or high), and in outlining purchasing trends within the categories. Hence, it provides support in making decisions regarding which areas the procurement organization should focus on to achieve its performance objectives. The findings also indicate the usefulness of the proposed method for operationalizing the suggested key metric. The benchmarking method (average revenue per user, ARPU) gives an estimate of the contract usage even without all the actual information for precise measurement at hand. As an implication for agency theory, the harmful effects of the asymmetric information between the principal (Hansel) and its agents (government units) may be eradicated by using the estimates. Of practical note, the average usage rate of Hansel's contracts employing 2009 procurement data was 59% based on the results of this study.

5.1.2 Paper 2: Redesigning the supplier reporting process and system in public procurement – Case Hansel

The second paper investigates the design challenge "From where and how to capture data?" in an inter-organizational context. To be more specific, the paper is concerned with problems observed in the Finnish governmental procurement that are centered on accessing purchase information from contracted suppliers. The current purchase reporting system at Hansel relies on the suppliers' compliance to the procedure, due to which some purchases remain unreported each month. This non-compliance in the reporting behavior is difficult to control because there is no mechanism to ensure that the suppliers report all purchases, apart from sporadic audits. An agency problem arises because the suppliers need to pay service fees to the procurement organization each month based on a percentage of the purchases they report. A negative incentive to the use of the reporting system is given to the suppliers since the more they report, the more they pay in service fees.

In order to help solve the immediate organizational problem experienced by the case company, and to gain better theoretical understanding of how to overcome such agency problems in inter-organizational information sharing, a new concept (system and process) for automating the supplier reporting is proposed. The suggested solution is based on electronic invoice duplication that would remove the need for separate reporting, as shown in Figure 3.

The findings reported in the paper show that the shift from closed point-to-point systems, such as electronic data interchange (EDI) systems, to the open web-based many-to-many platforms enables technological and process innovation in inter-organizational data capture. Third parties can benefit tremendously from the use of new reporting processes built on such platforms. As a result of the study, three design principles: overall efficiency, transparency, and data quality, are presented. The findings suggest that the successful design of such inter-organizational systems is dependent on how well these principles are realized for each of the parties. The value of the principles is in that they can also be generalized outside the case context. To be more precise, the underlying agency problem may also emerge in other inter-organizational settings in which reporting to a third party is required, but difficult to monitor. Such settings include tax reporting and customs reporting which are in many cases based on

voluntary compliance by the individuals and organizations under the obligation to report.

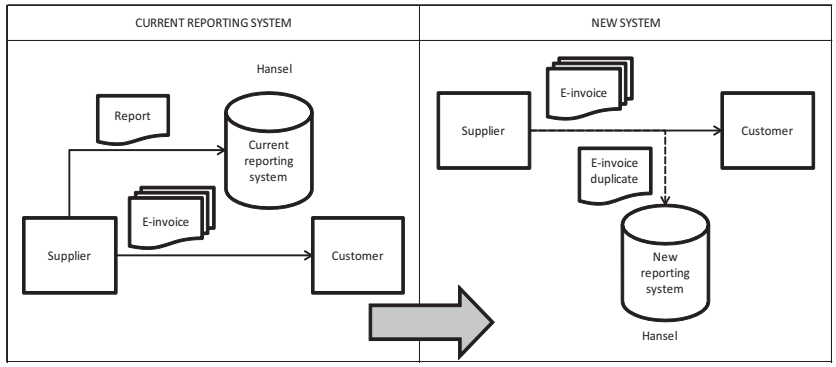


Figure 3 Concept design of the new reporting system and process at Hansel

5.1.3 Paper 3: Constructing a Design Framework for Performance Dashboards

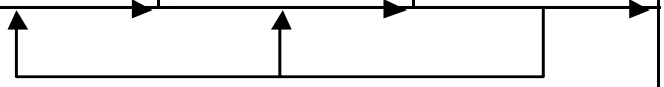
Paper 3 aims at generating more general level design guidance for performance management systems. The research project was triggered by the case organization's problems with their previous performance measurement and reporting, and the observation that existing literature did not offer sufficient advice on how to meet these challenges. Hence, the paper outlines a design framework for performance dashboards.

In the pursuance of doing so, general *design challenges* for performance dashboards were formulated by synthesizing previous literature to generalize the problem instance beyond the problems experienced by the case company. The three design challenges were used to illustrate the main phases of the design process, during which the performance dashboard was designed in an iterative fashion with the case company. The learning that was gained during the cycles was formalized to six *design principles* that directly relate to developing the artifact, and four emerging principles that govern the design process, as illustrated in Table 4.

In addition to pinpointing the essential design principles for performance dashboards, a structured framework was constructed to illustrate how the principles would be positioned within a suggested design process. The framework underscores that the design process is characterized by interrelated organizational and technological considerations throughout all three phases. In the first process phase, the importance of allocating an "owner" to each of the chosen performance measures was found to be a key issue in linking the measurement design to the next project phases. In the

second phase, the findings underlined the organizational challenge of data capture from processes that rely on human-generated data. In the third process phase, it was discovered that some employees – particularly those who were involved with creative work – found it demotivating that the company was entering a data-driven management culture. Contrary to the original plan, the case company therefore decided to give limited access to the performance dashboard solution for most employees. Furthermore, four principles for managing the design process emerged from the case project and earlier literature. Particularly the principle "Facilitate interaction between interest groups and individuals" is worth mentioning here as it inspired investigation of the issue further in paper 4.

Table 4 Design framework for performance dashboards

Design challenge	*What to measure?*	*Where and how to capture data?*	*How to deliver performance information to the users?*
Design principles (product related)	P1: Define a general performance measurement framework	P3: Analyze systematically how each measure should be put into operation	P5: Design for efficient integration to source systems
	P2: Follow a structured process for selecting key measures	P4: Ensure completeness and quality of data	P6: Design for a an effective user interface
			
Emerging principles (process related)	P7: Use an iterative, agile development process		
	P8: Use a modular approach in system design		
	P9: Facilitate interaction between the interest groups and individuals		
	P10: Ensure user involvement at each phase		

5.1.4 Paper 4: Multi-actor Interplay in IT Service Management

Paper 4 pursues a deeper investigation of the processes of designing performance management systems. More specifically, the purpose of the fourth paper is to study the interplay between the essential stakeholder groups during these processes. Empirically, the paper is based on interpretive case studies in two performance dashboard development projects. Interviews in two case organizations (a university and a procurement agency) were conducted to investigate in-depth how social

action between the stakeholders took place in these IT-service realization processes.

Three main stakeholder groups that interact with the IT function in the realization of organizational IT services were identified. These groups are system users, decision makers, and IT vendors. Social action between the stakeholder groups was observed through three phases of service realization processes: initiation, design, and implementation. The roles of the stakeholder groups and the characterization of the service processes varied between the two cases. User-led, management-led, IT-led, and joint development, were observed. The university case was very management-led at the beginning, but transformed into an IT-led process after the initiation phase. The procurement agency case started from a user-led initiation, but transformed to joint development in which the IT vendor was also closely involved.

Congruent with the previous literature on service management, the findings in the paper endorse that by enabling user participation, and by maintaining a close relationship with both the vendor and the decision makers throughout the process, the IT function could prevent conflicts arising from unrealistic expectations, communication gaps and asymmetric information between the stakeholders. However, the novelty of the findings is in the characterization of how the IT function governs the interplay in which these expectations, knowledge differences, and mutual interests are created. In this vein, the paper suggests importantly that the role of the IT function is to facilitate interaction between the involved parties instead of engaging in service relationships with either party in separation. Based on the results, it can be argued that this task of managing a service system as a whole is one of the most salient activities in the service that an IT function delivers to the rest of the organization. To do this, the IT function must be able to orchestrate the pursuance of consensus between the actors involved through knowledge sharing and promotion of mutual interests among the participants. Furthermore, balancing the formal and informal power structure between the relevant parties is a key managerial task.

5.2 Evaluation of the results

Design science research in IS underscores the pragmatist view, in which scientific research should be evaluated in the light of its usefulness (Hevner et al. 2004). Thomas and Tymon (1982) propose five key attributes for

evaluating the usefulness and validity of research: 1) descriptive relevance, 2) goal relevance, 3) operational validity, 4) nonobviousness, and 5) timeliness. The results of the thesis are reflected next against these aspects.

Descriptive relevance refers to how well and accurately research findings capture the phenomenon encountered by the practitioner in his or her organizational setting. One way to evaluate descriptive relevance of research is to examine its internal and external validity (Kilmann 1979). According to Kilmann (1979), researchers have traditionally emphasized internal validity – the confidence with which conclusions can be drawn from the set of data – and consequently, favor methods that allow unambiguous analysis by restricting data and phenomena. Researchers' attempts to maximize internal validity, however, are often made on the expense of the external validity to organizational settings (Thomas & Tymon 1982). In this thesis, the chosen research methods are not very restrictive and controlled, but rather put more emphasis on the researcher's interpretation of the studied phenomena in the organizational context. Furthermore, the researchers' involvement knowingly impacted the research results in the interventionist-based inquiry reported in papers 1, 2, and 3. Internal validity was nonetheless pursued through rich descriptions of the case settings and detailed accounts of how the research findings were drawn from data. External validity reflects how well the study can be generalized to other situations and contexts. Generalizability of the findings of design research can be illustrated first, through the distinction between observed problems and class of problems to which the problem belongs, and second, between the case context and the environment to which the solution is applicable. These are summarized for each of the four papers in Table 5.

Goal relevance is concerned with whether the research actually addresses real practitioner concerns. Thomas and Tymon (1982) argue that many academic researchers have the tendency to distance themselves from applied problems, because of the concern that attention to practical needs is addressed at the expense of theory development. However, without interaction between researcher and practitioner, the choice of dependent variable can easily diverge from practitioner concerns towards the direction of the researcher's own values or notions of managerial goals (Thomas & Tymon 1982). In this frame of reference, it can be said with confidence that goal relevance is achieved in the empirical segment of this thesis. The action research-based approaches in papers 1, 2, and 3 were triggered by

organizational needs, and hence it is justified to claim that the research addresses real practitioner concerns. In paper 4, the research questions were framed through an abductive process to reflect theoretical and practitical concerns equally.

Operational validity refers to the ability of the practitioner to implement the action implications of a theory, meaning that the practitioner can manipulate the independent variables (Thomas & Tymon 1982). Interpretive researchers do not predefine dependent and independent variables (Klein & Myers 1999), and hence such formulations have not been presented in this thesis. However, if we make the simplification that the dependent variable is "better design" and the proposed design guidance represent the independent variables, it can be argued that the independent variables may be manipulated in most cases. In interventionist research, some organizational change and manipulation of the independent variables takes place already during the research process. However, not all organizational changes are equally easy to carry out. For example, some of the recommended actions might necessitate extensive investments and hence become too costly to put into practice. In other instances, organizational structures and decision making hierarchies may be too inflexible for implementing the action implications.

Nonobviousness is the degree to which a theory meets or exceeds the complexity of "common sense theory" already used by a practitioner, in other words, whether the findings are trivial and add little to common sense. Oversimplified findings can be a cause of methodological controls, such as methods that restrict the investigation to only a few variables. Oversimplification can also be caused by the scientific value placed on abstraction, as a high level of abstraction draws attention away from details (Thomas & Tymon 1982). This thesis is based on interpretive qualitative research, and advocates in-depth, rather than general level, investigation. The individual research papers, particularly papers 1 and 2, deal with very specific underlying issues that relate to the design of inter-organizational performance management systems. These papers propose new and innovative solutions and are not very abstract as such. The attempt to gain scientific rigor is pursued by the theoretical underpinnings presented in these papers. Papers 3 and 4 are also concerned with specific problems observed in the case settings, but they aim at giving a more holistic guidance on how to design performance management systems. Because of

their rather abstract stance, nonobviousness of the findings is more difficult to show for these papers.

Timeliness refers to the requirement that a theory should be available when it is needed for making sense of current practical problems (Thomas & Tymon 1982). In applied fields such as IS, changes occur increasingly quickly, particularly due technological development. It is therefore important to make theoretical implications beyond the instantiations of systems and methods described in the studies. The next chapter illustrates how the findings and theoretical implications of this thesis contribute to a broader theoretical understanding of performance management challenges in organizations, beyond specific technologies and applications.

Table 5 Overview of the generalizability of the results

Paper	Problem observed	Context	Class of problems	Generalizable to
1	Maverick buying	Public procurement	Non-compliant purchasing behavior	Centralized procurement (public & private)
2	Non-reported purchases, missing performance data	Public procurement	Non-compliance in third-party reporting	Third party reporting systems (tax office, customs, etc.)
3	Insufficient knowledge of how to design performance dashboards	Digital marketing agency	Insufficient knowledge of how to design performance management systems	Performance management systems design in public and private organizations
4	Difficulties in managing stakeholder interplay in performance dashboard development	University, Procurement agency	Difficulties in managing the essential stakeholder relationships in multi-party IT service systems	Multi-party IT service systems

6. Discussion and conclusions

This thesis set out to investigate how to design performance management systems. A research framework that incorporates technological and organizational challenges regarding the design product (referring to the system itself), as well as the interplay between stakeholders involved in the design process, was presented. The four research papers investigated these challenges from multiple perspectives through qualitative research. The thesis contributes to both descriptive and prescriptive knowledge on the topic. The main theoretical contribution and practical implications of the thesis are discussed in this concluding chapter. Section 6.1 summarizes the overall theoretical contribution of the thesis, and provides an overview of the process through which the theoretical contribution is generated. Sub-sections 6.1.1 and 6.1.2 discuss the descriptive knowledge contribution and prescriptive knowledge contribution of the thesis, respectively, and the theoretical implications of the individual papers in more detail. The known limitations and suggestions for future research are discussed in the final section of this chapter.

6.1 Theoretical contribution

IS research builds on descriptive and prescriptive theories that provide a knowledge base to design science and behavioral science research (Hevner et al. 2004). Theoretical contribution comes, therefore, from adding to this knowledge base. Figure 4 illustrates the process through which descriptive and prescriptive theoretical contribution are generated in the thesis. The foundations of the research framework are built on descriptive "kernel" theories and theoretical perspectives. These kernel theories help us to better understand the focal challenges in performance management systems design. Within the research framework, each of the four papers (papers 1-4) uses foundational descriptive theories or theoretical models

and addresses a specific empirical issue. As an outcome, the papers add to the prescriptive knowledge base via usable IT artifacts and generalizable design principles for guiding the efficient and effective design of systems and processes. The deployment of the artifacts and design principles in organizational settings, in turn, contributes to the descriptive knowledge base via new insights to the relevant kernel theories. A detailed account of these contributions is provided next.

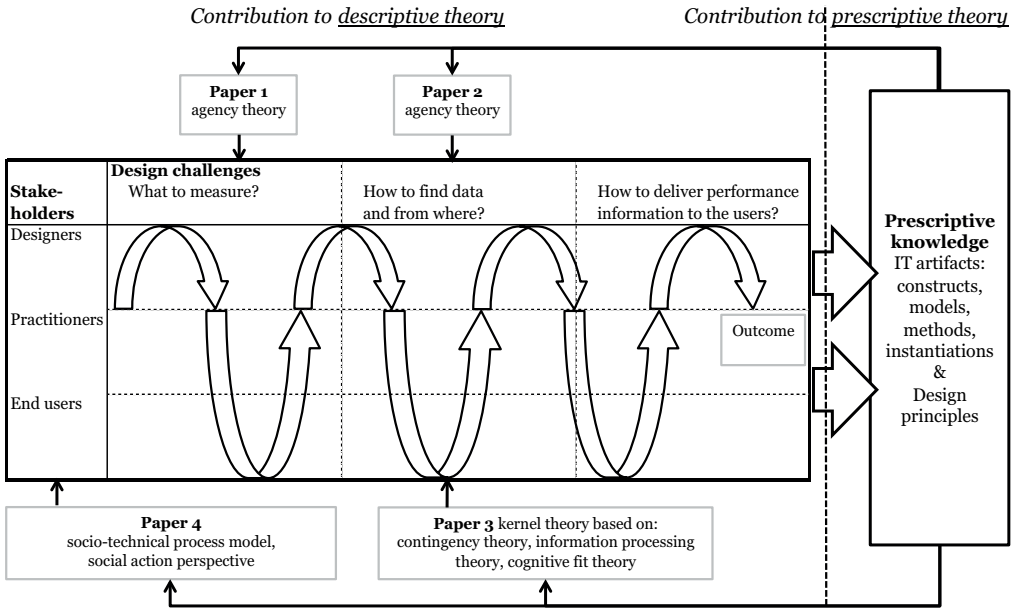


Figure 4 The process of generating theoretical contribution in the thesis

6.1.1 Descriptive knowledge contribution

The thesis contributes to descriptive knowledge by providing a better overall understanding of, as well as new insights to, the relevant kernel theories that inform the design of performance management systems. Three main contributions can be identified.

First, better understanding is gained regarding the role of principal-agent relationships in performance management, particularly in cases that require inter-organizational coordination. These new insights arise from the empirical work and theoretical underpinnings in papers 1 and 2. According to the traditional definition (e.g. Eisenhardt 1989), organizational agency problems can be mitigated either by decreasing information asymmetry between the principal and the agents, providing the agents with additional incentives, or using control mechanisms such as auditing to verify that the agents are behaving in the best interest of the

principal. However, in paper 1, a related, but different perspective is proposed. This mechanism is used to overcome performance management problems in inter-organizational purchasing arrangements with limited access to data. More specifically, the findings suggest that monitoring the purchasing behavior of a large number of organizations can reveal purchasing patterns that point out misuse of centralized procurement processes. Therefore the principal does not necessarily need to invest in processes and tools to access the information held by the agents at all. Rather, making such estimates and communicating them to the individual agents (buyer organizations in this case) is anticipated to trigger a "remedial" reaction in the agents' behavior. This implication resonates theoretically with the notion of "mandatoriness" (Boss et al. 2009), which refers to the degree to which individuals perceive that compliance with existing policies and procedures is compulsory or expected by organizational management. Paper 2, in turn, examines whether and under which conditions there could be a mechanism other than auditing to reduce non-compliance in inter-organizational information sharing, particularly in the case of third-party reporting based on "voluntary compliance". Such a principle governs information sharing in many supply chain interactions but may encourage opportunistic behavior (Özer et al. 2011). For example, many governments rely on such a system in tax collection. However, tax administrators and researchers have only a limited understanding of how much tax liability is uncollected, although this information is critical for measuring administrative performance and for targeting compliance strategies (Mikesell & Birskyte 2007). Based on the findings of paper 2, the agency problem in voluntary compliance can be mitigated by developing inter-organizational systems on open platforms in which relevant parties can join without difficulty and with low cost. The shift from "dyadic" (point-to-point) systems towards "community" (many-to-many) configurations in inter-organizational information systems has been acknowledged in previous literature (e.g. Zhu et al. 2006, Lyytinen & Damsgaard 2011), but agency theory has not been used in previous studies to explain information sharing behavior.

Second, the thesis contributes to descriptive knowledge by outlining a holistic theory-based characterization of performance management in organizations. Such a formulation has not been presented before. In paper 3, a kernel theory that builds on multiple theoretical perspectives (contingency theory, information processing theory, cognitive fit theory) is

proposed. In particular, it helps to explain how recent developments in organizations and business environments impact performance management and decision making. Although the empirical work does not directly add to the individual theories mentioned, the synthesis of theoretical perspectives and empirical findings adds to the descriptive knowledge base and also provides solid foundations for future studies.

Third, the thesis offers valuable insights to managing the dynamics of IS design and development processes. In this regard, paper 4 contributes to previous knowledge by suggesting a view of information systems development as management of a service system comprised by the interaction of several interrelated actors. The study highlights social action in the IT service context as a chain of encounters and episodes that take place in the IT service realization process. The study illustrates that in the realization of IT services, managing knowledge differences is key to understanding why service encounters between the stakeholders lead to conflict and resistance. Similarly, as the service system becomes increasingly complex, a conflict of interest between multiple stakeholders is more likely to occur than in simple dyadic service relationships. This seems to be particularly the case in IT services and systems intended for organization-wide use. Moreover, in Hirschheim's (1991) social action framework, behavioral resistance is generally preceded by open conflicts between the associated parties. The findings of this thesis indicate that resistance might also arise in the presence of no apparent conflict, but rather when there is a "false consensus" between the associated actors. This biased consensus might exist as a result of knowledge differences between stakeholders and because the mediating actor, in this case the IT function, is not able to facilitate knowledge sharing between all stakeholders. Importantly, the findings underscore that such a state may be unnoticed during the service realization process. All parties might therefore be under the belief that good IT service is being provided during the development process, yet the outcome may face resistance among eventual users and hence realize poor outcome value to the organization. As oppose to most of the prior IT management literature that focuses on the business value of IT as an outcome of IT service implementation (Peppard & Ward 2005), in this thesis, a contextual perspective of value, as suggested by Lusch, Vargo and O'Brien (2007) is undertaken. It posits that what firms - or IT functions in this case - provide should not be understood in terms of outputs with value, but rather as resource inputs for a continuing value creation process.

The results of paper 4 add to this knowledge by suggesting that the co-creation of value within an IT service system can be better understood through encounters and episodes of social action between essential stakeholders. It can also be argued that highlighting social action in the IT services context as a chain of encounters and episodes is particularly beneficial as this approach may also enable better understanding of other non-IT service processes that are punctuated by such events.

6.1.2 Prescriptive knowledge contribution

Overall, this thesis contributes to prescriptive knowledge by outlining a *design framework* for performance management systems. The framework comprises the research framework (Figure 1), the general design principles (Table 6), and the general design process management principles (Table 7). By recognizing recent shifts in technology, organizations and management, the framework presents three key organizational and technological principles that govern the design of system features and three management principles for guiding the development process. The proposed design framework contributes to the prescriptive knowledge base not only due to the organizational and technical design guidance it provides, but because it gives direction to the design process and offers managerial advice on how to overcome potential hazards associated with the interplay between multiple involved actors. In this vein, it embodies an ensemble view, in which the organizational actors, systems, and their interaction mold the technology artifact throughout the design process. This is a notable contribution particularly because most of the existing methods and techniques for the development of systems in the performance management and BI area are provided in the format of lists and rules, and most are targeted at a practitioner audience. Although the design framework offers no formal causal statements, a process model even this simple can offer valuable insight to researchers, system designers, and managers. As Whetten (1989) notes, relationships, not lists, are the domain of theory.

This thesis also makes prescriptive knowledge contribution through the new concrete design artifacts and design principles that are thoroughly discussed in the individual papers. This descriptive knowledge aims essentially at answering the three fundamental design challenges presented in the research framework. Hence, the prescriptive design knowledge arising from the empirical segment of the thesis is discussed next with regard to the key challenges.

The first design challenge, "What to measure?" is examined especially in papers 1 and 3. Paper 1 shows how this challenge may be solved in specific inter-organizational circumstances. The prescriptive knowledge contribution comes in this case from outlining a new approach to monitoring contract usage rates, a key performance indicator for centralized procurement, in settings with limited availability of performance data. The solution extends the average revenue per user-analysis, which previously has been primarily used in marketing and sales, to the procurement context. This new measure is a contribution that is specific to the field to which it is applied (purchasing performance measurement and spend analysis), as traditional purchasing performance measures have concentrated on quality, price, cost, inventory, availability, and supplier performance (Carter et al. 2005, Dumond 1994, Chao et al. 1993). Paper 3, in turn, takes the discussion on measurement design to a more general level. Based on the results, it is concluded that organizational contingencies determine the choice of the appropriate performance management framework, and that the design of specific metrics for the respective performance categories is often a tradeoff between several competing parameters, including information quality, data availability, and information processing capabilities of decision makers. Thus, the overall design principle 1 may be articulated in the following manner: *Design for a system that displays a limited set of key information.*

The prescriptive knowledge contribution that is associated with the second design challenge, "How to find data and from where?" comes primarily from the findings of papers 2 and 3. The suggested design principles, and the conceptual design for a system and process that helps to overcome agency problems associated with the voluntary compliance mechanism, constitute the prescriptive knowledge contribution in paper 2. The results of the paper point out that designers of successful open platform inter-organizational systems have to bear in mind that the system and process should encourage efficient reporting processes for all parties (the principle of overall efficiency), enable transparent information sharing (the principle of transparency), and facilitate the transfer of complete, standardized, and up-to-date data (the principle of data quality). As for intra-organizational information capture, the findings from paper 3 highlight the importance of well-managed processes in addition to the design challenges related to technological solutions (for storing data and integrating source systems to performance management applications). The

second overall design principle is hence formulated as follows: *Design for efficient data storage and integration, and effective data generation processes*.

The third design challenge, "How to deliver performance information to the users?" was investigated particularly in papers 3 and 4. The results increase prescriptive knowledge regarding the design tasks associated with building user interfaces to performance management systems (dashboards in these cases) and managing the internal and external competencies that are needed for successful completion of these tasks. In particular, the prescriptive theoretical implications draw designers' attention to the multitude of different organizational roles that the users of these systems may have, and directs the design activity accordingly. A rather obvious approach to this issue is to involve all users in the design process as early as possible. However, as the results point out, this might not be feasible in all cases and all users might not be willing to participate in the design process to begin with. Furthermore, the observation that users may not be able to point out what they actually need, particularly in the case where the potential technological solutions are very new, is hazardous from the designers' perspective. Therefore, designers need to interact with the users throughout the design process to ensure that all parties maintain adequate awareness of the technology as well as the work tasks that need to be supported. Generally speaking, the identified key tasks for system designers include ensuring task-technology fit between the different use scenarios and visual and functional features of the system, and defining organizational practices for accessing performance information. Hence, overall principle 3 is the following: *Design for intelligent information access coupled with functional and visual features that fit the intended tasks*.

To conclude, three general design principles for performance management systems are provided herein, with a short description (Table 6).

Table 6 General design principles for performance management systems

Design principles (product-related)	Description
Principle 1: Design for a system that displays a limited set of key information	Choosing, developing and committing to use a performance measurement framework is a recommended entry point for organizations to engage in performance management. A balanced set of performance measures beyond the financial dimension is recommended. Nevertheless, the choice of framework is subject to organizational contingencies. Key considerations include: how to structure the performance measurement framework, which performance dimensions to use, which metrics to apply in the respective dimensions, and how to define and formulate the metrics.
Principle 2: Design for efficient data storage and integration, and effective data generation processes	Possible data sources, integration capabilities to the source systems, and the latency of data capture characterize how the chosen metrics are implemented from the IS perspective. Standardization of data and mutual agreement on the exact definitions of all data elements between related parties prevent measurement errors and unreliable information. Processes of data generation are important to deal with, as their effectiveness is impacted by the behavior of internal and external organizational actors.
Principle 3: Design for intelligent information access coupled with functional and visual features that fit the intended tasks	Information access for a variety of users is advisable, but not always desirable, as the "more-is-better" assumption does not apply for all users. Visualization amplifies human cognition when dealing with complex problems and large amounts of information. Furthermore, interactive visualization enables accurate and timely decisions in unstructured decision making processes. A cognitive fit between the functional features and the intended decision making tasks is to be pursued.

As a further prescriptive knowledge contribution, the thesis provides important guidance to managing the design process of performance management systems. In this regard, the thesis findings stress the IT function's role. Previous research on information systems shows that control over information technology (IT) resources in organizations is typically dedicated to the IT function, which provides IT services to the entire organization (Gordon & Gordon 2002, Guillemette & Paré 2012). Commonly, system design and development are among these services. This

thesis identifies some crucial tasks for the organizational IT function in their pursuance of orchestrating value co-creation in the IT service processes. Many of the contemporary project management methodologies and IT service management best practices offer prescriptive advice on how to overcome some of the associated concerns, but the theory-based guidance on how to facilitate interaction in multi-party service systems is new to the literature. On the basis of the findings, three principles are conceptualized to bear in mind in this endeavor (Table 7).

Table 7 General management principles for the design process

Management principles (process-related)	Description
Principle 4: Create and maintain consensus by linking all stakeholders to the IT - business dialogue	Linking business needs to the IT imperatives and to the opportunities provided by IT is a perennial managerial concern. One of the key tasks of the IT function is to create and maintain consensus on both the objectives of the intended IT service and the practical implementation of the solution to meet the stakeholders' needs. To do so, the IT function should be able to facilitate negotiated interaction between all relevant parties.
Principle 5: Put leadership and coordination over governance in IT service realization	As multi-party IT service systems include autonomous actors, which are beyond the direct control and decision making power of the organizational IT management, the IT function needs to pursue network leadership capabilities instead of internal IT governance practices. Such an approach points to the need to manage boundary-crossing organizational, functional and cultural activities. It must be ensured that those boundaries do not become barriers to value creation in the service realization process.
Principle 6: Master the infusion of external capabilities for value creation	The IT function has to master the use of the best available external skills by choosing the right suppliers, acquiring suitable systems and services, and managing the contractual relationship with the vendors throughout the initiation, design and implementation phases of the service realization process. Successful coordination of the dialogue between involved parties in the design phase releases value in the implementation phase, and less effort needs to be laid on controlling the implementation using the best available resources to the task.

6.2 Implications for practice

The practical relevance of research is assessed using practitioner, including managers, specialists, consultants and other organizational actors, as a frame of reference (Thomas & Tymon 1982). Relevance is the departure point in design science research as it aims at utility by addressing practical needs. In behavioral science research, the aim for practical relevance of findings is not always as apparent, but needed nevertheless (Thomas & Tymon 1982). The practical contribution of this thesis is built on the guidance provided to the designers of performance management systems through the several artifacts and system instantiations that result from the research. Moreover, better understanding of relevant management challenges is provided.

Overall, the thesis makes important contribution to practice by providing usable tools for the designers of performance management systems to meet the associated complex technological and organizational challenges. This is achieved by drawing the designers' attention to three essential challenges: 1) What to measure?, 2) From where and how to find data?, and 3) How to deliver performance information to the users?. Moreover, the thesis pinpoints not only the design challenges, but also offers feasible solutions and tools for solving the problems, and outlines a stepwise approach to meeting the challenges during the design process.

Two specific practical contributions are made concerning the design of performance management systems in inter-organizational settings. First, the suggested method for analyzing, planning and managing framework agreements is an important practical contribution as it allows procurement organizations to efficiently track contract compliance among their internal customers and framework agreements, particularly by breaking down the usage rate estimates to the customer as well as the category level. This information enables more efficient and targeted design of incentives and governance mechanisms to reduce maverick buying behavior. The contribution concerns centralized procurement in particular, but also the design and management of inter-organizational performance management systems in general as this measurement model could be used in other similar instances, such as in supply chain interactions. A further practical contribution to inter-organizational performance management is provided via the new process and system for third party reporting. It offers a direct benefit to the case organization in its pursuance to obviate non-compliance in supplier reporting and the case organization can also offer better service

to the suppliers who have been dissatisfied with the burdensome reporting system. Other third party actors who rely on voluntary compliance in their reporting, such as the tax office and customs, could also benefit from utilizing such open platform-based systems and processes. Generally speaking, these third party actors may suffer from similar problems in their pursuance of capturing information from multiple actors in an effective and efficient manner.

Valuable information to practitioners is offered also through better understanding of how the involvement of different stakeholders and individuals impacts the development of performance management systems and other systems that are designed for organization-wide use. Specifically, this thesis draws managerial attention to organizational processes for generating and capturing data and to users' needs that may vary notably depending on the organizational roles and tasks that the system is set to support. This is particularly because performance management systems should serve various decisional roles and purposes beyond the executive level. The thesis provides important insights to IT managers in particular, by highlighting the systemic perspective in the realization of IT solutions. The development and implementation of organization-wide IT systems are increasingly service processes during which the IT function needs to facilitate interaction between several parties. In this respect, the IT function should not only be an "administrator" of internal IT resources, but also an "enabler", that actively tries to find and gain access to best internal and external resources. Furthermore, the essential task of the IT function is not to interact with these parties separately, but to enable dialogue and resource sharing in inter-actor relationships.

6.3 Limitations and avenues for future research

Certain limitations that are the result of the chosen research design in this thesis are worth mentioning. The research work is based on some known assumptions that are discussed here in more detail. The limitations, scoping, and assumptions are, however, valuable in the effort of outlining avenues for future research in this topic.

First, the thesis builds on qualitative inquiry in a handful of organizations. The chosen methodological approach enabled an in-depth investigation of the phenomena of interest, but the disadvantage is that it is more difficult to claim generalizability of the results. Particularly because

the case organizations included only one private sector organization, it cannot be said with full certainty that the findings from one company can be generalized across different industries. All of the organizations were small or medium sized enterprises, which leaves out large and micro size organizations from the sample. However, the situated learning from the case findings is reflected upon similar settings through theoretical considerations, which offers grounds for generalization outside the case contexts. Use of other research methods, such as quantitative surveys and lab experiments could strengthen the generalizability of these findings in the future.

Second, the two ADR projects (papers 2 and 3) are still on-going the design principles drawn from these projects along the way might not yet have reached their final form. Some principles might require refining and new principles might emerge in the later stages of the lifecycle of these systems, particularly once the systems have been in use for some time. Continuing to be involved in these projects hence offers an attractive stream for future research. Furthermore, the suggested design principles could be validated through further empirical studies in other case settings. Of more specific note, the design challenge labeled "how to deliver performance information to the users?" was not investigated in-depth in an individual paper, which was not the case with the other two design challenges. Information visualization has been studied from several perspectives before, and it seems to be getting ever more popular as a research topic, particularly with the emergence of big data and real-time BI. In the future, it would be interesting to study information visualization more thoroughly in the performance management systems context, and particularly in inter-organizational settings.

Third, several topical underlying assumptions are pursued in this thesis. One key assumption is that performance can be quantified, as shown in the proposed formulations such as "What to measure?" However, data extends increasingly beyond numeric and textual structured data to various sorts of unstructured data, as well. Furthermore, the share of unstructured business-relevant data is growing rapidly, both in absolute terms and in relation to structured data. Although many organizations still struggle with traditional performance measurement and management systems, investigating how performance management changes from "measuring" to "presenting" information in organizations creates many interesting opportunities for future studies. Furthermore, performance management is

not a static state of affairs, but organizations should instead constantly evaluate and modify their performance measures in order to adapt to the changes in their internal and external environments (Eccles 1991, Marx et al. 2011). Another important assumption is that this performance measurement leads to better decisions. Promising research findings have emerged in this area; one example is the study conducted by Brynjolfsson et al. (2011), in which they found that overall, firms that utilized data-driven decision making performed 5-6% better than those companies that did not. This gap between performance management and actual performance outcomes is an important stream for future research.

Fourth, it is recognized that "performance" is itself an ambiguous term, and capable of no simple definition. In particular, the term does not specify to whom the organization is delivering its "performance" (Otley 1999). In this thesis, an organizational level of analysis is pursued and hence it is assumed that a well-performing organization is one that is successfully attaining its objectives. In other words, performance is measured in terms of how effectively an organization implements an appropriate strategy. An interesting topic for further research would be to investigate the concept of performance in inter-organizational settings, in which performance can mean different things to different parties involved.

Finally, recent advances in information technology make it possible for decision makers to track information in real-time and obtain frequent feedback on their decisions (Lurie & Swaminathan 2009). A rather straight-forward argument would be that an increase in the frequency of feedback and the ability to make changes should lead to enhanced performance, as decision makers are able to respond more quickly to changes in the environment and see the consequences of their actions. At the same time, there is reason to believe that more frequent feedback can sometimes lead to declines in performance. In fact, some studies challenge the "more is better" assumption in this regard, and propose that frequent feedback can overwhelm an individual's cognitive resource capacity, thus reducing task effort and producing an inverted-U relationship with learning and performance over time (Lam et al. 2011). These considerations may initiate new research avenues in the field of BI, decision support systems, and performance management systems alike.

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Appendix: Summary of theoretical contribution in papers 1-4

Paper	1	2	3	4
Contribution to descriptive knowledge	Describes how agency problems impact the performance of third-party organizations, such as centralized procurement agencies, in inter-organizational settings. Argues for a new key performance indicator - contract usage rate - for centralized procurement. Presents a new theoretical mechanism (performance measurement model) for mitigating related agency problems.	Increases the theoretical understanding of how agency problems govern inter-organizational information sharing, particularly in configurations that rely on voluntary compliance. Describes the shift from point-to point connections towards many-to-many IOS platforms and how it may enable new process innovation in data capture.	Provides a theory-based characterization of organizational decision making and performance management in recognition of current developments in organizations and in their environments. Bridges performance measurement and management literature with information systems design literature to form a solid knowledge foundation for future studies in the field.	Describes a new perspective to IT management, in which IS design and development are realized through multi-actor service systems, within which value is co-created through a chain of encounters and episodes of social action. Outlines that resistance towards systems in use may also arise in the presence of no apparent conflict, but rather when there is a “false consensus” between the associated actors during the design process.
Contribution to prescriptive knowledge	Gives advice on how to monitor contract usage rates in settings with limited availability of performance data. The solution extends the average revenue per user-analysis, which previously has been primarily used in marketing and sales, to the procurement context.	Presents a concept for third-party reporting process and system that helps to avoid agency problems in these settings, and three design principles that encapsulate high level guidance for designers to develop successful inter-organizational systems on open platforms.	Outlines a framework that gives advice on how to effectively design performance dashboards. The framework comprises key organizational and technical design tasks and guidelines and a step-wise approach to managing the design process.	Presents three design process management principles for orchestrating stakeholder interplay in IT service systems. The principles underscore network leadership capabilities and the IT function’s capacity to facilitate negotiated interaction between the parties involved.

PART 2: ORIGINAL RESEARCH PAPERS

PAPER 1

Lempinen, H. & Karjalainen, K. (2010) “Applying Average Revenue per User model to estimate contract usage rates in cases of low spend visibility”, In *Towards New Horizons in Public Procurement,* Khi V. Thai (Ed.), PrAcademics Press, Boca Raton, Florida, USA, pp. 273-300.

Chapter 12

APPLYING AVERAGE REVENUE PER USER MODEL TO ESTIMATE CONTRACT USAGE RATES IN CASES OF LOW SPEND VISIBILITY

Heikki Lempinen and Katri Karjalainen

INTRODUCTION

Many public and private organisations are now centralizing their purchasing, typically with organization-wide framework agreements with selected suppliers to gain purchasing synergies. These centralized contracts are expected to enable the negotiation of lower prices as well as reduce duplicated effort and thus costs in purchasing process areas such as supplier search, negotiations and contract management. A centralised purchasing unit negotiates the contracts and all units and employees are expected to use them in their daily operative purchases. Such a situation of scattered responsibilities can easily set the scene for different types of non-compliant behaviours in terms of an organisation's purchasing policies despite the fact that compliance to the contracts is crucial to achieve the expected benefits (Karjalainen, Kemppainen, & van Raaij, 2009). This type of contract non-compliance, known as maverick buying (MB), is defined as the off-contract buying of goods and services for which an established procurement process is in place based on pre-negotiated contracts with selected suppliers (Karjalainen, Kemppainen, & van Raaij, 2009). Purchasing benchmark reports suggest MB is a common phenomenon: the percentage of compliant transactions is said to be less than 50% on average (Aberdeen, 2009a). According to Karjalainen, Kemppainen and van Raaij (2009), maverick buying in literature is most often associated with the procurement of indirect materials and maintenance, repair and operations (MRO) items. In many organizations a compliance rate as low as 25–50% for MRO purchasing is not uncommon (Arbin, 2008). Indirect spend typically constitutes a large share of an organization's external spending,

amounting to up to 20% of all purchases by value and 70%-90% by numbers of purchases made (Arbin, 2008). Especially in public procurement, indirect purchases can account for even a larger share of all purchases; for other than construction, few production operations are in place. Karjalainen, Kemppainen and van Raaij (2009) indeed refer to compliance rates of 20-80% in place for the Finnish government's central framework agreements. Management of indirect spending is thus an important consideration for organizations, public and private, and failure to adopt effective strategies in this area may have a detrimental impact on overall monetary performance (Arbin, 2008). Maverick buying has indeed been shown to have severe financial consequences on an organization. Angeles and Nath (2007) suggest maverick buying raises procurement costs for an organization by as much as 20% compared to purchases negotiated by its purchasing professionals. PricewaterhouseCoopers calculated that an organization could gain savings of 30-40% of non-direct spending if they buy only from preferred suppliers (Angeles & Nath, 2007). According to Aberdeen (2006), the average savings of compliant transactions is 22% compared to non-compliant purchases. These cost implications of maverick buying stem from a number of factors. The purchase price typically is higher because corporate contracts are based on leveraging the total spend volume to obtain discounts (Karjalainen, Kemppainen, & van Raaij, 2009), and the fragmentation of spend can inflate transaction costs (Lonsdale & Watson, 2005). Off-contract purchasing can also expose the organization to unnecessary purchasing risks as terms and conditions may not be properly reviewed (Karjalainen, Kemppainen, & van Raaij, 2009). Reduction in maverick buying is thus crucial for cost-effective procurement practices.

Only recently has literature in the field begun to acknowledge the existence of maverick buying and studies with more detailed analyses of MB and its causes have begun to emerge (Karjalainen, Kemppainen, & van Raaij, 2009; Kulp, Randall, Brandyberry, & Potts, 2006). The underlying causes of maverick buying have been identified to range from unawareness of the contract to perceived superiority of off-contract alternatives to malicious change resistance. (For a more detailed discussion on the underlying causes of maverick buying, the reader is referred to Karjalainen, Kemppainen and van Raaij (2009) and Kulp et al., 2006). Recent articles discuss the

different types of maverick buying and their underlying causes and suggest remedies for the phenomenon. Spend visibility is typically emphasised as a prerequisite to eradicate maverick buying. Without individual and unit spending visibility a firm cannot maximize its buying leverage, arrive at intelligent sourcing decisions or ensure compliance with supplier contracts (Angeles & Nath, 2007). Several benchmarking reports, however, suggest that spend visibility is often low, and organizations do not have the resources to detect compliance levels of units or individuals (Angeles & Nath, 2007; Kulp et al., 2006). This paper focuses on this gap in both practice and research - how to identify the areas (whether certain units or certain product categories) suffering from maverick buying when there is limited spend information so that efforts to reduce the phenomenon can be targeted more appropriately.

In purchasing performance measurement literature, compliance to contracts has also rarely been addressed. Traditional focus has been on such measures as quality, price/cost, inventory, availability, and supplier performance (e.g. Carter, Monczka, & Mosconi, 2005; Dumond, 1994; Chao, Scheuing, & Ruch, 1993). The design of an effective performance measurement system, which includes the selection of appropriate measures and approaches for analyzing results, is, however, central to aligning an organization's operations with its strategic direction (Evans, 2004). A clear gap thus exists in purchasing performance measurement related to the tracking of internal compliance. Specifically given the increasingly common strategy of centralized contracts and decentralized operative ordering, the measurement of compliance is important to ensure that savings pursued are achieved.

Despite the importance of an effective performance measurement system, it is one area that many organizations fail to address effectively (Evans, 2004), whether in relation to the inclusion of individual measures such as compliance or to the system as a whole. Franco-Santos et al. (2007) argue that there are only two necessary features of a business performance measurement system: performance measures and supporting infrastructure. Also Carter, Monczka and Mosconi (2005) suggest that purchasing performance measures must be backed with appropriate systems. In this paper, we argue both for the use of compliance as an important purchasing performance measure and suggest a system for measuring it in cases of low spend visibility. Kulp et al. (2006) suggest that due to the time,

resources, and expense of a spend analysis to get detailed information on compliance, companies may use pilot studies to figure out how to define compliance in a way that facilitates the task of gathering data. An organization could, for instance, analyze a single purchase category to further understand the types and extent of noncompliance. In this research paper, a different approach is suggested. By utilizing the average revenue per user (ARPU) – method, introduced in telecommunications marketing literature (see e.g. McCloughan & Lyons, 2006), a method for extrapolating compliance rates for all categories and units based on the data available is introduced. This method allows management to get an overview of contract compliance within the organization without having to invest in either expensive spend analysis tools and software that allow gathering data from the various systems in place in different units or in a new organization -wide purchasing system or having to devote resources and man-hours to manual inspection of orders and invoices to detect maverick spend. This kind of information allows purchasing managers to better target efforts to certain units and product categories to increase compliance in those areas.

This paper is structured as follows. In the next section, previous literature on spend analysis and purchasing performance measurement systems is reviewed. Section three presents the methodological positioning of the paper by elaborating on the action research approach used and the ARPU model. In the fourth section, a detailed presentation of the model building is offered through an example of framework agreements of the Finnish Government. The final section summarizes the results and concludes by discussing the theoretical and managerial contributions of the study.

LITERATURE REVIEW

Spend Analysis and Spend Visibility

Angeles and Nath (2007) referred to spend analysis as the process of aggregating, cleansing, and analyzing corporate spending data for the purposes of reducing costs and improving operational performance. According to them, providing visibility into individual and unit spending within the firm is a precursor to conducting spend analysis; visibility means making transparent who is spending, how much, on what and with whom.

Spend analysis is claimed to establish a way of auditing buying behaviour to detect MB (Karjalainen, Kemppainen, & van Raaij, 2009). According to a study by Aberdeen (2007), spend analysis is an effective tool for improving contract compliance, as the improvement in spend visibility gives managers knowledge of the on- and off-contract buys taking place. According to a survey of more than 700 companies across various industries globally, the average improvement in compliance with negotiated agreements after spend analysis was 33% (Aberdeen, 2007). The starting point for effective purchasing and supply management is thus effective demand management and among the critical issues in this is the detection and reduction of noncompliant purchases (Lonsdale and Watson, 2005). According to Kulp et al. (2006) the key to driving purchase compliance is in understanding where the problems of noncompliance lie. Kulp et al. (2006) suggested a three-phase process for increasing compliance in an organization, starting with data gathering, followed by identification of reasons for maverick buying and the design of conformance mechanisms. They, however, argued that many companies do not have readily available the data needed to analyze the compliance of purchases against contracted rates and suppliers at an item level. As organizations increase in size, complexity, and staff, tracking and enforcing compliance becomes more difficult (Kulp et al., 2006). There are integration problems related to managing data coming from multiple systems (Angeles & Nath, 2007). Angeles and Nath (2007) argued that the presence of functional silos, ad hoc management practices, weak technology support, and poor source data quality typically work against an organization's ability to conduct spend analysis. According to Kulp et al. (2006) acquiring data to assess compliance at a granular level is not trivial and often requires numerous hours of work. These situations of low spend visibility seem to be quite common in practice: a recent Aberdeen Group study of spending analysis practices of 157 firms revealed that only a few organizations truly know and understand how much they spend, on which products, and with which suppliers (Angeles & Nath, 2007). About 80 percent of the study participants recognized spending analysis as important or critical to their success but only about half of those specific respondents had any formal spending analysis tool in place and the few with these tools in place analyzed only half of their total spending (Angeles & Nath, 2007). Another recent purchasing benchmark report suggested that, in addition to the absence of automated spend analysis

systems, the top challenges that companies face with spend analysis include the use of too many incompatible data sources and poor data quality (Aberdeen Group, 2009b). According to the report, spend data is often sprinkled throughout the organization in multiple disparate systems. Furthermore, when the data is also of poor quality, inaccurate and/or not in a standard format, the visibility of spend gets even lower. A recent McKinsey study found that firms consider spending analysis and demand management as the two areas resistant to improvement (Kanakamedala, Ramsdell, & Roche, 2003).

Wagner and Kaufmann (2004) noted in their study that a majority of companies had noticed gathering performance data requires a great amount of time and energy; this was particularly the case when the companies' organizational structures were decentralized, when the companies' decentralized units were not hooked up to one common ERP and performance measurement system, and the more the business portfolio was diversified. Public procurement, especially governmental procurement, typically fits all these criteria. First, the organizational structure is decentralized, i.e. separate units and management systems are set up for the different areas of the government such as education, military, foreign affairs, social policy and health care. Second, all these units have historically been rather independent in their management and have set up their own legacy systems for e.g. accounting, purchasing, and IT systems in general. Third, the business portfolio in this case is decentralized, i.e., the government operates in multiple specialist areas. Public procurement is indeed a context where low spend visibility is the case perhaps even more often than in private organizations. Another reason for this is that governments have been slow to adopt e-procurement systems (MacManus, 2002; Moon, 2005). Without electronic systems in different phases of the public procurement process, gathering and combining data in an easily analyzable format may be difficult as data may be stored in various different archives. Essig, Tonkin and McGuffog (2007) argued that, actually, with or without e-procurement, studies indicated that public procurement suffers from a lack of management information. Specifically, lack of data capture and integration was found to occur as a result of there being many different financial and other procurement systems (Essig, Tonkin, & McGuffog, 2007).

Whether or not facilitated by e-procurement technologies, on-contract purchase information most likely flows through some administrative process in the central procurement unit, especially if there is a commission attached to contract usage. In cases where the central procurement unit has on-contract purchase data collected, the data can act as a premise for conducting spend analysis, also with regard to MB. In this study, the aim is to measure performance in centralized procurement with low spend visibility, specifically contract usage rates, by analysing on-contract spend patterns of internal customers.

Performance Measurement Systems

A business performance measurement system is mainly perceived as a set of metrics used to quantify both the efficiency and effectiveness of actions or as the reporting process that gives feedback to employees on the outcome of actions (Franco-Santos et al., 2007). From a strategic control perspective, a business performance measurement (BPM) system is a system that not only allows an organisation to cascade down its business performance measures, but also provides it with the information necessary to challenge the content and validity of the strategy (Franco-Santos et al., 2007). Franco-Santos et al. (2007) argue that there are only two necessary features of a business performance measurement system: performance measures and supporting infrastructure. They suggest that a supporting infrastructure can vary from very simplistic manual methods of recording data to sophisticated information systems and supporting procedures which might include data acquisition, collation, sorting, analysis, interpretation, and dissemination. Even though called a business performance measurement system, the same features are applicable to public organizations; performance measures derived from strategy and an infrastructure to monitor them are needed in a public context as well. Thus no distinction is made between public and private organizations' performance measurement systems in the following.

In essence, performance measurement systems allow managers to keep track of implementations of business strategy by comparing actual results against strategic goals and objectives. In BPM literature, however, performance measurement systems are usually linked closely to a wider range of performance management activities, namely setting strategic goals and objectives, establishing

initiatives and plans to achieve those goals, monitoring actual performance against the goals, and taking corrective action (Turban et al., 2007). Modern BPM systems take a top-down approach to measurement, where the strategic goals of a company are first transformed into critical success factors (CSFs) which the organization must excel in to achieve its strategic goals (Thierauf, 2001). After the critical success factors have been identified, they are disassembled into more tangible metrics, referred to as key performance indicators (KPI) (Thierauf, 2001). However, identifying the proper CFIs and KPIs is often not an easy task and requires careful consideration. A measurement system not steering the company into the right direction is worse than no measurement system at all. As the old saying goes, "If you can't measure, you can't manage," but also "what you measure wrong, you manage wrong" (Thierauf, 2001). In this paper, based on a strategic top-down approach, a KPI for centralized procurement is derived and a related performance measurement system is suggested. In order to do so, this study follows a five-step process suggested by Franco-Santos et al. (2007):

1) "Selection and design of measures" comprising of the processes of identifying stakeholders' needs and wants, planning, strategic objectives specification, measures design and selection and target setting. In this study, the selection of measures, specifically the measure of compliance, is discussed in the current chapter.
2) "Collection and manipulation of data" including the processes of data capture and data analysis. In this study, chapters 3 and 4 focus on data collection and analysis for and with the model developed.
3) "Information management" encompassing the processes of information provision, interpretation, decision making. Here, information management is discussed in relation to the model developed and relates to how the outputs of the model can be used.
4) "Performance evaluation and rewards" including the processes of evaluating performance and linking it to rewards. This is largely out of the scope of the current paper as it relates to the ongoing use of the model in an organization, but it is discussed briefly in the conclusions chapter.

5) "System review" including the different review procedures. Discussion on how the model can be updated based on new information becoming available is included in the chapter on the method used.

According to Murphy, Pearson and Siferd (1996), the procurement department is one of the most difficult functional areas to evaluate. As procurement serves many customers, several goals are needed to cover all vital responsibilities (Dumond, 1994). Carter, Monczka and Mosconi (2005) proposed nine strategic measure categories for purchasing: price/cost, revenue, inventory, availability, technology, innovation and new product introduction, workforce, supplier performance, operations and customer satisfaction. Maverick spend analysis is mentioned as one among many in the operational measures suggested in their study. We argue that compliance rate has not been given enough importance in purchasing performance measurement systems literature. Traditionally the most important measures suggested have ranged around costs, price, incoming quality, inventory, order cycle time, commodity knowledge and professionalism (Dumond, 1994; Chao, Scheuing, & Ruch, 1993). However, simply measuring inventory turnovers, contract prices and performance of approved suppliers and their product and service quality are of little use, if the actual purchases do not flow through these contracts and suppliers. Therefore, compliance rate should be one of the key performance indicators in purchasing. Naturally, the problems with spend visibility discussed above most likely contribute to the difficulty of measuring compliance rates.

Performance evaluation influences behaviour (Boss et al., 2009); measurement motivates and directs behaviour toward desired end results (Monczka, Trent, & Handfield, 2005). Maverick buying behaviour can actually be seen as a classic example of an agency problem (Karjalainen & van Raaij, 2009). Specifically, it is difficult and expensive for the principal –here the central procurement agency - to verify the behavior of the agents to whom the task of ordering via centralized framework agreements is delegated. This is because ordering behavior is often not monitored and only visible after the fact and in many organizations, any employee can make purchases and have the costs reimbursed post hoc (Karjalainen & van Raaij, 2009). If the organization does not have adequate tracking and spend analysis tools in place, it can be difficult to verify afterwards whether all purchases complied with the frame agreements. To safeguard his

interests, the principal can reduce the information asymmetry by investing in monitoring systems to constrain the agent's opportunity to shirk, or the principal can structure agent incentives such that the two parties' goals are aligned (Lassar & Kerr, 1996). The simple existence of a performance measurement system for procurement compliance may thus in itself already help to reduce maverick buying, even before actions based on the information provided by the system are undertaken as performance measurement reduces information asymmetry and thus opportunities to shirk. Data on compliance and the performance measures derived from it can also help to align goals between the principal and agents, as units with high compliance can be given rewards and low-complying units issued with sanctions. Boss et al. (2009) also introduced a concept of mandatoriness, which they defined as the degree to which individuals perceive that compliance with existing policies and procedures is compulsory or expected by organizational management. Boss et al. found that the act of evaluating behaviour is effective in convincing individuals that policies are mandatory: if management either never or only infrequently evaluates compliance, those policies will most likely be disregarded by employees.

Many authors (Van Weele, 2005; Neely, Gregory, & Platts, 1995; Kumar, Ozdamar & Peng Ng, 2005) believe there are two classes of performances, irrespective of the unit of analysis: efficiency and effectiveness. The former is a measure of resources used to reach the goals and can be defined as the relation between budget and actual resources. The latter is intended as the degree of compliance with the planned objectives: an organizational unit is more effective as it fulfils its own targets. The measure of compliance or usage rate, which is the focus of this paper, is an effectiveness measure. It is defined here as the actual purchases as a percentage of all potential purchases flowing through the centralized framework agreements in a given category for each user organization.

METHODOLOGY

Action Research and Case Study Methodology

Since the purpose of this study is to develop a model for evaluating contract usage rates in centralized procurement in cases of low spend visibility, a case example was used to build the research model. The case organization chosen for the study, Hansel Ltd, is the

central procurement unit of the Finnish government. A case study is best suited when the phenomenon under study is not readily distinguishable from its context (Yin, 1994). According to Galliers (1991), a case study is an attempt to describe the relationships which exist in reality, usually within a single organization or a group of organizations. Since this study was not merely descriptive, but the model was built in cooperation with the case company, the chosen study approach is action research. Action research is similar to the case study approach, but with the exception that in action research, the researcher is not an external observer, but collaborates with the practitioners, knowing that his or her presence affects the research situation and results.

Action research attempts to create results of practical value to the client organization while adding to theoretical knowledge (Galliers, 1991). According to Lee and Baskerville (2003) in action research, theory is regarded as tentative, applied and then improved by successive cycles of application and reflection until the practitioner-defined problem is adequately addressed. According to Galliers (1991), the strength of action research is that it enables capturing "reality" in far greater detail compared to many other research approaches, such as surveys and laboratory experiments. Respectively, the downside is that it is bounded to only one or few organizations which negatively affect the generalizability of the results (Galliers, 1991).

In the existing purchasing literature, solutions for estimating compliance under low spend visibility are not presented. Thus, the collaborative action research approach was chosen to generate new theoretical knowledge and solve a managerial problem at the case organization. The study was commenced by interviewing company management during summer 2009. The interviewees included 7 category managers, 6 account managers, business director, CFO, and IT development manager. Each category manager is responsible for 1-10 frame agreements whereas the account managers have responsibility of over 10-20 customer organizations.

The interviews were conducted in three rounds. In the first round, three workshop sessions were held with the business director, CFO, IT development manager and one category manager to discuss and form a scope of the research project. Based on these sessions, the initial model for estimating contract usage rates was built. Guided by

the interviews and the data available, the average revenue per user (ARPU) method was adopted as the basis of the model and the preliminary usage rate estimates were generated by utilizing historical purchase data. In the second round of interviews, the category managers were assigned to make their best estimate of the framework agreement-specific "potential" purchase volume if all customers would use Hansel's framework agreements in all their purchases of the respective category. According to these estimates, the model was refined and adjustments were made regarding some of the product and service categories. In the last round, the account managers were interviewed and their feedback regarding the model and the usage rate estimates was collected for further improvement of the model. After the improvements, the final extended ARPU model was put together and contract usage rates were generated.

ARPU-Average Revenue per User Method

In an attempt to build a system for monitoring contract usage rates in centralized procurement when all required data is not directly available, this study builds on the ARPU method. In its basic form, ARPU is a simple method of calculating the average revenue generated by an individual customer in a specific market, product or service category, customer segment etc. ARPU is a commonly used performance measure in (mobile) telecommunications marketing (McCloughan & Lyons, 2006). In that context, higher ARPU comes, generally speaking, from an increase either in the price or the number of minutes used in mobile telecommunication. In this study, the ARPU model is applied to procurement context. The extension of ARPU to a procurement context is quite a natural step. This is because procurement has many of the characteristics of the marketing function, the difference being that it faces the other direction in the supply chain compared to marketing and sales (Croom & Johnston, 2003). In this case, the volume of purchases in a particular product of service category represents "revenue" whereas "users" are the individual employees within the purchasing organization's internal customers. Thereby, from the point of view of the central procurement unit, ARPU would equal average purchase volume per employee in the internal customer organizations. In the procurement ARPU, a higher score originates from an increase in either the percentage of compliant purchases from an existing user of framework agreements or from new buyers becoming compliant.

Building on the basis of ARPU, some statistical methods were also used as constructs in the final model. The resulting model is an extended ARPU model that incorporates methods of spend analysis and extrapolation. A detailed description of the model and its constructs follows in the next section.

The strength of the quantitative approach is that it enables generating estimates of the contract usage rates when exact information is not available. Another advantage of the method is that since it uses historical data, the analysis is easy to update as new data becomes available. Conversely, the method's weakness is that it aims to depict reality by making generalizations. The method assumes that all customers behave somewhat similarly and the demand for all the products and services that are purchased centrally would be homogeneous to a certain extent. In real life, however, users do not always follow predetermined spend patterns. Hence, by aiming to generalize the spend patterns of internal customers, the model may in some instances fail to capture true spending behaviour. Adjustments in the model's parameters are thus likely to be needed as more data becomes available allowing the reliability of the results to be evaluated more accurately.

MODEL CONSTRUCTION: THE HANSEL CASE

Spend Visibility and Compliance in the Finnish Government

The Finnish government buys roughly 4.5 billion € worth of products and services each year. Of this amount, approximately €.8 – €1 billion are products and services suitable for centralization. Hansel Ltd, the central procurement unit in Finland, negotiates and maintains central framework agreements which are used by other governmental units such as ministries, ministerial offices, state agencies and publicly owned enterprises for purchasing of goods and services. The purchase volume channeled through the central frame agreements has increased notably over the past years; the annual purchase volume has more than doubled since 2006, reaching €534 million in 2009.

Hansel has traditionally measured its performance by the volume of purchases made through the framework agreements. However, the absolute change in volume does not tell how much of the potential volume is reached and how it is distributed between customers and

product/service categories. Although the central procurement unit has detailed information about how much each customer has used each framework agreement, the central procurement unit cannot calculate contract usage rates in detail because it has no visibility to off-contract spend. An integrated accounting scheme that would span all governmental units that use the framework agreements does not exist. Hence, the central procurement unit has no category-specific information on how much the other governmental units spend on products and services that are available for purchase via Hansel's contracts.

Earlier research made on public procurement in Finland suggests that the total volume of purchases via framework agreements could reach 850 million euro if all units were fully compliant (Karjalainen, Kivioja, & Pellava, 2008) and that the category-specific compliance rates of Hansel framework agreements vary between 20% and 80% (Karjalainen, Kemppainen, & van Raaij, 2009). Furthermore, Karjalainen, Kivioja and Pellava (2008) suggest that if Hansel reached 100% compliance, they could generate annual savings of 25.7% compared to the decentralized model, which equals more than 250 million euro per year. With 2006 contract compliance, estimated annual savings were 8.3% which equals 95 million euro. Hence, the study results indicate that the annual "cost" of MB to the Finnish Government at that time was more than 150 million euro. The study by Karjalainen, Kivioja and Pellava estimated contract compliance using sampling techniques, clustering and purchasing professionals' views on compliance on certain product and service categories. Thereby, the results give insight to contract compliance on a rather general level and reflect the situation at the time the study was conducted. Furthermore, the earlier estimates did not reflect how the different customer organizations used Hansel contracts. In this paper, the purpose is to introduce a system that produces category- and customer-specific compliance estimates and facilitates monitoring contract usage rates over time. Instead of a static estimate of current contract usage, the model is created so that it allows updating the estimates when new data becomes available. The case setting itself is complex. To be able to estimate contract usage on the category and customer level, a two-dimensional model has to be created with customers on one axis and product/service categories on the other. Hansel's customers comprise a 4-level hierarchy structure in which different administrative sectors (level 1) are divided to accounting

offices (level 2), and further to offices, agencies etc. (levels 3 and 4) In 2009, Hansel's customer organizations employed some 150.000 people, which represent the total number of individual users utilized later in the analysis. For the purpose of this study, the level of analysis was set to accounting office customers. This is due to practical reasons and also because the organization sets its annual budget on this level. In 2009, the number of level 2 customers was 122. As for the category-dimension, the central framework agreements are built on different product or service categories, such as office supplies, electricity and scheduled flights. In 2009, Hansel had 67 framework agreements, each representing a certain category of products or services.

The spreadsheet model was built on a matrix structure of i customers and j product and service categories where i = 122 and j = 67.

TABLE 1
Category: Customer Matrix

Customer	Product/Service Category				
	P_1	P_2	P_3	....	P_j
C_1					
C_2					
C_3					
...					
C_i					

Model Formulation

As already pointed out, the contract compliance metric is composed of two elements: the "potential" volume if all government units used the central framework agreements to the full (with current coverage of products and services) and the actual purchase volume funneled through the contracts at the moment. Let us use the term "potential volume" for the first and "actual volume" for the second.

Hansel collects information regarding actual contract usage through a web portal in which suppliers are required to report the framework agreement trade usually once a month. This data is directly available in detailed format. Since there is practically no

visibility to off-contract spend, the potential total volume of the framework agreements needs to be estimated to enable the calculation of the usage rates. To do this, a model for evaluating contract usage rates is proposed that builds on analyzing on-contract spend patterns of the existing internal customers. The model draws on the ARPU method, historical purchase data and classification of the framework agreements.

Euro values are used as an indicator for purchase volume in order to make the analysis comparable across all categories. In the first phase of the analysis, the model uses customer- and category-specific actual purchase volumes from the previous year (460 million euro in 2008) and the number of employees in the customer organizations (total 150 000 in 2009) to calculate average purchase volume per user for each customer organization in a given category. Purchases per employee are calculated to make the different size customer organizations comparable with regard to purchase volumes. According to the interviewees, demand for centrally purchased products and services is generally in proportion to the number of employees and headcount thus gives the best indication of the expected purchase volume of a particular customer organization. The average purchase volume (V^{uij}) for each customer organization (*i),* and for each product/service category (*j),* equals the actual purchase volume (V^{aij}) divided by the number of employees (*U)* in customer organizations (*i)*:

$$Vuij = {}^{Vaij}/_{Ui}$$

The main assumption behind the model is that the demand for products and services that are purchased centrally is fairly homogeneous across all categories. However, in reality the product and service categories are different. This has been taken into account in the model by categorizing the framework agreements in terms of their type (i.e. “special product/service” vs. “volume” categories) or life-cycle (e.g. “growth” vs. “saturated” categories) before setting the ideal user level for each frame agreement. Frequency of user organizations within a specific category is used as an indicator: if, say, 46 of Hansel’s 115 customer organizations (40%) used Hansel’s contracts to buy car insurances, the frame agreement for car insurances would be classified as a “contract in medium growth phase”. If 15 customer organizations (13%), in turn, used the central

framework agreement to buy lubricants, it is classified as a "special product". Table 2 illustrates this classification. There are five groups divided by the relative number of user organizations. Contracts belonging to group 1 are already used by a minimum 85% of Hansel's customers and thereby are regarded as "saturated", i.e. not much potential growth is expected coming from these contracts anymore. Contracts in group 2 are those for which the number of user organizations is between 60% and 85%. These contracts are expected to be on the steepest phase of the growth curve. Group 3, in turn, consists of contracts that are expected to grow more steadily. Those contracts, used by less than 30% of the customer organizations, are classified according to their type either as "special " product or service categories that will never be used by certain customers, or new contracts that have not yet attained that many users but for which the number of user organizations is expected to grow. The new contracts that have not yet generated much purchase volume have to be moved to a group that best reflects the expected potential. This is done by manually changing the 0-1-2 coding that is generated on the spreadsheet automatically to the other groups. Groups 1-5 are converted to dummy variables 0,1 and 2 purely due to technical reasons. The spreadsheet uses the dummy variables to determine which ideal user measure to use and which organizations are potential users in a given category.

TABLE 2
Classification of the Frame Agreements

No.	Frame agreement group	No. of user organizations (min)	Ideal user measure	Dummy variable	Potential customer organizations
1	Saturated contracts	85%	2nd quartile	1	all
2	Contracts in high growth phase	60%	3rd quartile	2	all
3	Contracts in medium growth phase	30%	2nd quartile	1	all
4	Contracts on special products and services	0%	3rd quartile	0	previous users
5	New contracts	0%	3rd quartile	2	all

First, the model sets the ideal user level for each category. The idea is to determine an organization that uses a given framework agreement well. The ideal user level is the amount of purchases that an individual employee in that customer organization generates on average. More specifically, the model finds the ideal user level by taking a certain predetermined descriptive statistics measure from the average purchase volume per user data for each framework agreement. In this case, the second and third quartile points were chosen as the measures for defining the ideal user levels, depending on the group that the framework agreement belongs to. Quartile points are measures of central tendency and thus represent "typical values" in a given data set. Second quartile point (Median, Q2) cuts the data set in half meaning that 50% of data points are larger and 50% are smaller than Q2. It was used to define the ideal user level for framework agreements for which the expected growth is either medium or saturated (groups 1 and 3). Specifically, the assumption is that half of the user organizations have already reached the ideal volume in these framework agreements. The third quartile point (Q3) cuts off the highest 25% of data points and thereby 75% of the values in the data set are smaller than Q3. The third quartile point was used to set the ideal user level for framework agreements belonging to groups 2, 4 and 5 for which there are assumed to be fewer ideal users and hence the expected growth is higher. Based on the classification, the model also defines the potential user organizations for each frame agreement. For special product and service contracts in group 4, the model assumes that only those organizations that have previously used the contract are potential customers, whereas for the volume categories 1, 2, 3 and 5 all customers are regarded as potential customers even though they have not used the contracts before.

The advantage of using quartile measures, as opposed to arithmetic means, is that it decreases the bias in estimates that would be caused by euro values that are significantly low or high in a given category. If arithmetic means of euro values were used to determine "typical" purchase volume, the analysis would be greatly distorted in cases where there are either many customers who underutilize the contract, or customers who buy much more compared to others in a particular category. Quartile measures, instead, find a customer that uses the frame agreement well in relation to others in a given category and uses the actual volume of

that customer as a reference value. The risk of getting estimates that are downward biased has to be taken into consideration with framework agreements that are known to be underutilized by all customer organizations. This is usually the case with recently established frame agreements and can be taken into account in the model either by generating the estimated potential volume manually or by allocating it to the group of frame agreements with a high growth expectation. Next, the model generates estimates for potential purchase volume per user by extrapolating the ideal purchase volume per user to other customer organizations as the potential volume per user. For those customer organizations *i*, whose average volume per user V^u_{pot} is above the ideal V^u in a given category *j*, the potential volume equals actual volume. In other words, the assumption is that they have already reached their estimated full potential and are thereby already ideal users. For those customer organizations, whose average volume per user is below the ideal level, the ideal level is set as their potential per user volume.

$$V^u_{pot\,ij} = V^u_{ij} \quad \text{if } V^u_{ij} > V^u_{*j}$$

$$V^u_{pot\,ij} = V^u_{*j} \quad \text{if } V^u_{ij} \leq V^u_{*j}$$

Consider a simplified example with five customer organizations A, B, C, D and E who bought 20, 40, 60, 80 and 100 euro worth of mobile phones per employee through Hansel's contracts during the year, respectively. If the third quartile is set to be the determining measure in this category, ideal user volume would be 80 euro. Hence, the group of customer organizations that have already reached the ideal volume includes D and E. The assumption is that customers A, B and C have a demand for mobile phones that is at least as high as for the ideal user organization D and hence are buying 60, 40 and 20 euro off-contract. As a result, the potential volume per user for A, B, C and D is 80 euro, and 100 euro for customer organization E.

Then, the model generates the aggregate potential volume V_{pot} estimates for each customer *i* and framework agreement *j* simply by multiplying potential purchase volume per user by the number of employees in customer organizations:

$$V_{pot\,ij} = V^u_{pot\,ij} \times U_i$$

Finally, the model estimates customer-specific usage rates for the framework agreements. Contract usage rate *C* equals the actual volume divided by potential volume:

$$Cij = {}^{Vatj}/_{Vptj}$$

Results

In brief, the model estimates contract usage rates through the following steps:

1. Data: Actual purchase volume for i customer organizations and j product/service categories and the number of employees in i customer organizations;
2. Average purchase volume per user (i customers, j categories) = purchase volume divided by the number of employees in each customer organization;
3. Classification of the framework agreements to groups according to the number of user organizations in each category;
4. Setting the ideal user level for each frame agreement by analysing the actual average purchases per user data through quartile points;
5. Identification of potential customer organizations for each frame agreement (all vs. previous users);
6. Potential purchase volume per user;
   a. actual, if the customer organization is above the ideal user level; and
   b. ideal user volume, if the customer organization is below the ideal user level;
7. Potential purchase volume per category and customer organization = potential purchase volume per user multiplied by the number of individual users in customer organizations; and
8. Customer-specific usage rate estimates for the framework agreements = actual purchase volume divided by the potential estimates.

The case-specific estimates generated by the model suggest that total purchase volume could reach 904 million euro per year with the

existing framework agreements, which is in line with the estimates presented by Karjalainen, Kivioja and Pellava (2008) in their earlier study. Compared to 2009 actual volume of purchases, the current average usage rate is 59%.

For practical reasons, the model was built on a Microsoft Excel spreadsheet. With the 122 x 67 matrix, the processing power of a normal work station with MS Office software is enough. Appendix 1 gives a glance of how the potential volume and contract usage rate estimates look on a spreadsheet. Spreadsheet data can also be imported to other systems for reporting and monitoring purposes if needed. In Hansel's case, the data goes to a separate Business Intelligence system that facilitates dynamic and perhaps more reader-friendly monitoring of the usage rates compared to plain spreadsheets.

DISCUSSION AND CONCLUSIONS

Theoretical and Managerial Implications

In this study, we set out to develop a model for evaluating contract usage rates in centralized procurement in cases of low spend visibility. For this purpose, a study was conducted in Hansel Ltd, the central procurement unit of the Finnish government. By extending the average revenue per user method to the procurement context, this paper introduced a novel way of conducting spend analysis and estimating contract compliance in centralized procurement.

The developed system fulfils all five categories of BPM system roles as suggested by Franco-Santos et al. (2007). First, it measures performance as it gives estimates on how well units have complied with centralized framework agreements. Second, it enables strategy management; a category which according to Franco-Santos et al. comprises such roles as planning, strategy implementation and focus attention. Specifically, in this case, the data on compliance levels by units and categories gives the central purchasing agency of the government a better view on where to target their efforts in increasing compliance. Third, the developed system allows for communication, which comprises the roles of internal and external communication, benchmarking and compliance with regulations (Franco-Santos et al. 2007). The current situation in the Finnish government has been

such that even the units themselves have not had visibility to their own spending patterns and compliance rates due to limited characteristics of the procurement systems, and they have had to turn to the central purchasing agency to ask for this information. With the developed system, the agency is able to communicate compliance information back to the units and to benchmark their compliance performance. The fourth category of a BPM system role is influencing behaviour (Franco-Santos et al. 2007). The data on compliance allows the central purchasing agency to better identify those units where compliance is low and target mechanisms to induce compliance more accurately. Finally, learning and improvement, the fifth role comprising of feedback, double-loop learning and performance improvement (Franco-Santos et al. 2007) is also fulfilled, as the tool created allows for managers to learn of problem areas and when for example a low compliance rate is noticed in a certain category to get feedback on for example the contract characteristics that may cause the users to buy off-contract. This allows the public procurement agency to modify its tendering criteria and specifications on subsequent contracts.

On one hand, this paper provides a theory testing study where an existing model is applied to a different context. On the other hand, the action research method used produces a new model by modifying and extending the existing model. This is a mixed-method study that utilizes both the more interpretative method of action research as well as multiple descriptive quantitative methods. The contribution of this study to research in this field is to introduce a novel way of estimating contract usage rates when the visibility of spend is low. This is a theoretical contribution to spend analysis and business performance measurement research. The model can be applied to estimating spend visibility in other public and private organizations with low spend visibility by following the steps suggested.

For practitioners, the study offers a solid tool for analysing, planning and managing framework agreements. It also gives managers assistance in internal customer segmentation and hence helps to effectively allocate internal sales resources to the areas where contract usage rates are low and thus helps eradicate maverick buying behaviour. This information has not been available before. In previous studies (e.g. Kulp et al., 2006; Karjalainen, Kemppainen, & van Raaij, 2009), remedies for MB occurring due to

different underlying reasons have been suggested. It is emphasized that in order to identify the causes of noncompliance and design counter mechanisms, an organization must first understand where the problems of noncompliance lie (Kulp et al., 2006). This study addresses this issue of identifying the areas of noncompliance. A key contribution of the model is that it allows the central procurement unit to efficiently track contract compliance among its internal customers and framework agreements by breaking down the usage rate estimates to the customer as well as category level. This information allows for more efficient and targeted design of incentives and governance mechanisms to reduce maverick buying behavior, which is the next key step for managers after a view on noncompliance has been achieved with the mechanism suggested in the paper. For instance, when one unit is discovered to have significantly lower compliance rates than expected, given its spend profile, more detailed enquiry among the framework agreement users of that unit can be conducted. It may be that a low compliance within one particular unit is due to poor information given of the existence of the contracts within that category. If, on the other hand, low compliance is detected for a certain product category within a limited geographical area, it can be investigated if this has to do with low service provided by the national framework agreement supplier's local branch, which is driving users towards noncompliance. Appropriate action can then be taken to improve supplier performance and communicate these actions to the user. If based on the suggested analysis, high levels of MB are detected for a category where maverick buying is presumably easy, given the ample availability of options online (e.g. flights and other travel purchases), focus of efforts can be targeted on designing a simple–to-use, online-ordering system for the framework agreement in case.

Although the model is set to take into account certain variation between different categories, systematically generated estimates must be considered with some reservations. The method does not apply to all products and services equally well and cannot predict irregularities from the assumed spend patterns. The model is designed to give estimates for a one year time-span. It best applies to framework agreements for which the purchase pattern is relatively flat i.e. purchases are made continuously. The model cannot automatically predict investment-type purchases that are not made every year. By looking at historical data, the potential estimate does

not take into account the possibility of expanding the "coverage" of Hansel's framework agreements. Also due to this, the potential purchase volume of new and prospective framework agreements has to be estimated separately. Also, it is not yet known how stable the estimates are over time due to the exploratory nature of the study. Average purchase volume data from multiple years could be used to increase stability. However, a reliable evaluation of the stability cannot be done until the estimates have been updated several times.

This research focuses on estimating compliance to centralized contracts under limited spend visibility. This research does not wish to take a normative approach in promoting centralization as the optimal purchasing organizational form for all contexts, in public or private procurement, nor is the viewpoint in this research that maverick buying in all cases is harmful and that management should seek its total elimination. There are situations in which purchasing off-contract may be the only option or in which it may justifiably be the most cost-effective alternative for the whole organization. This research focuses on the viewpoint that if centralization of purchasing has been decided by management as the optimal strategy in an organization, how can employee behaviours (i.e. maverick buying) acting against this managerial policy best be detected, evaluated and acted upon.

In terms of future research, combining some forecasting methods to the proposed model might allow for better estimates of some investment-type purchases to be generated, especially for investments with cyclical characteristics such as major IT systems of hardware. Additionally, future research on purchasing should focus more on solving the problems of spend visibility with different information systems solutions, as currently the literature on e-procurement is mainly focused on buyer-supplier interfaces. But as suggested in this paper, improving the communications and processes with a contracted supplier through electronic tools for example will not bring any benefits unless purchases actually flow through those contracts. This is why research, and managerial attention as well, on improving spend visibility within organizations is key.

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APPENDIX 1
Aggregate Potential Volume and Contract Usage Rate Estimates Generated on Spreadsheet

Panel A: Potential Volume								
1000 €		Product/Service Category						
Customer	...	ppp	ppp	ppp	ppp	ppp	...	Total
...								...
ccc		9 033	11 218	3 864	6 713	9 527		88 768
ccc		21 325	27 900	9 426	20 135	22 325		185 046
ccc		4 730	6 629	2 249	3 378	3 835		41 953
ccc		11 429	17 456	5 612	9 295	9 498		119 514
ccc		7 088	12 549	2 849	5 046	5 393		62 874
ccc		7 587	12 626	3 538	10 638	7 204		71 755
ccc		1 629	2 444	887	1 221	1 662		14 680
...								...
Total	...	89 630	135 951	61 945	100 255	80 458	...	903 732
Panel B: Usage Rate								
		Product/Service Category						
Customer	...	ppp	ppp	ppp	ppp	ppp	...	Total
...								...
ccc		64 %	59 %	17 %	28 %	89 %		66 %
ccc		58 %	56 %	11 %	21 %	72 %		48 %
ccc		70 %	63 %	61 %	22 %	73 %		54 %
ccc		40 %	48 %	79 %	10 %	38 %		54 %
ccc		69 %	63 %	22 %	41 %	64 %		59 %
ccc		34 %	50 %	12 %	28 %	81 %		43 %
ccc		80 %	75 %	74 %	32 %	65 %		77 %
...								...
Total	...	***59 %***	***54 %***	***75 %***	***39 %***	***75 %***	...	59 %

PAPER 2

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Redesigning the supplier reporting process and system in public procurement – case Hansel

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Abstract: In this paper, we report the findings of a supplier reporting system redesign project in a public organisation, Hansel Ltd., the central procurement unit of the Finnish Government. With the agency theory as the theoretical lense, the action design research (ADR) as the research method, and electronic invoicing as the facilitating technology, we identify and formulate design principles for building an effective and efficient supplier reporting process and the related information system. In addition to being useful for our case company, we illustrate how these design principles can be applied to a class of similar problems. With this study, we contribute to the knowledge on organisational and information systems design, as well as to the understanding of agency relationships and problems in the public sector.

Keywords: inter-organisational information sharing; agency theory; public procurement; action design research; ADR; organisational design, electronic invoicing; Finland.

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1 Introduction

In attempt to reduce costs and increase purchasing efficiency, many organisations are looking for ways to exploit purchasing synergies (Faes et al., 2000; Smart and Dudas, 2007). To do this, organisations have been moving towards centralised purchasing and corporate-wide framework agreements. The purpose of these centralised contracts is to enable the negotiation of lower prices as well as to save costs through reduced duplicated effort in the purchasing process, including supplier search, negotiations and contract management (Karjalainen et al., 2009).

In Finland, Hansel Ltd. (hereinafter Hansel), acts as the central procurement unit that negotiates and maintains central framework agreements that are used by other governmental units such as ministries, ministerial offices, state agencies and publicly owned enterprises for purchasing of goods and services. Hansel aims at creating savings for the Finnish Government through purchasing centralisation. Hansel is a privately held company, yet, it is owned 100% by the Ministry of Finance and can thereby be regarded as a public organisation. It is a non-profit organisation that operates on service fees collected from the suppliers participating in the frame agreements. These fees are at most 1.5% of the value of purchases made through the framework agreements, and are at the moment based on purchase information provided by the suppliers. The purchase volume channelled through Hansel frame agreements has increased notably over the past five years; the total annual purchase volume has more than doubled since 2006, reaching €553 million in 2010.

For the meantime, Hansel collects information on the contract usage through a web portal in which suppliers are required to report the framework agreement trade once a month. This data collection procedure is problematic: it is very burdensome for the suppliers who are consequently very dissatisfied with it. Accordingly, the existing system does not particularly encourage compliance in supplier reporting. Through this existing system, Hansel has very little control over the suppliers and it has become evident that some of the purchases are not reported. Subsequently, Hansel is not able to collect all the due service fees, and it receives only incomplete information about the use of the framework agreements.

Hence, Hansel started a development project, in which both the process and the supporting ICT system for the supply chain management for Hansel, the government units that are its customers and the suppliers, is being reconsidered and redesigned.

The purpose of this project is to design an efficient and effective supplier reporting process and the related IT-system to be used in Finnish public procurement. By adopting the agency theory as our theoretical lenses, and action design research (ADR) as our research method, we identify and formulate three design principles for such a system. In addition of being directly useful for the case organisation, we suggest that these design principles can be applied to a class of problems similar to the one at hand.

The structure of this paper is as follows. In the next section, we introduce our theoretical grounding, and outline relevant literature on inter-organisational information sharing. Following the literature review, we present the ADR methodology. We then go through the Hansel case, and present our solution at Hansel and discuss the findings of the project from research perspective. Finally, we conclude the report and briefly discuss the next phases in this ongoing research project.

2 Theoretical grounding

This study is grounded on the agency theory. Originally, the agency theory has been used to describe how incentives and information affect the behaviour of individuals in an organisation in terms of the imposed contractual relationships that exist between principals and agents (Eisenhardt, 1989), but has also been applied to wider organisational contexts to explain behaviour between different units and actors (see e.g., Gurbaxani and Whang, 1991). In this study, our focus is on an agency relationship between a public authority and the actors under obligation to report to it.

Reporting schemes, particularly in the case of public authorities, are built on agency relationships. The agency problem arises when the expectations or goals of the principal and the agent conflict and it is difficult or expensive for the principal to verify the agent's behaviour (Eisenhardt, 1989). Compliance with the obligation to file tax returns serves a prime example. The principal (the tax-collector) cannot observe the true income of the agent (the tax payer) unless an audit is performed. The principal wishes to maximise its net revenue from taxes and therefore asks the agent first to report his or her income and only after that makes the decision whether to audit or not. The agent responds to this system so as to maximise his or her own wellbeing (Reinganum and Wilde, 1985).

Another example is maverick buying, that can be seen as an agency problem in which the purchasing unit acts as the principal and the customer as its agent. Maverick buying, or off-contract buying, is defined as the purchase of goods or services without using the organisation's formally defined processes and authorised vendors (Angeles and Nath, 2007). This kind of non-compliant behaviour can occur in a setting with scattered responsibilities, such as, centralised procurement in the public sector, as the incentives of the principal and the agents are not fully aligned (Karjalainen et al., 2009).

In our study, Hansel is viewed as the principal and the suppliers as the agents. The agency problem here is caused by the fact that Hansel cannot fully observe the behaviour of the suppliers in reporting. Agent behaviour in organisations is governed by explicit incentives that both the organisation and the agent understand (Holmström, 1979; Raghu et al., 2004). The incentives for the suppliers to behave in the best interest of Hansel and the whole supply chain are evidently not all strong enough at the moment. The source of this incentive problem, or moral hazard, is the partial goal conflict among participants and an asymmetry of information between the principal and the agents that results because agents' actions cannot be observed and hence contracted upon (Holmström, 1979; Milgrom and Roberts, 1992).

3 Information sharing in a supply chain

Supply chain management involves not only the movement of physical products and services but also the flow of information in both directions (Barua et al., 2004). Information sharing in supply chains has been studied widely in IS literature, as well as in marketing, economics and operations management [for an extensive review, see Patnayakuni et al. (2006)]. Operations management literature mostly deals with information sharing as a prerequisite for effective supply chain coordination (Lee and Whang, 2000; Cachon and Fisher, 2002). Within the information systems science literature, the role of IT in information sharing has been studied, for example, in the context of inter-organisational systems, such as, EDI (Tuunainen, 1999; Grover and

Saeed, 2007; Legner and Schemm, 2008) and web-based (XML) systems for supply chain coordination (Zhu et al., 2006; Nurmilaakso, 2008; Hadaya and Pellerin, 2010).

The type of information shared between buyer and seller can be categorised into strategic information and non-strategic information (Klein and Rai, 2009). Strategic information includes production-related information about resource conditions and planning, strategic financial information related to revenue and profit metrics, as well as marketing-related information for competitive positioning. Non-strategic information sharing, in turn, refers to the exchange of order-level information in routine transactions (Klein and Rai, 2009). In this study, we focus on non-strategic information sharing, more specifically on sharing XML-based invoice data.

Buyer and supplier information flows are expected to impact positively the relationship-specific performance of both sharing and receiving parties (Klein and Rai, 2009). In our study, we suggest that sharing information in the supply chain can indeed bring benefit to the supply chain partners in question, including Hansel as the central procurement unit, and its suppliers. While sharing of XML-based invoice data is expected to increase the transparency of information and, consequently, mitigate the agency problem, it also facilitates building of an efficient reporting procedure and a system for the suppliers. Furthermore, XML-based data transfer makes EDI type of dyadic connections unnecessary and standardised electronic invoicing (e-invoicing) format enables automatic processing of the data.

4 Research method

ADR is a new research method combining action research and design research for the purpose of generating prescriptive design knowledge through building and evaluating ensemble IT artefacts in an organisational setting (Sein et al., 2011).

Our research project with Hansel was conducted collaboratively, in a manner of action research. In action research, the researcher is not an external observer, but collaborates with the practitioners, knowing that his or her presence affects the research situation and results. Action research attempts to create results of practical value to the client organisation while adding to theoretical knowledge (Galliers, 1991).

From the design research perspective, our research can be seen as socio-technical IS design research, meaning IS design research that in the design is not limited to the technological aspects of the IT artefact but also includes management and use of the article (Henningsson et al., 2010). Socio-technical IS design research has been shown to require, by nature of its objective, a close collaboration between stakeholders possessing the knowledge and skills to design the IT component of the resign and the social organisation that is the target for design efforts (Henningsson et al., 2010).

Whereas in action research, theory is regarded as tentative, applied and then improved by successive cycles of application and reflection until the practitioner-defined problem is adequately addressed (Lee and Baskerville, 2003), in ADR the initial research opportunity is based on existing theories and technologies (Sein et al., 2011). In this study, our point of departure is the principal-agent problem between Hansel and the suppliers, and our aim is to find a suitable way of mitigating it. Furthermore, we utilise the existing e-invoicing technology as a basis in designing the IT solution.

The ADR method is essentially setup to deal with two seemingly disparate challenges:

1 addressing a problem situation encountered in a specific organisational setting by intervening and evaluating

2 constructing and evaluating an IT artefact that addresses the class of problems typified by the encountered situation (Sein et al., 2011).

The goals of this research project are well aligned with these challenges: the project is both about building a new reporting system for Hansel through an action research project, as well as about applying the design research approach in building the IT artefact. The ADR method is useful both in supporting the research process along the way, and in helping to make a theoretical contribution by creating results that are generalisable outside the case context, as well. Overall, the Hansel project complies with the principles of the ADR method of practice-inspired research and building a theory-ingrained artefact.

The study was commenced by interviewing company management and representatives from related external organisations during a nine month time period between September 2010 and March 2011. The core ADR team consists of the researchers, the Chief Financial Officer (CFO), the IT development manager, and the business controller of Hansel. The data collection was conducted in two project cycles. Within each cycle the suggested process redesigns were refined through multiple iterations. The following table (Table 1) lists the interest groups and the related competence areas of those involved in the project. The table also contains information on the data collection methods used with each group, the project cycle or cycles the group has been involved in, as well as the number of encounters the ADR team has had with the given group so far.

Table 1 Data collection

Interest group	*Main competence area(s)*	*Data collection method(s)*	*Involvement in project cycle #*	*Number of encounters*
Hansel management	Problem formulation, process redesign	Unstructured interviews/ brainstorming	1, 2	6
E-invoice operators	XML-invoicing technology and business models	Unstructured and semi-structured interviews	1, 2	4
Financial shared services centre of the Finnish Government	Invoice management in the Finnish Government	Semi-structured interviews	2	1
Aalto University, service factory	Business models, ADR	Brainstorming, literature review	1, 2	2
Luottokunta (credit card payment service provider)	Reporting of purchases made using a government credit card	Semi-structured interviews	1	1
State treasury	Government e-invoicing, government e-procurement	Semi-structured interviews	1	1

In the first project cycle, two workshop sessions were organised with the CFO, the IT development manager and the business controller to discuss and form a scope of the project. Based on these sessions, the initial process redesign for supplier reporting was

developed. By interviewing other interest groups and testing the suggested designs through multiple iterations, the process and supporting ICT system was readjusted and refined. In the second cycle, the emergent designs were revisited in discussions with most of the interest groups.

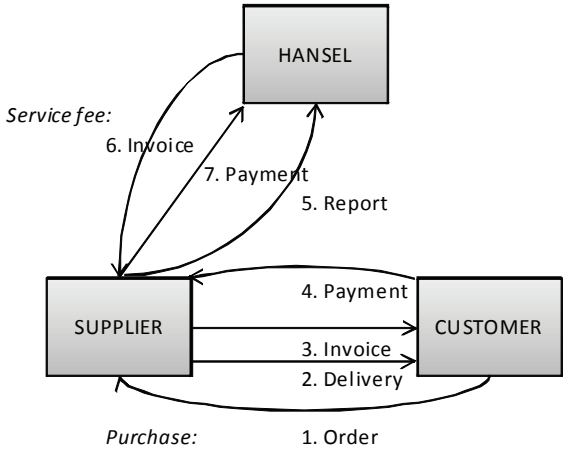
5 Redesigning the supplier reporting at Hansel

5.1 Problem setting

The Finnish Government buys roughly 4.5 billion euros worth of products and services each year. Of this amount, approximately 1 billion euros are spent on products and services suitable for centralised procurement. Hansel negotiates and maintains the central framework agreements to be used by other governmental units for their purchases. Total volume of these purchases channelled through the central frame agreements was 553 million euros in 2010.

Until early 2000s, Hansel acted as a reseller between the suppliers and the customers, but today Hansel specialises in tendering and contractual procedures, and offers its expertise as a service to its customers (i.e., other governmental units) by allowing them to utilise the frame agreements. By doing so, Hansel is not involved in the actual purchase transactions, but instead the government customers deal directly with the suppliers. Prices and contract terms are determined by the frame agreements, yet, the actual goods or services, invoices and payments are exchanged between the supplier and the customer (Figure 1). Hansel collects information on the purchases (i.e., items, prices, amounts) as basis for the service fees charged and for monitoring purposes. With the current system, the suppliers are required to report their purchases on a monthly basis through a web portal. By delegating direct sales to the suppliers, and obligating them to report the transactions, Hansel forms, by definition, a principal-agent relationship with the suppliers.

Figure 1 Purchase-to-pay process in Finnish public procurement



The process of collecting data from the suppliers is problematic for Hansel in many respects. First, the current procedure is laborious from the suppliers' point of view, particularly because of the strict requirements for row-level information on each item sold. For some large suppliers in particular sectors, for example, in office supplies, this can result in several hundred thousand rows of information on the report each month. This requires, in many cases, a lot of costly manual processing at the supplier's site. Due to the inconvenient and burdensome reporting system, some suppliers are considering breaking away from the public tendering system.

Second problematic issue is related to the principal-agent relationship and the risk of moral hazard in the behaviour of the suppliers. The suppliers are expected to pay Hansel a percentage-based fee (maximum of 1.5%) of the purchases reported. In an attempt to avoid the service fee, a supplier might be tempted to leave some purchases unreported. The risk of this undesirable behaviour might very well increase if the reporting procedure requires a lot of extra resources from the supplier. Hansel sporadically audits a small number of suppliers suspected of non-compliance, but has no other way to monitor whether the suppliers report all of their purchases or not. In most of these audits, a supplier has been caught omitting some purchases from the report. Incomplete information resulting from unreported purchases also weakens the quality of information in Hansel's internal reporting.

In summary, the most significant problems in the current reporting system are the inefficient procedures and consequent poor service to the suppliers, and unreported purchases caused by moral hazard leading to decreased service fee income as well as poor information quality. On the other hand, one strength of the current reporting procedure is created by the fact that all data coming through the web portal is in a standard, electronic format and can be automatically processed by Hansel.

5.2 Formulation of the initial research questions

The challenges and pressures from the suppliers and also from inside the organisation described in the previous section forced Hansel to reconsider its supplier reporting process. In addition, it was realised that when a supplier makes an invoice to a governmental customer, more or less the same information, that needs to be reported afterwards to Hansel through the web portal is included in it. Nevertheless, the increased adoption rate of e-invoicing in Finland, particularly in the public sector, offered new possibilities for redesigning the supplier reporting process and the IT system.

These considerations acted as the starting point for the redesign project at Hansel, and the initial research question was formulated as follows: How to build an effective and efficient system for supplier reporting so that Hansel can:

1 offer better service for the suppliers (efficiency)

2 enhance the control of supplier reporting and decrease the number of unreported purchases (effectiveness)

3 ensure appropriate quality level of reporting information?

Furthermore, from the research perspective, we wanted to consider such a system's design principles that would be applicable to a class of similar problems.

5.3 Designing a new supplier reporting system

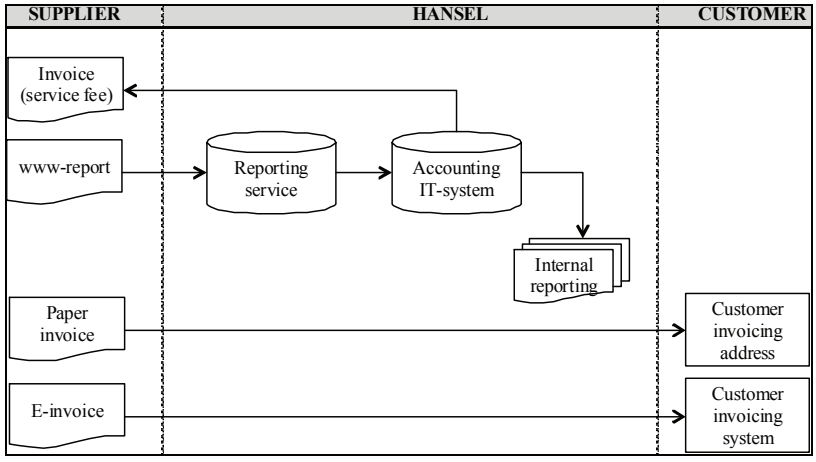
An internal development project was setup at Hansel to ensure commitment to the redesign initiative. A budget was allocated for the project and approved by the board of managers. The researcher responsible for the ADR study was assigned as the project manager. The main interest groups inside Hansel included the financial department and the IT department. All team members had a particular role in the project. As the project owner, the CFO had a strategic incentive to replace the old, partly dysfunctional system for supplier reporting with a new one. The IT development manager, in turn, was responsible for ICT related matters, and the financial controller for specific practical supplier reporting issues. The project manager was responsible for gathering, documenting and coordinating the analyses of all project related material and data.

As for the research process, we followed the phases of ADR, as suggested by Sein et al. (2011). First, we formulated the research problem and research questions. Next, we studied how to build the supplier reporting system through several building, intervention, and evaluation (BIE) cycles. In parallel with the first two phases, our aim was to generate new knowledge about the suggested solution and its applicability to similar problems by iteratively reflecting it against the formulated design principles.

5.3.1 First project cycle: the initial designs

We started the project by investigating the strengths and the weaknesses of the technologies and procedures upon which the company had relied on so far. We traced the underlying cause of the problems Hansel was experiencing with the current system to the business process that the organisation was using to collect supplier reports. Figure 2 depicts the current process and related IT-infrastructure at Hansel.

Figure 2 The existing Supplier reporting system and processes



Once the customer order has been made, the supplier sends an invoice, either on paper or in electronic format, to the customer, and generates a separate report about the monthly purchases for Hansel. Hansel collects these reports through a reporting service platform, from which the data is transferred to the accounting information system in Hansel. The data is processed in the system, and based on this Hansel calculates the service fee and sends an invoice of it to the supplier. The processed data is also used for internal reporting and performance monitoring purposes. Although the existing system functions well and generates good quality data on the purchases for Hansel, there are two major drawbacks in the procedure. First, the supplier needs to generate the same purchase information twice, first on the invoice and then on the report, imposing an additional strain on the supplier. Second, since reporting is the suppliers' responsibility, there is a risk of non-compliant behaviour: the more they report, the more service fees they have to pay.

The problem of the suppliers having to key in the same data twice also served as a basis for the initial solution for the reporting system redesign. Since all the data that Hansel needs already exists on the invoices, why should they require a separate report? We investigated the available solutions that support e-invoicing and that are used in similar settings. For example, it was discovered that the Finnish Tax Administration was developing a solution for efficient collection of VAT payments through so called 'split payments' system. With this model, the payment is split and channelled to several receivers at the same time, and the Tax office could collect VAT payments directly from the companies. This would radically enhance the current procedure in which the VAT payments are collected periodically in arrears. Although split payments could potentially benefit supplier reporting in Hansel as well, this solution as a basis of the redesign project was written off, since the technology did not exist, yet. Instead, the invoicing scheme used in factoring arrangements in Finland offered a more viable solution. Factoring is a financial transaction in which a company sells its accounts receivables (i.e., invoices) to a third party (called a factor) at a discount in exchange for immediate payment. This procedure is based on an e-invoice duplicate that is sent to the factor aside the original customer invoice.

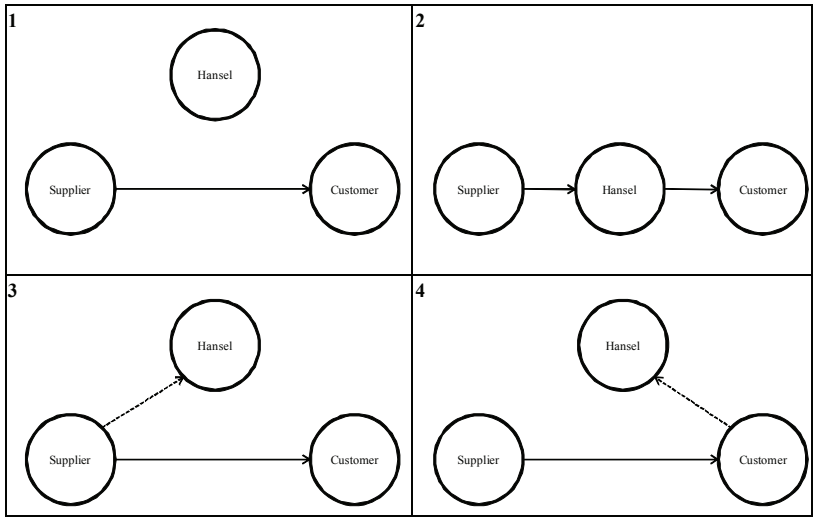
Based on the shortcomings – as well as strengths – of the existing system at Hansel, we were able to formulate three fundamental design principles: efficient reporting, increased transparency, and appropriate data quality. Our working hypothesis for the first iterations was thus that both the problem of inefficient reporting service and the agency problem could be handled by using XML-based e-invoicing technology, without sacrificing the level of data quality.

Efficiency in reporting is essential from the perspectives of suppliers, customers and Hansel alike, but is not easily achieved for all parties at the same time. For instance, the existing process model is cumbersome for the suppliers, not so much for Hansel. Then again in a system where all e-invoices from a supplier to a customer are channelled through Hansel's IT systems (alternative #2 in the following process considerations), the load will be on Hansel. Increased transparency refers to decreased information asymmetry about the purchases made through the frame agreements between the principal (Hansel) and the agents (the suppliers). The objective is to utilise the XML invoice data to decrease the related moral hazard problems. The data for the system needs to be of sufficient quality. It needs to be in standardised format that can be processed automatically. Furthermore, all the relevant data must be available.

In addition, based on the feedback given by Hansel management, it is of crucial importance that the reporting system and the process fit with the overall business model of Hansel.

During the first project cycle, we identified three alternative designs in addition to the current one for Hansel's supplier reporting system. Following the three formulated design principles, we tested our working hypothesis through iterations of BIE in all of the four alternatives. In Figure 3, we present a simplified illustration of how invoice data (and thereby purchase information) would be shared among the supplier, customer and Hansel in the alternative designs.

Figure 3 Alternative designs for utilising e-invoices in supplier reporting



In the existing business process (#1), Hansel is not directly involved in the trade transaction. Invoices are sent directly from the supplier to the customer and Hansel has zero visibility to the purchase when it occurs. Instead, purchase information is collected afterwards through separate reports. The benefits as well as problems related to the existing system acted as grounding for the three alternative designs.

The first iteration of the new reporting process was based on the idea that Hansel could collect the purchase data from invoices by stationing itself in between the supplier and customer in the invoicing process (#2). Hansel would receive all the invoices from the suppliers, extract relevant data and then forward the invoices to the customers. This is similar to Hansel's previous model of acting as a reseller between the suppliers and the government customers. In addition to the invoices, also the actual merchandise passed through Hansel's warehouses, making the model a very laborious one. At that time, Hansel employed 14 people in the invoicing department, whereas now all the invoices are handled by one person. Although Hansel could achieve increased control and transparency of the purchases with this kind of process, it would at the same time compromise the efficiency principle by imposing a tremendous amount of extra work for

Hansel financial department. While the increasing share of e-invoices would enable more efficient processing of the documents, detaching invoice streams from the actual delivery of the goods and services would result in complexity and inefficiencies in the process, particularly when there are changes or mistakes in the delivery of the merchandise. Hence, Hansel management was strongly against bringing the invoicing process back in-house.

In search of the design for an efficient reporting system, the alternative considered next (#3) incorporated the idea of e-invoice duplicates to the process. The notion was that while preparing an e-invoice to the customer, the supplier could replace the separate report by copying the e-invoice and sending it to Hansel. This would tremendously ease the burden of reporting from the suppliers' point of view. The disadvantage was, however, that the reporting would still be the suppliers' responsibility and the system thereby would not eliminate the risk of moral hazard, that is, unreported purchases. It could decrease the risk though, by making the reporting procedure less cumbersome.

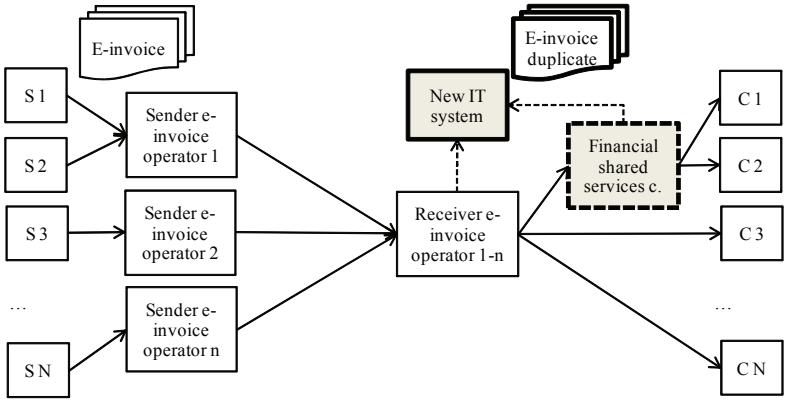
In order to reduce the moral hazard problem, the ADR team considered the fourth alternative design (#4), where an e-invoice would be duplicated by the customer instead of the supplier. The customers could be encouraged to do this by offering financial incentives: for example, Hansel could promise to return a small percentage of the purchase value to the customer for the copy of the invoice. While this design might perhaps be less vulnerable to non-compliant behaviour, the problem here, similarly to the previous alternative, is that the IT systems for different customers (and suppliers) can vary, and building an e-invoice duplication functionality in all of them would be laborious, complicated, and costly. Despite of these shortcomings, this alternative was deemed a feasible solution. Therefore, the project team decided to choose this alternative and proceed to the second project cycle during which the design would be further refined into a final solution.

5.3.2 Second project cycle: the final design

In the second project cycle, we first revisited the four alternative designs with Hansel and other relevant interest groups. As a result of the first cycle, it had been decided to utilise e-invoice duplicates to replace separate supplier reporting. The main task in cycle 2 was to determine technologically the most viable point of the process from which the XML-invoice data should be drawn from. In order to avoid a decentralised solution where each customer's invoice management system would need to be separately tailored to fit the process, we identified two stages along the process where the data could be extracted to Hansel's new IT system in a centralised fashion (see Figure 4).

First, e-invoices could be duplicated by the operator responsible for receiving the e-invoices. Once sent, e-invoices are transmitted from suppliers to customers through an operator network. Upon transferring the XML-invoice to the customer, the operator could make a copy of it and send it to Hansel. These operators can be specialised IT service companies or financial institutions, such as banks. Alternatively, the XML-invoice data could be drawn from the financial shared service centre (FSSC) of the Finnish Government. Once the e-invoice has left the receiving end operator, the FSSC pre-processes the invoices before forwarding them to the customer organisations for approval and payment. The FSSC has the invoice data in XML-format which could be easily transferred to Hansel.

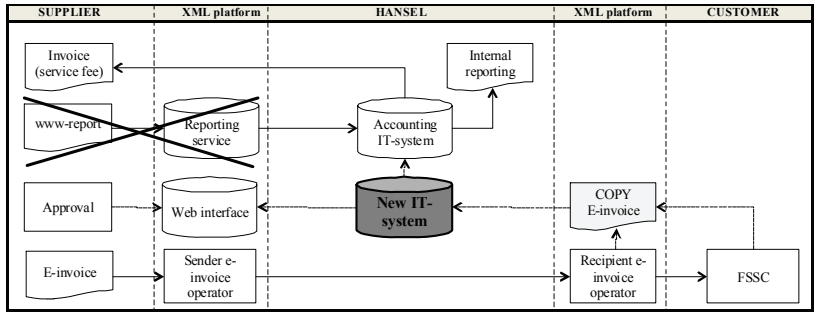
Figure 4 The final redesign for automated supplier reporting process



As a result, we suggested a 'hybrid' solution in which the majority of XML-based invoice data (copies of the e-invoices) is drawn from the FSSC. If a customer does not use the services of the FSSC (about 20% of all customers), Hansel could get the data from the receiver's e-invoice operator.

The following figure (Figure 5) outlines the IT infrastructure needed to support the redesigned process. With the e-invoice duplicate, there is no need for a separate supplier reporting system. Instead, a new IT-system has to be built for collecting the e-invoice information. The new system processes the invoice data using specific filters (e.g., supplier ID, customer ID, product number) and forwards it to the accounting information system as basis for service fee collection and internal reporting. The data should also be visible for the suppliers through a web interface, where they are required on monthly basis to make possible corrections to incomplete purchase data and then to approve the information.

Figure 5 The new process and related IT infrastructure



There remains, nevertheless, a concern about the appropriate data quality. In order to be able to process the data automatically, Hansel needs it in a specific format. The XML-invoice standard facilitates the transfer of standardised data, yet it does not ensure that the supplier keys the data correctly in to the invoices. With a supplier interface for correction and approval, this risk is expected to be mitigated, at least to some extent.

6 Discussion

The benefit of the redesigned process and IT system is expected to be increasing the efficiency of reporting since separate supplier reporting is obviated. As an additional advantage, Hansel will be able to capture the purchase information (almost) in real-time. Also, the risk of moral hazard in reporting is expected to decrease: firstly, by making the reporting procedure easier, and secondly, by automating the data extraction and filtering for reporting instead of relying on the suppliers.

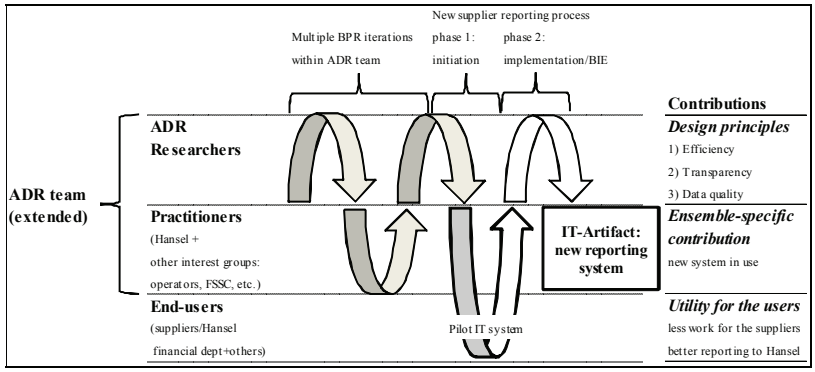
Several remarks can be made with regard to agency theory. As discussed, the agency problem arises when there are goal conflicts and it is difficult or expensive for the principal to verify the agent's behaviour. Although the goal conflict remains, sharing of XML-based invoicing information with the principal should reduce information asymmetry between the principal and the agents and thereby obviate the related agency problems. The new system is set to relieve Hansel from the auditing duties by automating supplier monitoring. The audits that Hansel has made before have indeed been costly, and it is not in economically viable to audit all the 400 suppliers. So far, Hansel has had a policy of making two audits per year. Every time an audit has been made, the supplier in question has been caught leaving purchases unreported. Compared to the costs, the relative benefit of conducting a few additional audits that would be possible with current resources, however, is quite minimal. Instead, the new process and system can facilitate monitoring of all suppliers through the e-invoicing platform with no additional costs.

The problem instance studied in the Hansel case can be generalised to similar inter-organisational agency problems related to reporting to a public authority. Examples include companies reporting their VAT sales to the tax authorities or international trade figures to the customs authorities. Similarly to Hansel's suppliers who have an obligation to report their purchases to central procurement unit, companies subject to value added taxation or customs duties are obliged to report to the corresponding authorities. A moral hazard can emerge as these companies (agents to the authority as the principal) could try to benefit financially from not reporting, and so by avoiding paying taxes or customs duties. Similarly, the proposed solution should be generalisable for solving other reporting-related agency problems. Building on the proposed design principles and using e-invoicing technology as a platform, other authorities could benefit from such a system. The solution instance remains to be validated in actual use.

At the time when this research report was written, the project was entering the pilot system implementation phase. In the previous phase, the redesigned process and system was presented to and approved by the board of managers at Hansel. Even though the new system is still subject to some uncertainties, further learning about the new reporting system and its feasibility can only be achieved through building a pilot system and having it tested by the end-users. As a result of the project so far, we have introduced a design of the renewed reporting IT system and process for Hansel and its suppliers as well as three design principles for such a system.

Figure 6 depicts the research process needed to develop the new artefact, that is, the new reporting systems for Hansel.

Figure 6 ADR process in the supplier reporting project at Hansel



Source: Adapted from Sein et al. (2011)

It also portrays the members of the extended ADR team, and the involvement of these groups at different phases of the project. The researchers were present and active at each and every phase of the project, whereas the end-users will not be involved until the pilot version of the projected system is ready to be tested. The group titled 'practitioners' included expert representatives of Hansel, as well as other interest groups, such as, e-invoicing operators and the FSSC of the Finnish Government. End-users of the reporting system, in turn, include primarily the suppliers and the financial department in Hansel.

7 Summary and conclusions

The project is now moving from the initiation phase (phase 1), to the implementation phase of the new system (phase 2) (see Figure 6 in the previous section). Although we have not reached the end of the entire cycle yet, several contributions have already been made. First, the practical contribution for the case company is in redesigning the process and the IT system for supplier reporting. Second, this study makes contribution to practice as well as research by proposing not only a novel process and system for supplier reporting in public procurement, but also the three design principles for such a system. Furthermore, these design principles were reflected upon problems of similar class, in addition to the one at hand. Hence, our study also contributes by offering guidelines for building IT artefacts in public organisations. The theoretical contribution is provided by enhancing our understanding of agency problems in authority reporting and how to solve or mitigate them with standardised information sharing. Third, the methodological contribution of this study results from applying and testing the ADR approach in the context of a process and system redesign initiative in a public organisation. Furthermore, our case allowed us to test the method in an inter-organisational setting with three separate groups of stakeholders.

In this paper, we have reported the findings of an ARD study in a public organisation, Hansel Ltd., the central procurement unit of the Finnish Government. The purpose of this project was to better understand how to design an efficient and effective supplier reporting process and a related IT-system. With the agency theory as our theoretical lenses, we presented three fundamental design principles for such a system: efficient reporting, increased transparency, and appropriate data quality. These design principles are proving to be useful for our case organisation, and in addition, as we have illustrated, they can also be applied to a class of similar problems. As a summary, we believe that with this study, we have contributed to knowledge on organisational design and engineering challenges in inter-organisational collaboration in public organisations.

The next step in this ongoing project is to follow through and collect data from the system implementation phase. The results and effects of the proposed supplier reporting system cannot be fully explored before the pilot system is tested and used. Another remaining concern is whether there are legal impediments in transferring invoice information to a third party. With regard to the agency theory, it is interesting to observe how the use of this system affects non-compliant reporting. There can be several reasons, of course, for not reporting; both unintentional and intentional. Finally, implementation of the production version of the system implementation will allow us to make the conclusive test of the design principles and observe the definitive utility of the system to suppliers as well as to Hansel.

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PAPER 3

Lempinen, H. (2012) “Constructing a Design Framework for Performance Dashboards”, In *Nordic Contributions in IS Research,* LNBIP 124, C. Keller et al. (Eds.), Springer-Verlag, Berlin, Heidelberg, Germany, pp. 109–130.

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Constructing a Design Framework for Performance Dashboards

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Abstract. The purpose of this paper is to outline a framework for designing *performance dashboards*, a type of information system used for performance measurement in organizations. Initial briefing in a case company indicated that a framework is needed due to the complexity and spread of the issues related to designing such systems. However, existing literature does not offer a proper tool for this purpose. Instead, earlier literature concentrates either on measurement design or information systems design and does not illustrate the interplay between them very thoroughly. Hence, drawing from a synthesis between performance measurement and information systems literature, a framework for dashboard design was constructed and then refined with the case company in an iterative manner. Action design research method was used to produce a set of principles for design and development of the system. Furthermore, by depicting links between the suggested design principles, the final framework for dashboard design is presented. Practical relevance of the suggested design framework is illustrated in the case context.

Keywords: performance measurement, dashboards, business intelligence, action design research, executive information systems, information systems development, information systems design theory, visualization.

1 Introduction

A performance dashboard enables organizations to effectively measure, monitor, and manage business performance [1]. Dashboards visualize organizational key performance indicators (KPIs) and utilize different performance measurement models to identify and implement measures for all levels in the organization. Technologically, dashboards are multilayered applications built on business intelligence (BI) and data integration infrastructure. Dashboards are gaining popularity both in private and public sectors and being implemented by organizations worldwide. Due to the growing interest of practitioners, plethora of practitioner-oriented literature on dashboards exists [e.g. 1, 47, 48], while earlier literature published in academic outlets is relatively scarce. Some initiatives have been made to explain what dashboards are [2], how they apply to certain organizational contexts and industries [3, 4] and what drives their adoption [5].

C. Keller et al. (Eds.): SCIS 2012, LNBIP 124, pp. 109–130, 2012.

Performance dashboard research stems from performance measurement (PM) and information systems (IS) literature. While there is a rich stream of research in both areas, a holistic framework for designing performance dashboards that is both relevant and does not compromise on academic rigor is missing. Performance measurement literature mostly concentrates on identifying right measures and KPIs [6], but tend to overlook the complexity of implementing the chosen measures from the information systems perspective. On the other hand, IS literature rarely addresses the process of identifying relevant measures very carefully [7]. In order to make a measurement model work, understanding of IT systems is required, and in order to create an IT system that supports decision making and analysis in the right way, one needs to understand how to measure performance.

These challenges in performance dashboard design are manifested in the case organization, Finnish web design and marketing agency Activeark Ltd. The company has grown substantially during its ten first years and during this fast growth, the company management realized that decisions are ever more difficult to be based on a ”gut feel”. Due to this, the company started to take interest in data-driven management and decision making. Their previous attempt to build an integrated system for performance measurement and reporting failed after the company management realized that they had no clear understanding of what they wanted to measure and how they would actually put the measurement into effect. The case company struggled particularly with finding reliable data for measuring the utilization of internal resources and project performance. These challenges, combined with the lack of a proper framework for addressing the issues, acted as a trigger for the research project.

The problems experienced by the case company are commonplace in many organizations as they grow and diverge. As performance dashboards run on electronic data that needs to be complete and easy to process, populating the dashboard with data is anything but trivial [5]. The precursors of modern BI-based dashboards, executive information systems (EIS), faced problems because the data required was not often readily available; considerable human effort was needed to acquire, analyze, and then enter the data into the system [1]. It is believed that today’s data warehouses make data sourcing much less of an issue than it was in the 1980s and 1990s, however, [8], but at the same time, data sources are getting broader and more versatile. Organizations are faced with enormous quantities of data from many sources; “big data” from the internet and information sharing between organizations being increasingly important sources.

This study follows the IS design science paradigm in attempt to illustrate how to develop performance dashboards. Information systems design science approach focuses on designing and building innovative IT artifacts [9], by aiming to answer “how to?” questions [10]. The overriding goal of this research project is to construct a framework for dashboard design rather than the resulting system itself. The practical value of this study is in the guidance for designing such a system in the case company. Action design research methodology (ADR) [11] is used as the research method. As oppose to the traditional stage-gate design research methods that emphasize a technological view of the IT artifact, ADR recognizes that the artifact

emerges from interaction with the organizational context. Thereby, ADR is found as a suitable research method for closing the gap between organizational measurement and IT in dashboard design. Learning from the case project is documented as general design principles and a framework to apply in similar conditions outside the case organization, as well.

2 Performance Dashboards

2.1 Performance Measurement and IS

Performance measurement systems are IS that transform performance data into assessments of organizational and individual performance [12]. Even so, performance measurement systems seem to receive little attention in information systems literature [13]. Very few studies discuss the interplay between performance measurement and information system literature as thoroughly and explicitly as Marchand and Raymond [14], who synthesize the two as performance measurement information systems (PMIS), as illustrated in Figure 1.

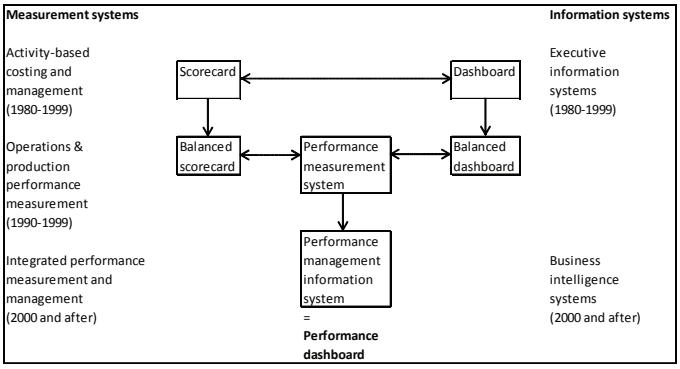


Fig. 1. Evolution of measurement systems and information systems (adapted from Marchand and Raymond 2008)

Research in measurement systems has produced several measurement models [see 6, 15 for reviews] and discussed the design, implementation and use of these models from several perspectives [e.g. 15, 16]. The most well-known and widely used performance measurement framework is the Balanced Scorecard (BSC), originally introduced by Kaplan & Norton in 1992 [17], and in several papers and books after that. Today's measurement systems literature is increasingly integrated with "performance management", and deal with issues including setting strategic goals and objectives, establishing initiatives and plans to achieve those goals, monitoring actual performance against the goals, and taking corrective action [18].

On the information systems side, executive information systems (EIS) were studied from several perspectives particularly during 1980s and 1990s. Executive information systems (EIS) are computer-based information systems that support decision making of executives [19]. EIS can be seen as a subcategory of decision support systems (DSS). A "dashboard" metaphor has been used for describing EIS interfaces, while in this paper a "performance dashboard" has a broader meaning. Information systems literature has dealt with a variety of EIS issues including adoption [e.g. 19, 20], and design [7, 21]. Currently, information systems literature in this area is mostly situated in the business intelligence (BI) domain, as BI provides the IT infrastructure and applications required to implement business performance management [22]. The performance dashboard, an instantiation of PMIS, stems from a "marriage" between performance management and BI [1].

As the visible part of a dashboard system is its user interface, many definitions focus on its visual features. For example, Few [23] defines a dashboard as a "visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance". However, some authors accentuate that performance dashboards are essentially performance management systems [1] including two necessary features: performance measures and the supporting infrastructure [24]. The existence of measures in a PMS comes without explaining. The supporting infrastructure can vary from very simplistic manual methods of recording data to sophisticated information systems whereas the supporting procedures include data acquisition, collation, sorting, analysis, interpretation, and dissemination [24]. Yigitbasioglu and Velcu [2], define a dashboard as "a visual and interactive performance management tool that displays on a single screen the most important information to achieve one or several individual and/or organizational objectives, allowing the user to identify, explore, and communicate problem areas that need corrective action".

In this paper, a performance dashboard is defined as *an interactive performance management tool consisting of a measurement system and an information system, and supported by the models and processes for information gathering, processing, distribution, and visualization.*

2.2 Designing and Developing Performance Dashboards

Walls et al. [21] used the term "information systems design theory" ISDT to refer to solutions for specialized classes of IS design problems, such as DSS and EIS. ISDT is a prescriptive theory integrating normative and descriptive theories into design paths intended to produce more effective information systems [25]. The role of ISDT is two-fold; it is based in theory, and it provides guidance to practitioners. The benefit of an ISDT is that it reduces developers' uncertainty by restricting the range of allowable system features and development activities to a more manageable set, thereby increasing the reliability of development and the likelihood of success. In addition, ISDT stimulates research by suggesting testable research hypothesis [26].

In performance measurement design, questions generally relate to what to measure and how to structure the performance measurement system [6]. This is what

performance measurement literature has been mostly dealing with over the last decades and has suggested numerous models and techniques to achieve this. IT, on the other hand, plays a more significant role in designing how to deal with processes including data creation, data collection, data analysis, and information distribution in performance measurement [6]. EIS design studies [21, 27] generally address these issues.

Some development steps have been presented even for performance dashboards but they are either targeted at a practitioner audience [1, 47, 48] or tend to be rather non-specific [5]. Generally speaking, the issue of dashboard design has been left essentially unaddressed in scientific studies [2].

According to Walls et al. [21], an IS design theory is a package of three interrelated elements: a set of user requirements derived from kernel theory, a set of principles governing the design of a system, and a set of principles regarded effective for guiding the development process. By addressing all three elements, an IS design theory can provide a "complete package of guidance for designers facing particular sets of circumstances" [26]. In order to provide a complete package of guidance for performance dashboard designers, a design framework is constructed in the present study. The design framework consists of a set of principles for governing system design, as well as a set of principles for guiding the development process. The design principles are concerned equally with performance measurement and information systems design. Following the approach by Walls et al. [21], a kernel theory and user requirements for performance dashboards are presented as basis for developing the design principles. The kernel theory and user requirements constitute a "theory-ingrained artifact" that is discussed in detail in the next section.

3 Research Approach and Theoretical Grounding

3.1 ADR

The method chosen to carry out this study is action design research (ADR) introduced by Sein et al. [11]. It is an action research (AR)-based method for conducting IS design research (DR). DR seeks to develop prescriptive design knowledge, sometimes referred to as design principles [21], through building and evaluating innovative IT artifacts intended to solve an identified class of problems [9, 28]. AR is grounded in practical action, aimed at solving an immediate problem situation while carefully informing theory [29].

The dominant DR thinking takes a technological view of the IT artifact while ADR, by incorporating action, posits that the artifact emerges from interaction with the organizational context. In ADR, the research problem is derived from practice and the theory-ingrained artifact is then developed iteratively together with the case organization. As the organizational needs are essential in the development of systems for performance measurement, ADR is deemed a suitable method for investigating how to design and develop performance dashboards.

The ADR process starts from problem formulation, which includes determining the initial scope, deciding the roles and scope for practitioner participation, and

formulating the initial research questions [11]. Critical issues in this stage are securing the long-term commitment of the organization and formulating the identified problem as an instance of a class of problems. Problem formulation in the case context and its expansion to a class of problems is discussed in more detail in the section 3.2. Roles and scope of the practitioner participation is discussed in section 4.1.

In the next stage, the IT artifact is developed through several cycles of building, intervention, and evaluation (BIE) with the case organization. The main difference to previous stage-gate DR methods is that evaluation of the IT artifact is interwoven with building of the artifact. This stage draws on three principles: reciprocal shaping, mutually influential roles, and authentic and concurrent evaluation [11]. Reflection and learning continues throughout the ADR process, emphasizing that the ensemble artifact reflects not only the preliminary design but is shaped by organizational use, perspectives and participants. Section 4.2. outlines the cyclic BIE process in the case setting and describes how the design was shaped throughout the process with practitioner involvement.

Finally, in spite of the situated nature of ADR, learning from the project is further developed into general solution concepts for a class of similar problems. This stage aims therefore to formalize learning through design principles derived from the design research outcomes. Principles for performance dashboard design are drawn together in section 5.

3.2 Problem Formulation

The case organization, a Finnish web design and marketing agency Activeark Ltd, has undoubtedly been a success story in its first ten years. When it was founded in 2003, the company had three employees and an office space in a basement in Helsinki, Finland. Since those days, the company's business has grown in scale and scope. Currently, the company employs around 80 people in their offices in Helsinki, London and Mumbai. The financial numbers have developed accordingly – the annual turnover reached 8 million euro in 2011. Activeark produces web sites and digital marketing campaigns for their customers on project basis. Although the projects usually yield concrete outputs such as websites, Activeark is essentially a service company since their production leans, to a large extent, on human resources. Customer projects are carried out by a team of web designers, coders, project management and sales personnel. In order to coordinate the big picture, the company has implemented a matrix structure in which project teams complement traditional business functions.

The fast growth in the case organization led to problems with maintaining visibility and control of different functions and business units. There had been several initiatives to plan and implement metrics for different business areas, but there was no holistic measurement framework in use nor was there a clear agreement of the key metrics for the company and its units. Company management was aware that they had data that could be better utilized in performance measurement but the problem was that this data was stored in several information systems and people were using the data in different ways. This resulted in inconsistent and incomparable performance

reporting. Efforts had been made to achieve a common system for performance measurement and internal reporting, but much of it was still based on manual, highly time consuming, and error-prone procedures. Due to this, the information was already out-of-date when it was delivered to the user. Furthermore, performance reports were distributed in static sheets and hence the users could not easily make further analysis from the information. A specific challenge related to unreliable information about how the company utilized their human resources and hence managed production. The staff was obliged to input their working hours to a project management system every week based on which the management could then analyze, for example, how efficiently they had completed customer projects. The problem was that all employees did not use the system regularly. Table 1 outlines the problems in the current systems and processes.

Table 1. Problems with current performance measurement

Problem	**System in use**
Key measures not agreed upon	Inconsistent performance evaluation
Data scattered in several systems	Poor overall visibility to performance Decentralized analysis
Unreliable data collection procedures	Poor data quality, particularly regarding utilization of human resources
Manual reporting	Time consuming and prone to errors Static and not up-to-date

The problems experienced by the case company are doubtless common in many organizations as they grow and diverge, and as internal and external organizational environments change. Companies need to be more responsive to rapidly changing customer and market needs and co-ordinate a whole network of supply chain partners, whilst reducing costs [6]. Managers need up-to-date performance figures on production, quality, markets, customers, etc. through which they can achieve overall performance targets by proactively controlling several processes [6]. Identifying the right KPIs for an organization, in other words answering the question "what to measure?", is far from being trouble-free in complex circumstances like these, as observed also in the case setting. Furthermore, in many cases, performance measurement today is not sensitive enough to changes in the internal and external environment of the organization [6].

The case organization experienced severe problems with scattered data and unreliable data collection procedures. These problems are commonplace in many organizations as data expands in scale and scope. More often than not the information needed is spread around several sources and in various different formats. "From where and how to find data?" is an increasingly important question in performance measurement, and a critical challenge in performance dashboard design in particular, as these systems run on electronic data that needs to be complete and easy to process [5].

Many companies are using information technology to provide performance measurement to the users online. However, few performance measurement systems

have an integrated management information systems infrastructure [6]. Lack of IS support results in cumbersome and time-consuming data collection, sorting, maintenance and reporting [14]. Manual reporting should be replaced by a more efficient way of gathering and analyzing relevant data, and finding and effective way of distributing this information to users. The challenge of "how to deliver performance information to the users?" is enduring and also present in the case organization.

Based on the problems experienced by the case organization and reflecting them upon other organizations facing similar circumstances, three general challenges in performance dashboard design are formulated. These design challenges represent the areas of organizational and technological issues and choices that an organizations need to consider when designing the systems.

In conclusion, the design challenges for performance dashboards are:

1. What to measure?
2. Where and how to capture data?
3. How to deliver performance information to the users?

3.3 Theory-Ingrained Artifact

The kernel theory, which underlies an IS design theory, may be an academic theory (such as organizational psychology) or a practitioner theory-in-use [26]. Following the approach by Markus et al. [26], and Ngai et al. [25] the characteristics of performance measurement and decision making in today's organizations are analyzed as the kernel theory. Then, user requirements for a system that supports these processes (performance dashboard) are derived from the kernel theory. Building on this knowledge, learning through building, intervention and evaluation (BIE) with the case organization is articulated into IS design and development principles in sections 4. and 5.

Kernel theory. Overall, the rationale for developing performance measurement and the related information systems in organizations today arise from an increasing need to improve both the efficiency and effectiveness of decision making. The traditional view is that DSS primarily attempts to improve the effectiveness of decision-making (accuracy, timeliness, quality) rather than its efficiency (cost of making the decision, including the charges for computer time) [30]. However, as observed in the problem formulation stage, there is also an increasing pressure to improve the efficiency of decision making in situations in which performance measurement is not properly supported by IS. These pressures can be explained by some special characteristics of today's organizational decision making, as described next.

C#1: Decision makers suffer from information overload as the volume, velocity, and variety of data is growing rapidly. Organizations face enormous quantities of data from various sources, easily cumulating to terabytes and even petabytes of information. *Furthermore,* data *is o*ften time-sensitive, and should be used as it is

streaming in to the organization in order to maximize its value. Data also extends beyond structured data, including unstructured data of all varieties: text, audio, video, click streams, log files and more [31].

C#2: Excessive information may lead to disregard of information and to decision inaccuracy. Information processing theory posits that decision makers can only process a fraction of the available information which has implications to how performance measures are used [32]. Ittner & Larcker [33] found evidence that corporate managers routinely discount or ignore non-financial measures. While the notion that other than non-financial measures are also needed in management dates as far back as to the 1950s [34], there is no consensus what the other dimensions are and in fact the evidence that there should be a "balance" in the measures is far from conclusive [24]. Most authors do tend to agree that a contingency approach is most suited, meaning that there is no universal best way to manage and hence the measures should reflect the strategy of the organization in order to steer it towards a desired direction.

C#3: Performance information is complex and challenges human cognition. Decision makers process information by structuring problem spaces and searching those spaces until a goal is achieved [2]. The space search is limited by the human attention span. Information visualization can potentially amplify human cognition as it helps to digest complex information more efficiently [2]. Visualization is effective when perceived data quantities and relationships between data reflect the actual data. Visualization is efficient if the maximum amount of data is perceived in a minimum amount of time [2].

C#4: Decision making takes place in semi-structured and unstructured situations, and it is therefore difficult to predefine in detail what the decision makers need [30]. Complex decision making problems are increasingly emergent and unexpected.

C#5: Decision makers include individuals from all levels in the organization, not only executives. It must be also noted that the users' information needs in these kinds of decision making situations are heterogeneous and change over time.

User Requirements. Requirements determination aims at defining what a specific system should be like and what it should be able to do. Based on an extensive literature review, Marx et al. classify the most cited EIS requirements into four categories: the scope of information, system functions, user interface, and information management [7]. As performance dashboards represent a new generation of DSS, and share many characteristics with EIS, the categories presented by Marx et al. [7] are discussed next in the performance dashboard context. Requirements that constitute these categories should be satisfied in the system design.

Information scoping: The system should provide relevant information to the user. The dashboard terminology in the organizational context originates from the vehicle dashboard, which reports the few metrics that the driver needs to know [2]. Considerations in this category include whether to include financial vs. non-financial

data, internal vs. external data, task-related vs. individual data, and so forth [7]. This set of requirements corresponds to characteristic C#2.

Information management: DSS in general should be able to handle large amount of data [30]. Dashboards, as other BI-based analysis and decision making tools, are built on data warehousing technologies [35]. In addition to the quantity, also the correctness and quality of data should be ensured [7]. Timeliness of information is another requirement for performance dashboards; "third-generation" data management and decision support rely on real-time data [35]. This category corresponds to C#1.

Functions: The system should facilitate effective decision making through functions that fit the user need. It should offer a single screen view to all relevant information but with the possibility to drill-down to detail [2]. Other relevant functional requirements include: simulations, trend and sensitivity analyses, exception reporting and alerts, hierarchical information aggregation, and mobile access [7]. Instead of static reporting, flexible "ad-hoc" analysis capabilities should be promoted to support semi-structured and un-structured decision making, as described in C#4.

User interface: The system should have graphical orientation. Graphical orientation in DSS is believed to give decision makers a better understanding of the true situation in a given market place [30]. Today's decision support systems can help managers make attractive, informative graphical presentations by producing line drawing, pie chart, trend line and more [30]. A dashboard conveys information through visualization, referring to the use of interactive visual representations of abstract, non-physically based data to amplify cognition [2]. The system should offer information accessibility for different user groups in order to provide support to individuals at all levels in the organization. Furthermore, considering the different skill levels of the users, the system should be easy to use [7]**.** These requirements correspond to characteristics C#3 and C#5.

4 Performance Dashboard Design in the Case Organization

4.1 Setting up the Project

To overcome the problems with the current performance measurement, Activeark decided to initiate a performance dashboard project. The goal was to build a system that would offer them a balanced view to relevant information on a single screen. This would enable more informed, timely decision making, streamline processes and cut slack from reporting. While the purpose of the company's project was to build the system itself, the goal of the research project was to construct a framework for designing such a system, since one that would address all these issues properly, did not exist.

The study was conducted over a six-month period between August 2011 and January 2012 by being involved in the case company's performance dashboard project. An ADR team was established to coordinate the project and the related

research effort. The ADR team consisted of a researcher and the CFO of the company, who was also assigned project owner. Other project stakeholders in the company included the executive team (lead by the CEO), responsible managers for each KPI (COO, Resource manager, CAO, Head of HR), users of the system, and the IT department. These groups are in part overlapping but treated as separate because of the different roles through which the people contributed to the project.

For the purpose of coordination, the project was set to be conducted in three consecutive phases after planning and initiation. This division was made based on the three general design challenges. The different groups, their roles, and their involvement in different project phases are listed in Table 2. Types of encounters with the different groups and data collection methods are listed. In addition to the data collected from the encounters with the stakeholder groups, the ADR team had access to the source systems and current performance measurement/reporting systems at all times during the project.

Table 2. Stakeholders

Group	#encounters with the ADR team	Type of encounter /data collection methods	Role/ competence area	Involvement in project phase
ADR team	8	Brainstorming sessions, unstructured interviews, e-mail	Project management, design methods and tools	1, 2, 3
Executive team	3	Planning sessions, follow-up meetings	Overall business strategy + related KPIs, authority to make decisions	1, 2
Responsible managers for each KPI (users)	4	Semi-structured interviews, performance measure record sheet	Detailed understanding of KPIs, user needs	1, 2, 3
IT department	2	Unstructured interviews	Source systems, integrations	2, 3
IT vendor	3	Planning sessions, negotiations	Dashboard software	2, 3

4.2 Building, Intervention, and Evaluation

The design challenges were addressed in three project phases as illustrated in Fig 2.

In the first project phase, the goal was to develop a general measurement scheme for the company by identifying Key Performance Indicators (KPIs) through a systematic method. In the second phase, the goal was to investigate in detail how the KPIs would be put into operation. In the third phase, issues related to formulating requirements and choosing a suitable IT system for collecting, analyzing and visualizing the information. The process was kept flexible so that previous and future choices could be reflected and refined iteratively during each of the phases.

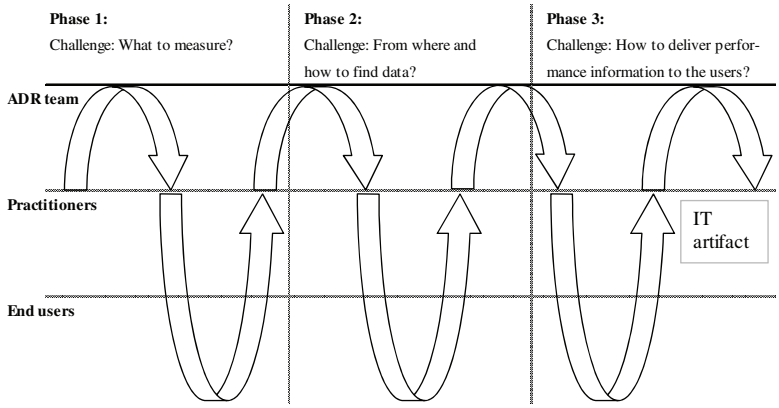


Fig. 2. ADR process

In addition to determining the design challenges and outlining the ADR process, the purpose of this study is to come up with a set of design principles for the design product and process by looking more in-depth into the design challenges and related issues through the case example. Next, we shall go through all of the three in more detail and reflect them upon the four classes of dashboard requirements.

Phase 1: What to measure? In the first project phase, the goal was to identify what the company should measure and build a general framework for performance management. From the IS perspective, this phase deals mostly with the "information scoping" requirement. However, advice in IS literature to address these issues is quite weak. Instead, performance measurement literature concentrates heavily on measure design and selection by dealing with what organizations should measure and how to structure performance measurement systems [24]. Several models and frameworks for categorizing measures and KPIs have been presented, including the Performance measurement matrix [36], the Performance pyramid [37], the Balanced Scorecard (BSC) [17], and the Performance Prism [38]. The purpose of these models is to identify areas where measurement is needed, and design metrics and key performance indicators (KPIs) for those areas (a metric becomes an indicator when it is set against a target value). BSC is the most widely used, and has also proved to yield good results as a measurement framework for dashboard systems [4].

The measurement frameworks gained criticism in the 1990s because they alone do not tell a company what to measure [39]. To complement these models and frameworks, several performance measurement design processes have been presented in earlier literature. The purpose of these processes is to show how to actually implement the measurement frameworks to practice and integrate performance measurement into the management of business. For example, design processes for the balanced scorecard include "Putting the BSC to work" [40], and "The performance

model" [41] (see Bourne et al. [39] for an extensive review on different PM design processes).

At Activeark, the company management had initial ideas of some relevant KPIs, yet there was no consensus about the entire set of measures or a proper scheme for implementing them. As a first step, the ADR team, together with the executive team, formulated a preliminary set of KPIs for the company. The four dimensions of the Balanced Scorecard [17]; financial, internal business process, customer, and learning and growth, were used as the grouping principle, and the process presented by Kaplan and Norton [40] was used to derive the KPIs from company strategy. The BSC was chosen especially because the company wanted to see the trade-offs between different business aspects (profit vs. customer satisfaction, employee satisfaction vs. productivity).

The starting point for KPI formulation was company values (pro-activity, humble attitude, customer service, quality, innovation, and results focus) and the strategies to achieve them. The ADR team met with the executive team to brainstorm and choose appropriate measures. The company had well-thought existing KPIs in some areas which could be utilized as-is. For example, the "internal business process" dimension of the BSC was covered by the company's existing "profitability framework", a three-KPI scheme for monitoring the utilization of internal resources and project performance. The goal was to develop a maximum of 10 KPIs altogether, but in the end the company came up with 14. To keep the number of KPIs appropriate, it should be carefully examined which metrics allow the company to make informed decisions and are thereby essential, and which are just nice to have. Importantly, in order to ensure management commitment to each KPI, the company also assigned owners for each KPI. Having a responsible person for each KPI would also help in the next phase when the KPIs are investigated in more detail.

Based on the first project phase, and in order to address the design challenge "what to measure?", two design principles are formulated (followed by comments and related issues observed in the case project):

P1: Define a general performance measurement framework

- use one of the several available models and frameworks and/or utilize an existing set of measures
- selection criteria: information scoping
- output: suitable categorization of KPIs, not necessarily "balanced"

P2: Follow a structured process for selecting key measures

- several processes presented in literature
- limit the number of KPIs by sparing only those that are essential
- assign an owner for each measure

Phase 2: How to find data and from where? Data capture processes are set to identify sources of data and the processes used for data generation [24]. These processes are increasingly important as data sources expand in scale and scope, and as performance management systems set ever-tightening demands for the data. In this phase, feasibility of suggested metrics and KPIs is evaluated in more detail by

determining whether they can actually be measured with the data to which the organization has access. It may also involve initiating new procedures, so that information currently not recorded is captured and it may involve completely new initiatives, such as setting up a regular customer or employee survey [16].

This phase contributes to several of the IS system requirements. It is concerned with particularly with information management issues, but also looks into the scoping of information in more detail. It is also necessary to make some preparatory work for system functions at this phase.

The performance measurement record sheet [42] was used to analyze each individual measure. It is a tool for investigating the relevant aspects of each performance measure or KPI in detail and documenting this knowledge in a structured format. It aims to clarify the purpose of the measure, set targets and formulas, and decide how often the information needs to be updated. An essential purpose of the record sheet is to identify the data sources for each measure. It is also used for identifying the people involved in generating the data and articulating the data generation process.

For the purposes of performance dashboard design, a new information element, "level of analysis", was added to the sheet to indicate the drill-down capabilities of each KPI (according to the CEO, the drill-down feature was the single most important function in the dashboard system because it allowed them to identify the root causes of problems). The ADR team interviewed the managers responsible for each KPI individually. The interview data was documented on separate performance measurement record sheets. The record sheet turned out to be a very useful tool for analyzing how the KPIs would be put into operation and offered a good overall view of the KPIs.

During the interviews, some of the source systems (e.g. project management system and accounting system) were investigated in more detail. The ADR team noticed that there were some inconsistencies in the meaning and definition of certain data elements. For example, the company used the terms "billable hours" and "invoiceable hours" to indicate the amount of project work conducted. In the end, these two information elements turned out to mean different things. Also, some of the KPIs were readjusted because the executive team though that the KPI in its initial form would be updated too infrequently. After all, one of the key problems in the existing performance measurement was that it was static. Finally, after a wider revision of the KPIs with the company COO, two new KPIs, "sales pipeline" and "project pipeline", were added to the list for better support of forecasting sales, business planning and managing resources.

The source of data for each KPI was perhaps the most crucial aspect to investigate at this point as data was stored and updated in several source systems. These included systems for project management, accounting, HR, and finance. In order to address issues related to the quality and completeness of data, it was very important to look into the data generation processes in more detail. Although documented in electronic systems, much of the data is still generated manually. For example, the employees use a project management system to allocate their hours to different customer projects and other work. The human element brings considerable uncertainty to the data and

thereby creates a lot of pressure to ensure that the employees input their hours in the system every week. The same goes for project managers who are asked to input, for example, the amount of offers they have made during the month for sales forecasting purposes. This clearly highlighted the importance of data generation processes in addition to the technological issues and the source system itself. As an implication, company management has to find ways for supporting these processes to ensure completeness and quality of data.

The following design principles can be drawn from the second project phase in order to address the design challenge "from where and how to find data?":

P3: Analyze systematically how each measure should be put into operation
- Performance measure record sheet [42], or similar tool recommended
- Critical questions: Is data available for measurement and where to find it? Is there other data that could be utilized for PM?
- Revise the metrics: were some KPIs forgotten or neglected in the first phase? How frequently is the measure updated, is there a need for re-adjustment?
- Investigate the hierarchical structure of data through a "drill-down capability" sheet

P4: Ensure completeness and quality of data
- Processes: investigate how data has been generated so far. How to improve these processes if necessary and how to handle possible new ones?
- Ensure that data is in standard format and clearly defined. Facilitate consensus regarding the meaning of each data element

Phase 3: How to deliver performance information to the users? In this phase, systems and procedures are put in place to collect and process data that enable measurements to be made regularly [16]. These information provision processes [24] deal with how the measures can be linked to databases and information systems, and how the measurement framework can be communicated throughout the organization [40]. Design issues in this phase relate to finding the most suitable way of linking the dashboard system into source systems and designing an effective dashboard display [1]. This corresponds to the EIS requirements of information management, functions, and user interface.

Performance dashboards, along with other BI-based tools are usually built on a data warehousing solutions. Furthermore, extract, transform, and load (ETL) processes are put in place to gather the data and transform it to usable format. Processes of distributing this information to the users are then essentially carried out through a user interface. Yigitbasioglu and Velcu [2] divide dashboard interface design features into functional and visual. Functional features are features that relate indirectly to visualization but describe what the dashboard can do. These include drill-down tables, drillable charts, hierarchical information aggregation, simulations, trends, and sensitivity analysis [7]. Visual feature design, in turn, is concerned with e.g. how the use of colors affects decision-making performance. Although the use of colors may improve the process of visualization, excessive use of colors can have an adverse effect on decision making by distracting the user [2]. This problem can be

potentially reduced by maximizing the "data-ink ratio", which measures the proportion of ink used to represent data to the total ink used to print the graph [2]. Furthermore, a good balance between visual complexity and information utility is required. Visual complexity can be defined as "the degree of difficulty in providing a verbal description of an image" [43].

Based on the analysis made during phases 1 and 2 Activeark started to negotiate with a software vendor for IT system delivery. The company could efficiently communicate their needs to the vendor through completed record sheets in the kick-off meetings. The case company has a relatively light IT infrastructure, and it was not economically viable to build a separate data warehouse for storing data. Instead, an alternative solution was found. Today's software market offers dashboard systems that utilize associative technology, meaning that it can gather data from multiple sources without having to store the data in intermediate storages. As the source systems were not too complex, and discussions with the company IT department showed that integrating the dashboard directly to the source systems was possible, it was considered a suitable solution. Also, the implementation would be quicker and less expensive this way. Flexibility with regard to possible future changes in the underlying IT systems is a further benefit in using this type of technology.

As for the functional features, the drill-down capability was seen as the most important from the users' point of view. It would enable pinpointing causes for possible problems and deviations in measurement. The user interface should enable flexible information filtering and ad-hoc analysis capabilities. The final design of the functional features was left undecided, though, because needs would emerge when the system is in use. This would of course require flexibility from the software. Visually, the goal was to design the user interface so that it showed all relevant information at a glance, but at the same time, was not too crowded. In addition to the indicator scores, the company especially wanted to illustrate trends, i.e. how performance develops over time. The company had already constructed a "mock-up" version of the dashboard interface earlier, which could be directly utilized as a starting point for designing the system's visual display.

The premise of performance dashboards, as oppose to EIS, is that they can be accessed at all levels in the organization. However, the questions regarding who should have access to the dashboard turned out to be not that straight-forward. According to the HR manager, all employees were not interested in the performance information to begin with. Instead, they felt that performance measurement is de-motivating and they were anxious about "being lead with numbers". Hence, after careful consideration, the company decided to give access to the executive team and business unit leaders at this point. All employees could be given (limited) access to the system in the future.

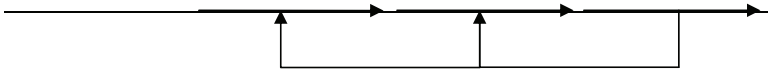
Based on this, the company formulated initial specifications for the system together with the software vendor who then made an offer to Activeark regarding the delivery. Currently, the company is moving to the implementation phase of the system.

The following design principles are formulated based on the third project phase to give guidance in dealing with the final design challenge "How to deliver performance information to the users?":

P5: Design for efficient integration to source systems
- choose a system that is most suited for the IT infrastructure of the organization (data warehousing vs. associative technology)
- use the record sheet to show necessary integrations to the software supplier

P6: Design for a an effective user interface
- Provide functional features that fit the task, revise in use
- Visualization: single-screen view to all relevant information preferred, should be kept simple. Aim at a good balance between visual complexity and information utility.
- Frugal use of colors recommended, maximize data-ink ratio.
- use the record sheet to communicate user needs to the software supplier

Table 3. A design framework for performance dashboards

Design challenge	*What to measure?*	*Where and how to capture data?*	*How to deliver performance information to the users?*
Design principles (product related)	P1: Define a general performance measurement framework	P3: Analyze systematically how each measure should be put into operation	P5: Design for efficient integration to source systems
	P2: Follow a structured process for selecting key measures	P4: Ensure completeness and quality of data	P6: Design for a an effective user interface
			
Emerging principles (process related)	P7: Use an iterative, agile development process		
	P8: Use a modular approach in system design		
	P9: Facilitate interaction between the interest groups and individuals		
	P10: Ensure user involvement at each phase		

5 Conclusions

Design can be seen as both a product and a process [21]. The design *product* is the set of requirements and necessary design characteristics that should guide IT artifact construction. The design *process* is composed of the steps and procedures taken to develop the artifact. In addition to the principles presented in the previous section that directly relate to the design product (performance dashboard), some further observations were made regarding the design process. It was recognized early that the systems development lifecycle, or "waterfall" model, does not work well for decision

support applications. Instead, an iterative or evolutionary design was recommended [44]. Such an approach is particularly suitable in design situations involving complex or vaguely defined user requirements [26]. Furthermore, a DSS should be developed using a modular approach. With this approach, separate functions of the DSS are placed in separate module allowing efficient testing and implement of systems. It also allows various modules to be used for multiple purposes in different systems [30]. Users of the system should be involved at each phase in order to ensure their commitment and that the system satisfies their needs. Furthermore, the case project showed that in order to succeed, interaction between all stakeholders should be facilitated throughout the process. Based on these observations, four more design principles were formulated (P7, P8, P9, P10). Due to space limitations, these principles are not discussed in detail in this paper. Instead, they are presented as emerging principles that need to be investigated further in future studies.

6 Theoretical and Managerial Implications

Several methods both for designing performance measures and for developing IS systems for decision support have been presented before. However, performance measurement design methods tend to forget IT, and at the same time the information systems development (ISD) methods are many times overly IT-driven. The case project shows that both viewpoints should be equally present when designing performance dashboards and performance management information systems in general. Furthermore, earlier literature seems to overlook the complexity of data capture. Generally speaking, the amount and complexity of data that organizations are facing is increasing rapidly and finding suitable data for performance dashboards is anything but trivial. The case project highlights challenges of data capture in service organizations where business processes are not automated and data generation relies solely on human effort. With regard to design, not only the source of data is important but also the processes for generating the data should be carefully examined in the performance dashboard context.

The academic contribution in this study draws from the synthesis built between performance measurement and information systems in designing performance dashboards. Following the approach by Walls et al. [21], elements of ISDT are discussed in the performance dashboard context. By discussing the characteristics of today's organizational decision making, a kernel theory and user requirements for performance dashboards are presented. This contributes to theoretical knowledge on this new type of DSS used for performance measurement. Based on the theory-ingrained artifact, a framework for performance dashboard design is suggested. The framework comprises of a balanced set of organizational (measurement) and technological (IT) design principles that govern the design of system features and four emerging design principles for guiding the development process.

As a managerial implication, the case study shows that the framework is useful in addressing key practical issues in performance dashboard design. Furthermore, it gives structure to the design process through the modular development process with

three design challenges. The design framework should be useful for companies outside the case context as well, since it utilizes well-established tools to solve the design challenges (e.g. BSC, or other performance measurement framework). In other words, separate elements used within the design framework are based in theory and already validated in practice to an extent. The novelty of the present approach comes from providing a comprehensive framework for understanding how modern-day information systems for performance measurement should be designed and developed.

As for limitations, although it is acknowledged that design continues throughout the lifecycle of the system, this paper focuses on the design issues during system building. Use and review phases are left out from the scope of this paper. Although learning from these phases eventually affects system design, the most influential design decisions are made essentially during design and implementation. Furthermore, the suggested design framework should be validated through further empirical studies in the future. Particularly the emerging design principles need further validation.

A deeper investigation of data issues offers another interesting avenue for future research in this area. The amount of data that organizations have is growing exponentially, and although data sourcing can sometimes be problematic, new data can also help to measure things that would not have been possible to measure before. These changes have an effect on all of the grand challenges in performance dashboard design. They influence what an organization should and is able to measure, where and how data is captured, and how the information is finally provided to the users. Another interesting future research topic is whether data capture processes can be successfully built on "decentralized" databases, like in the case context. The common view is that BI-based analysis tools and DSS require a centralized data warehouse [45]. However, Van Alstyne et al. [46] posit that due to data ownership issues, having a centralized data base might not be even desirable. A key reason for the importance of ownership in this regard is self-interest: owners have a greater interest in system success than non-owners. Theoretically this could be explained by incomplete contracts approach from economics. Van Alstyne et al. [46] gives an illustrative example: "Just as rental cars are driven less carefully than cars driven by their owners, databases that are not owned by their users are maintained less conscientiously than databases used by their owners.". Hence, locally autonomous databases could be a more effective way to organize data capture, particularly in situations where information sharing between organizations or groups is the primary source of data, such as in inter-organizational settings.

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PAPER 4

Lempinen, H. & Rajala, R. (Unpublished) “Multi-actor Interplay in IT Service Management”.

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Multi-actor Interplay in IT Service Management

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Multi-actor Interplay in IT Service Management

Abstract

Organizational information technology (IT) needs are increasingly served through complex service systems made up of various configurations of people, technologies, organizations, and shared information. Ideally, such service systems create value for both the providers and users of the service. We suggest that value creation in an IT service system builds on the quality of social action between different stakeholder groups involved in the service realization process. Through a qualitative empirical inquiry, we present a process view of IT service realization and identify the crucial encounters that manifest the social action between different stakeholder groups within a service system. The results show that social action in a multi-actor service system entails potential conflicts and resistance in the service realization process. The pursuance of consensus among the actors for joint value creation involves network management and governance capabilities that support knowledge sharing and promotion of mutual interests among the participants. The paper underscores that the extent to which the IT function can learn to manage value co-creation in an IT service system will ultimately determine its success or failure in achieving its promises.

Keywords: IT value, service system, service process, social action, multi-actor collaboration, performance dashboard

Paper type: Research paper

1 INTRODUCTION

The way an organizational information technology (IT) function creates business value has remained a perpetual question in information systems (IS) research since the 1960s (Keen, 1993; Peppard and Ward, 2005). One of the crucial questions for organizations to consider in creating value through IT is how to link the available IT capabilities to business needs (Guillemette and Pare, 2012). In many organizations, this is a central task that the IT function offers as a service to the rest of the organization (Peppard, 2003). In this regard, it has been shown that the IT function has an important role both as a facilitator of services provided to organizational users, and as a resource intermediary between

business imperatives and external IT resources (Keen, 1993). There are several types of IT-related services that are provided either directly or indirectly by the IT function, including technology delivery and maintenance, IT process management, and IT systems development (Peppard, 2003).

As many organizations today provide and consume IT as a service, value through IT is created and experienced throughout the service realization process (Mathiassen and Sørensen, 2008; Peppard 2003). Value is not something that strictly comes as an outcome of IT projects. Furthermore, the recent literature on service innovation (e.g. Lusch et al., 2007; Grönroos, 2008; Gassmann et al., 2010; Grönroos and Ravald, 2011) suggests that value is created in the collaboration between the service provider, the user(s), and a variety of suppliers, partners and other collaborators.

Value co-creation, however, referring to a joint activity resulting in mutually beneficial outcomes, can be difficult to achieve in IT service engagements (Stucky et al., 2011). This is particularly the case as IT services today are provided through a myriad of interactions between technology and people (Mathiassen and Sørensen 2008; Alter, 2010). Hence, the orchestration of multi-party service systems imposes challenges to the IT function that call for more empirical and conceptual research.

Prior literature does not provide an in-depth view into how value is co-created in the intra- and inter-organizational relationships between the actors involved. To address this gap, we adopt a social-action framework (Hirschheim et al., 1991) to investigate social actions in service systems. We also utilized the socio-technical process model of Newman and Robey (1992) to analyze the dynamics of stakeholder interplay throughout two examples of information-systems development projects that represent a common organizational IT service.

In many earlier studies, these theoretical approaches have proved to be valuable in analyzing information systems development processes and related activities. We applied these theoretical frameworks to analyze how value is created in the interaction of the IT function and the essential stakeholder groups in social encounters throughout the service realization process.

In doing so, we followed an abductive approach to case research as suggested by Dubois and Gadde (2002), which includes an interpretive empirical inquiry (Walsham, 1995). Our data was collected from two cases of organizations that have recently adopted a performance dashboard system as a service provided through a service system dedicated to that task.

This paper is structured as follows: after this introduction, section two presents the theoretical background for this research. Section three discusses the methodology. In section four, we present the case analyses. Lastly, the rest of the paper is devoted to a discussion of findings and conclusions.

2 THEORETICAL BACKGROUND

2.1 Value creation in multi-party IT service systems

A service system refers to a configuration of people, technologies, organizations, and shared information that focuses on creating and delivering services that realize value for both the providers and the users (Maglio and Spohrer, 2008, Qiu, 2009). The integration of needs, resources, information, and objectives among the providers and users stimulates service co-creation processes in the frame described as the service-dominant logic of operation (Vargo and Lusch, 2008, Badinelli et al., 2012). However, mutually beneficial outcomes can be difficult to achieve in organizational IT service engagements, as those who pay for the service, those who benefit from the service, and those who participate in the service delivery process may be different actors that have varying aims (Peppard, 2003; Stucky et al., 2011).

In the information systems literature, we identify three crucial stakeholders that interact with the IT function to create value through IT services: users, IT vendors and organizational decision makers. Decision makers refer to the organization's management, such as directors and business executives, who are not specialized in IT and on behalf of whom the IT function provides IT services to the organization. Users, in turn, refer to the consumers of organizational IT services, including non-IT staff and managers. Sometimes the users include customers that receive service from the organization. IT vendors are external parties from whom the organization receives software, hardware, and services.

Furthermore, we regard the IT function as an intermediary between the various stakeholders. This is manifested as a centralized, decentralized or federal entity that provides IT services to the entire organization (Gordon and Gordon, 2002). As there is a significant involvement of people in the delivery process of IT services, the implication is that IT services are the result of role interactions, with both the provider and recipient having a role to play in the delivery process and its outcome (Peppard, 2003). In this vein, we adopt the view that one or several human actors belonging to the respective stakeholder group represent each role.

Users. According to the recent research on service management, users' needs should take a center stage in service systems, and their role has been argued to be especially salient in IT service realization (Stucky et al., 2011). In many organizations, users have diverse IT needs that require IT-specific skills and competencies that the users do not often possess. These capabilities are provided to the users by the organization's IT function. However, such a service cannot be provided in isolation. Instead, user participation is required for increased user-perceived value (Blazevic and Lievens, 2008). User participation is widely accepted as essential to developing successful services (Zeithaml et al., 1985;

Bitner et al., 1997; Sierra and McQuitty, 2005; Yun Kyung and Menor, 2010). Furthermore, the role of users is commonly acknowledged in the development of IT solutions (Markus and Robey, 1988; Orlikowski and Baroudi, 1990; Orlikowski and Gash, 1994). Prior IS research has investigated many aspects of user participation, including the type, formality and influence of participation (Mumford, 1979), the degree of participation (Ives and Olson, 1984), the content of participation, and the extent of participation (Hirschheim, 1983). Congruently, the involvement of users in delivering IT solutions is held to be one of the most important factors influencing implementation success or failure (e.g. Barki and Hartwick, 1989). Doll and Deng (2001) show that user participation is especially important in the development of information systems within organizations and IT services intended for organization-wide use.

Decision makers. Decision makers involve organizational actors at several levels, such as line managers, business unit heads, and top executives, who are essential actors throughout the service process, from initiation to effective realization (Armstrong and Sambamurthy, 1999; Luftman and Brier, 1999). Tasks and decisions that require skills beyond the decision maker's knowledge are embedded in technology-intensive service systems.

The domain of management, information, is intangible and the application, IT, is something the decision maker usually knows little about (Peppard, 2003). Instead, other specialized actors carry out these tasks on behalf of the decision makers. These tasks are in many organizations allocated to the IT function. Although the role of decision makers in IT services is crucially important, securing their involvement and engagement may be difficult. To this end, Locke and Schweiger (1979) advocate participative decision-making, in which it is generally recommended that managers encourage other organizational actors to have broad participation in a variety of decision-making issues. Indeed, the locus and distribution of decision-making power regarding IT remains a significant concern in IS research (Sambamurthy and Zmud, 1999; Weill, 2004).

IT vendors. Supplier-customer collaboration is a key dimension in all service systems. According to the service-dominant logic (Vargo and Lusch, 2008), the relationship with suppliers and technology providers is an increasingly important aspect of successful service systems, as service realization is largely dependent upon external resources. In this view, value is co-created in business-to-business (B2B) relationships between a firm and its main stakeholders, such as technology suppliers (Sarker et al., 2012). This is also evident in IT services, as information systems are no longer produced in-house by the organization or its IT function, but increasingly acquired through IT outsourcing and other collaborative arrangements (Lee et al., 2004). Furthermore, many vendors offer systems as a service that comprises the offering and expertise of several suppliers, such as IT software and hardware providers, and IT consultants. From the IT function's viewpoint, this development has given increasing importance to

the tasks of vendor selection, vendor relationships management, and contract management (Peppard, 2003). Heiskanen et al. (2008) underscore that IT outsourcing relationships are essentially socio-technical processes that are governed by the interaction between multiple stakeholders over time. Furthermore, Dwyer, Schurr, and Oh (1987) explained that buyer-seller relationships are based on dynamic interaction between two or more individuals who represent those companies, and the relationships thereby cannot be understood by focusing only on two organizations relating to another.

2.2 Social action in the process of realizing an organizational IT service

The development of IT solutions and services is inherently complex because it must deal with technological issues and also organizational factors that are often outside of the project team's control (Xia and Lee, 2005). In adopting a service orientation, it is recognized that several internal and external actors all have a role to play in successfully delivering IT solutions (Peppard, 2003). Moreover, each of the stakeholders involved in the provision of a particular service have different knowledge and competencies that are deemed critical to the realization of the service.

In considering the problems experienced in such circumstances from a knowledge-integration perspective, we have chosen to adopt a processual account, which takes as its starting point that all human knowledge is developed, transmitted and maintained in social situations (Berger and Luckmann, 1966). From this perspective, knowledge is not a resource that can be simply transferred (Barney, 1991), nor is it simply embedded in organizational processes (Winter, 1987). Rather it is seen to emerge as people interact recurrently in the context of established routines and procedures (Newell et al., 2004).

These interactions embed both the knowledge and competencies, and also involve the different expectations and requirements of the associated parties towards the service delivery process and its outcomes (Peppard, 2003; Mathiassen and Sørensen, 2008). IS literature provides us with two useful lenses to investigate social interaction in such processes: the social-action perspective by Hirschheim et al. (1991); and the socio-technical process model by Newman and Robey (1992). Both theoretical frameworks build on a socio-technical view of information systems, which acknowledges organizational IT as a situated and socially-constructed phenomenon (Markus, 2004; Peppard and Ward, 2005).

IT service as social action. The social action perspective by Hirschheim et al. (1991) builds on the awareness that the primary reason for complexity in IT projects is caused by human activity. In this view, IT solutions are created though processes governed by the social interplay of multiple actors, who attempt to make sense of their and others' actions largely through the medium of language. Each dyadic interaction between the stakeholders defines an episode of social

action. In these episodes, the stakeholders create consensus (agreement), resistance, or conflict (disagreement) through power, knowledge, subjective meanings, and human interests of the associated parties. Creating value through IT is dependent upon managing a social process in terms of the quality and outcome of the episodes (Hirschheim et al., 1991).

Drawing on the conceptualization of Hirschheim, Klein and Newman (1991), we investigate how *knowledge*, *interest, and power* lead to *consensus*, *conflict*, and *resistance* of value creation in IT service systems. According to this conceptualization, subjective meaning is embedded in social action, but is difficult to observe in an empirical context (Hirschheim et al., 1991), and is hence left out from our analysis. Edvardsson, Tronvoll and Gruber (2011) suggest that *consensus,* which consists of shared understandings and rules for social conduct, is a vital trait for value creation in any social system. Conversely, *conflict* between parties in a service system can lead to *resistance* in actors' behavior in the service process, which is a barrier for collaborative value creation.

Service systems may be viewed as cognitive systems within which *knowledge* is a "meta-resource" that is shared in interaction between parties (Badinelli et al., 2012). In IT services, each stakeholder holds or has access to specific knowledge regarding technology, use context, management, organizational characteristics, and other vital information that is necessary for the effective realization of the service. For example, developing an IT strategy, software system, and technical infrastructure are essentially constructed from knowledge that has been deployed by systems architects, developers, communications experts, and other stakeholders in the design and construction (Peppard 2003).

Furthermore, many organizations have outsourced their IT to an external service provider or vendor as it provides them with access to knowledge that they may not currently possess. Access to knowledge is not sufficient by itself (Grant, 1996). Instead, the IT function is essentially assigned with the task of integrating and coordinating organization-wide knowledge to provide value through IT services (Peppard, 2003). The purpose of sharing knowledge is essentially to build consensus among associated actors while knowledge differences between the actors is seen as a salient cause of conflict in this view (Hirschheim et al., 1991). The knowledge that characterizes social action is a combination of articulable and non-articulable personal knowledge, and public and tacit collective knowledge (Hirschheim et al., 1991). Various forms of knowledge is held by these different actors and then emerges in their interactions within the service system.

Furthermore, a service-dominant logic underscores joint value creation and alignment of the *interests* of the actors involved (Vargo and Lusch, 2008). Deighton and Grayson (1995) argue, however, that benefits are not always shared equally as the consensus in the marketplace is formed inevitably through

a compromise between what the users want, what the company wants, and what the institutionalized reality allows. Conflicting interests of stakeholders are hence not uncommon in service systems. In cases where the perceived interests of a particular party are not sufficiently met, it may cause resistance in that actor's behavior.

Social *power* is the ability to call upon and use resources to overcome such resistance (Hirschheim et al., 1991). A powerful party can coerce less powerful parties to engage in a particular service, even independent of their perceived interest in the service (Peñaloza and Venkatesh, 2006, Standifer and Wall, 2003). Power can be defined in simple terms as the capacity to effect and affect organizational outcomes (Minzberg, 1983). The concept of power can be viewed from processual, institutional and organizational perspectives (Fincham, 1992). We focus on the processual perspective of power in the social interaction between stakeholders in IT service realization.

IT service as a socio-technical process. The socio-technical process model by Newman and Robey (1992) explains how and why outcomes are generated as a result of episodes of social action and their sequence in the process of delivering IT solutions. The process approach complements the dominant view in service research that characterizes service as a process instead of only an outcome. In IT services, the delivery process can be in many cases just as important as the outcome. Examples of this include IT support and IT training and it also applies to service outsourcing as clients are not just buying a result, but also making an implicit commitment to be involved in the delivery process (Peppard, 2003).

The socio-technical process model highlights two types of events that are critical to the effective realization of IT solutions and value creation. *Encounters* are single events that take place at a specific point in time, while *episodes* constitute of a stable set of activities over a longer period of time. Encounters precede and succeed episodes. The socio-technical process begins with a set of antecedent conditions, or the history concerning systems development. The antecedent conditions and events together lead to certain process outcomes. The model does not clearly make a difference between success and failure, but instead the outcome is conceptualized as a state of relationships. Outcomes may be characterized as user-led, analyst-led, or as joint-development processes (Newman and Robey, 1992).

3 METHODOLOGY

This research follows an abductive process as presented by Dubois and Gadde (2002), which is based on a systematic combining of theoretical knowledge and empirical insight. Thus, the research process includes both inductive and deductive phases. The inductive phases were conducted using an interpretive case study method (Walsham, 1995). The theoretical lenses adopted from the

previous IS literature, the social action framework (Hirschheim, et al. 1991) and the socio-technical process model (Newman and Robey, 1992), were used to organize the analysis and interpret the findings. The applied research framework was successively modified, partly as a result of unanticipated empirical findings, but also based on theoretical insights gained during the process.

3.1 Case selection and description

Our empirical inquiry investigates IT service realization in two case studies. We focus on organizational IT service centered on a specific type of information system, performance dashboards. Performance dashboards were selected as the context of this study as their use is organization-wide and hence their development is typically characterized by the needs, involvement and predisposition of several stakeholder groups rather than single users or departments (Pauwels et al. 2009). Moreover, Pauwels et al. (2009) point out that the development of performance dashboards exemplify the management of often-conflicting interests among stakeholder groups. In this vein, the development of performance dashboards offers a fruitful context to investigate the social action that takes place within an IT service system.

A performance dashboard enables a variety of users throughout the organization to effectively measure, monitor, and manage business performance (Eckerson 2010). Technologically, dashboards consist of a computer interface and a business-intelligence platform (Clark et al., 2007). The idea of dashboards is to help visualize large amounts of data in a condensed representation to identify trends, patterns, and anomalies for effective decisions (Eckerson 2010). The interest in developing performance dashboards in an organization is driven by a need to address fundamental management problems such as knowing about the performance of the business units they are responsible for (Nudurupati et al., 2011). Furthermore, performance dashboards are increasingly deployed at several organizational levels due to the emergence of flat decision-making hierarchies, self-governing teams and the empowerment of workers (Borgatti and Foster 2003).

3.2 Data collection and analysis

In order to examine in-depth how social action takes place in service systems, two case studies were conducted in organizations that recently adopted a performance dashboard system. In both cases, the IT function operated as a service provider for the organization and was in charge of managing the systems development project. An interpretive case study method (Walsham, 1995) was chosen to investigate how and why the different events in the interaction between essential stakeholders and the IT function created value in the two organizations. Klein and Myers (1999) describe that interpretive researchers assume that access to reality is only through social constructions such as

language, consciousness, shared meanings, and instruments. Interpretive research can help researchers to understand human thought and action in social and organizational contexts and thereby produce deep insights into the information systems phenomena. In this regard, the interpretive stance is particularly suited to a study that builds on such a socio-technical process approach.

The data was collected through face-to-face, semi-structured interviews with key persons in the IT solution-delivery projects at both case organizations. The interviewees include managers, service process owners, and users of the investigated services. Table **1** lists the interviews and describes the interviewees' role in the projects. The interviews were conducted pair wise by two authors. We used a semi-structured interview guideline to conduct the interviews (Myers and Newman 2007). All interviews were tape recorded and transcribed.

Table 1: Summary of the interviews.

Case	Interviewee	Role in the process	Date of interview
Case 1: University administration			
	Financial manager	Process owner/user	Jan. 25, 2012
	Financial controller	Project team member/user	Feb. 1, 2012
	IT manager	Project owner	Feb. 8, 2012
	IT development manager	Project manager	Feb. 23, 2012
	Financial controller	User	Mar. 16, 2012
Case 2: Procurement agency			
	CFO	Project owner	Sep. 30, 2010
	IT manager	Project manager	Nov. 29, 2010
	Category manager	User	Nov. 30, 2010
	Account manager	User	Dec. 9, 2010
	Account manager	User	Jun. 13, 2011
	CEO	Decision maker/User	Jun. 17, 2011

In the analysis of data, we adopted a processual account, which presumes that most of the human knowledge we need in this analysis is developed, transmitted and maintained in social situations (Berger and Luckmann, 1966). The data analyses consisted of interpretation of the data during the interviews, and in-depth familiarization of the transcripts afterwards. Investigator triangulation was pursued employing two researchers, who analyzed the data. That is, two researchers grouped the findings from each case study individually, and

compared the findings of the two cases jointly. In this study, the theoretical approach evolved throughout the data collection period.

4 ANALYSIS

Following the guidelines presented by Newman and Robey (1992), we analyzed antecedent conditions, service realization processes, and the outcomes of the critical encounters and episodes in our cases. By following the theoretical concepts by Hirschheim et al. (1991), we focused especially on how the knowledge, interest, and power of the different parties led to consensus, conflict and resistance in various encounters.

Figure 1 illustrates an abstracted view of the service realization processes in the cases. Three phases were identified in the service realization of both cases: initiation, design, and implementation. Similar sequential phases have been identified in previous IS research (e.g. Xia and Lee, 2005). Furthermore, the involvement and interaction of three essential stakeholder groups - users, decision makers, and IT vendors (marked in numbers 1 to 3) - were investigated in the process. Congruent with Newman and Robey (1992), a set of antecedent conditions precedes the process initiation in the case setting.

The key episodes in the process are illustrated in Figure **1** with the curved arrows representing time periods within which the service takes place. The social encounters occur between episodes when the stakeholders interact. Different forms of social interaction take place during the episodes as well, but the encounters represent notable situations of interaction, which take place at a specific point in time. The process eventually leads to an outcome, in this case, the information system in organizational use.

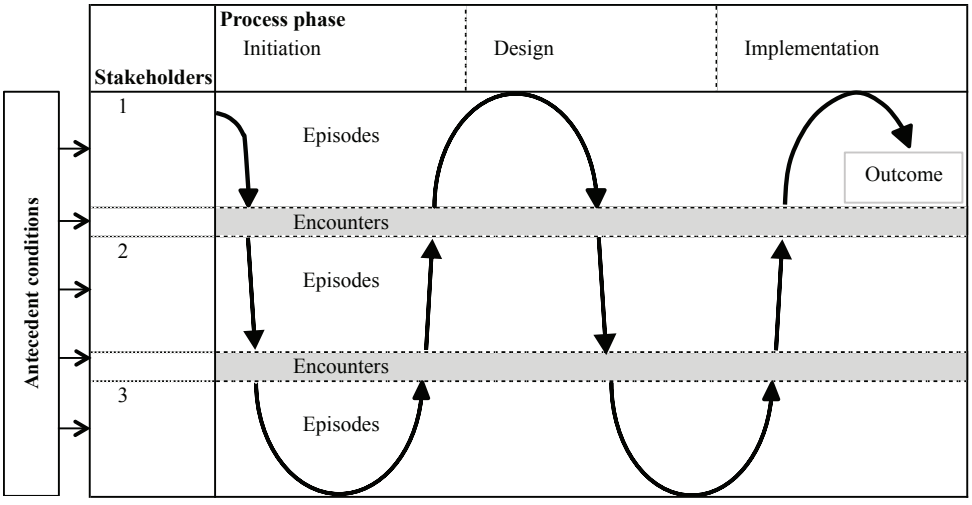

Figure 1: The service realization process.

The encounters are marked with labels en1, en2, en3,… in the following case analyses. The episodes that follow each encounter are not marked or numbered in order to keep the illustration simple and readable.

4.1 Case 1: An organizational performance dashboard solution for a university administration

Antecedent conditions. The setting of the first case study was a Northern European university that was established in January 2010 through the merger of three existing universities in the area. The three schools had a total of 17,000 students, 4,300 staff members, and 2,200 master's graduates each year. The integration of the administrative functions and IT systems, including the student register, library services, staff and student intranets, and financial systems was one of the key issues in putting the merger into practice. The university administration needed a system to monitor the performance of the new university and to lead the associated organizational change. This information included financial data, HR measures and student information. At the time of the merger, the integration process imposed a significant amount of pressure on the administrative functions, especially the IT function. A total of 74 IT projects, including the dashboard project, were undertaken during that time. The dashboard project was interconnected with another project, as the IT department decided to first implement a centralized database to gather and store data from the different sources, and then build a dashboard system on top of it to provide user access to the performance information.

Service realization. The need for a dashboard solution was triggered by the university management's interest towards more efficient performance management practices. Hence, the task of building a new performance management system was assigned to the university's newly established IT services unit. The system development was initiated right away regardless of the little time that the IT department had for preparation (*en1*). Because of the decision-making structure between the management and the IT department, the implementation planning was carried out in isolation from the rest of the organization. Other users of the system apart from a few managers in the central administration were not consulted at this point, although the system was meant for organization-wide use. An episode of confusion followed, as the IT department did not have clear knowledge of the management's expectations regarding the service. As a result, a performance dashboard centered on administrative reporting was deemed as a suitable IT solution:

> We chose the system without knowing what was actually needed. But we knew that we needed to have a system nevertheless (Process owner/user).

The IT department prepared a request for proposals for the system based on their interpretation of what the management was after, and sent it to a group of IT vendors for the purpose of finding a suitable technology supplier for the

system (*en2*). The tendering procedure yielded responses from only two vendors, the offerings of which were based on the same software product. Thereafter, the users were given a chance to participate in the evaluation of the offers (*en3*). However, the users felt that they had little influence on the choice of the external service provider.

Once the supplier was selected, a project was established to design and implement the system solution in co-operation with the external service provider and a few representatives of the internal stakeholders. A tight project schedule, IT-driven project management, and one-sided user participation in the project characterized this episode. Although both the IT personnel and the users were represented in the project team, the project was strongly driven by the IT department's interests. The involved users represented the financial administration. Other users, including top management' representatives, were not actively involved in the system design. This led to an increasing knowledge difference between the organizational actors who were eventually expected to use the solution. Otherwise, the project was conducted in an efficient manner and no conflicts were observed during this episode between the parties involved.

The relationship between the IT supplier and the IT department can be described as mainly a contractor-buyer relationship, whereas the users had a role as active customers. However, it was later observed that knowledge differences and ineffective communication between the IT department, IT vendor, and users led to somewhat dysfunctional outcomes in the system implementation phase. The main problems included that the users' remained unaware of the capabilities of the system, and the IT department was unable to share the necessary technical knowledge with the users. Instead, the users requested similar features from the new system that the previous financial reporting system already provided. Consequently, the user requirements provided to the IT vendor were based on biased information (*en4*). As the project manager explained:

> In a way it was very good that we had users involved, because we were in a hurry---. One thing that I regret afterwards is that we made the specifications too precise, especially by determining too strictly what the reports should look like [on the basis of existing financial reports] (Project manager).

While the IT department and users communicated rather closely on the business needs and the features of the intended solution, the IT vendor operated separately. There were no face-to-face meetings between the users and the vendor, because the vendor's premises were located quite far away (in another city) and the client organization's employees were expected to use teleconferencing rather than travel to meetings. Consequently, the users experienced problems in communication with the vendor. Moreover, the university was running two interrelated projects at that time and the dashboard

project owner noted that there were some communication problems between the vendors of these projects.

As the deadline was approaching, the project team did not have enough time to conduct sufficient testing prior to implementing the solution. Problems followed, and the service realization eventually drifted to a conflict, as the vendor could not meet the client organization's expectations in the delivery of the solution. The system implementation project was completed only in part by the original deadline in January 2010. The financial reporting capabilities were already at place, but the dashboard service was not in organization-wide use, as was originally planned.

Outcomes. The communication problems between the IT department, university management and the IT vendor led to difficulties in managing the expectations of different stakeholders at the time of delivery of the solution (*en5*). The vendor felt uncertain of what was expected from the service. Ultimately, the outcome did not satisfy the decision makers, as it exceeded the budget and conflicted with the vendor's original promises. The project owner explained:

> The vendor advertised that their system can be implemented in hours compared with other dashboard solutions. In our case, it took much more time and money than what was expected (Project owner).

Furthermore, the following encounter (*en6*) featured a clear conflict with the users' expectations. The finance department expected a better financial reporting system, but the technical solution did not meet their reporting needs. The solution also failed to serve the other user groups' needs, including top management's expectations on organization-wide performance management. Instead, the service was implemented predominantly on the basis of the financial department's needs and IT-led requirements engineering. Although the users had no role in the system initiation, and many of them were not involved in the development whatsoever, the new system was aimed for organization-wide use. Consequently, there was strong resistance towards the system among the users and poor user perceived value of the service during the subsequent episode. From the vendor's perspective, this conflict was not foreseeable, as it was in their primary interest to deliver a system that satisfied the requirements as spelled out by the IT department:

> Software vendor did exactly what we asked --- we got a [financial] report, exactly according to the specifications (Project team member/user).

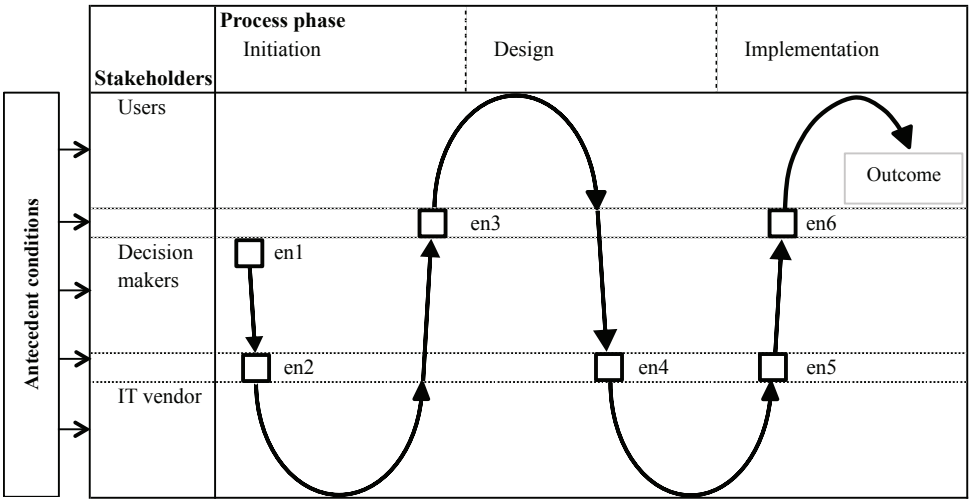

Figure 2: The socio-technical process at the university administration.

4.2 Case 2: A purchasing performance dashboard at a procurement agency

Antecedent conditions. The empirical setting for the second case was a governmental purchasing agency in a Nordic country. The procurement agency negotiates and maintains central framework agreements, which are used by other government units such as ministries, ministerial offices, state agencies and publicly-owned enterprises for the purchase of goods and services. The procurement agency specializes in tendering and contractual procedures and the organization employs experts in procurement, law, and other areas. Although the organization employs only 60 people, the procurement agency is responsible for facilitating a considerable share of public sector procurement in its country. The purchase volume channeled through the central frame agreements reached €553 million in 2010. The procurement agency had experienced problems with their previous spreadsheet-based system through which they reported purchasing figures and monitored how the agency was performing. Hence, the company decided to implement a performance dashboard that would enable purchasing performance management and analysis in a more convenient way.

Service realization. Users' need for a better performance management solution initiated the service realization process at the procurement agency. The organization's IT department actively mapped the users' IT-related needs. The IT department proactively looked for suitable IT solutions that would contribute to their organizational IT service offering. The dashboard service realization began when the IT department and the users agreed that there was an evident need for a better performance management system (*en1*). Thereafter, the IT department started searching the market for a suitable solution. The IT department's activity was guided by the users' needs during this episode. The user participation is explained in the following quotation from one of the users:

> One of our colleagues was there as a representative from our side. --- He knew our needs and --- told the project team what we would appreciate (User).

In the case of the performance dashboard, the IT department knew more about what the specific IT solution might look like that would meet the organizational needs as expressed by the users. The IT department found a suitable vendor to provide the system, and with whom they were quick to reach a consensus regarding the challenges and opportunities that the procurement agency was facing, thanks to a capable representative from the vendor's side (*en2*).

The IT department decided to implement a pilot system before going any further in the process. The pilot system served two purposes: first, it was a way to gain knowledge regarding the feasibility and usefulness of the system solution, and second, if it showed potential benefits, then it could be used to illustrate the system's capabilities to the decision makers in the organization. By doing so, the IT department was able to avoid potential conflicts between the users' needs and the chosen system solution, also obviate any decision makers' resistance towards the associated IT service. It was also an attractive approach because the vendor was willing to implement this part of the service for a relatively low price, after which the client organization could retain the contract if needed. The pilot system was introduced in a demo session with the procurement agency's key decision makers and the vendor's representatives (*en3*). Of note, the key actors in this case had an encounter with all the actors together, which did not happen in the university case. As a result of this encounter, the decision makers of the procurement agency were convinced about the benefits of the solution and its realization as a service:

> After [seeing] the demo we wanted it (Project owner).

The IT department, IT vendor and the users continued to work in close cooperation to design the features of the system. Active communication between the case organization's project team and the vendor's technicians and consultants was considered to take place during this episode. Consensus between all parties was pursued by carefully selecting the representatives of all user groups to the project team. Some of the primary users were even present in the coding sessions together with the IT staff and the technology vendor's representatives. The vendor did most of the actual coding work at the procurement agency's premises, which enabled continuous interaction between the developer and the users. In the following encounter (*en4*), users' needs were formalized to system requirements to guide the implementation of the IT solution. Importantly, user participation in the realization process did not automatically ensure success of the outcome. Of note, the IT department identified some knowledge asymmetries between the users and the IT vendor regarding the new solution and the system that was used in the organization for

the same purpose before. For this reason, the IT department needed to increase the users' understanding of the system's capabilities:

> It was actually very hard to even get them to understand what kind of other possibilities we maybe have, because three years ago the pivot table was the greatest thing they had ever seen (Project manager).

Once the users learned about the potential of the system, they became active to request new features and functionality to be included in the final solution.

Outcomes. Once in use, the solution turned out to be valuable to both the decision makers and users. Top management support throughout the development process facilitated mutual understanding among the stakeholders regarding the goals and expected deliverables of the IT service. A close relationship between the vendor and the client organization characterized the process. The procurement agency spent a considerable amount of time on specifying the system features, after which the implementation project took only fourteen days. This was a positive surprise for the decision makers and users alike:

> I have never seen an IT project like that because it was so fast. It really included everything that was promised. Although the schedule was tight we managed to do it in time, and the end solution was great (Project manager).

After less than a year of operation, all members of the organization had access to the purchasing performance dashboard. As the service realization was driven by the users, resistance towards its adoption was not to be expected when it was implemented in the organization (*en5*). Still, having experienced severe user resistance in many IT projects before, the project owner was surprised about how quickly the dashboard was adopted in the organization.

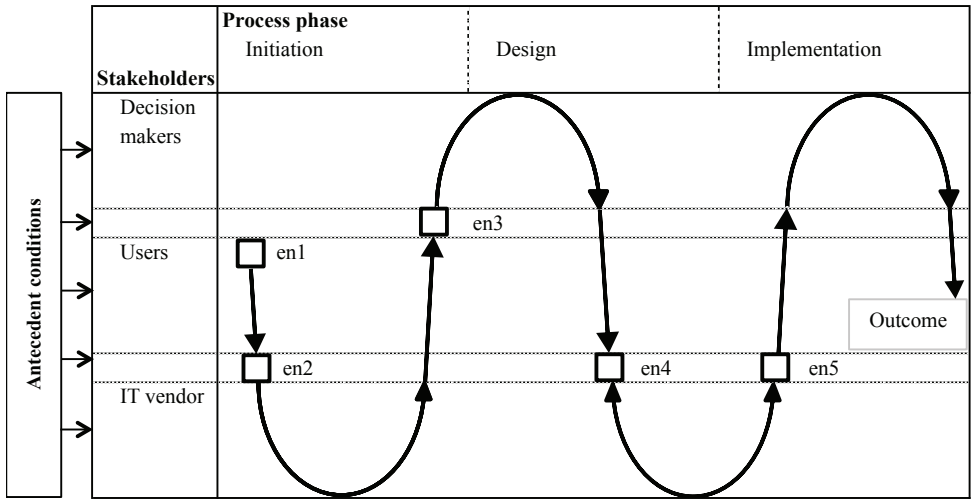

Figure 3: The socio-technical process at the procurement agency.

5 DISCUSSION AND CONCLUSIONS

Our study investigated social action in two multi-party service systems centered on producing a new organizational IT service. In these service systems, we analyzed the dynamics of stakeholder interplay across the service realization process, from initiation to design and implementation. Our empirical study investigated two cases that represent such processes. One of the cases, a dashboard solution for a university administration, illustrates the process in a public not-for-profit organization, while the other case reviewed a dashboard solution at a procurement agency that was a public utility centered on tendering and contractual procedures related to efficient purchasing of goods and services.

We identified three main stakeholder groups for the investigated organizational IT service (information systems development): users, decision makers, and IT vendors. The social action between these stakeholder groups was observed through three phases of the service realization process: initiation, design and implementation. The roles of the stakeholder groups and the characteristics of the service processes varied between the cases. Several types of development processes were identified, and these included: user-led, management-led, IT-led, and joint development. These approaches differed in how the associated parties approached the building of consensus on development initiatives, targets, and activities. The university case was rather management-led at the beginning, but transformed into an IT-led process after the initiation phase. The procurement agency case started from a user-led initiation of the service, but transformed to joint development in which the IT vendor was also closely involved.

In congruence with the previous literature on IT management, our findings endorse user participation as an important driver for achieving user-perceived value in IT services. The literature is consistent in that user participation is more likely to improve user satisfaction and productivity for those decision issues where the end-user has superior expertise or knowledge (Locke and Schweiger, 1979; Groen et al., 2012). This notion is highlighted in our cases, as the feasibility of the IT solution in use was highly dependent upon the input of several interacting users along the service realization process. Moreover, by maintaining a close relationship with both the vendor and the decision makers throughout the process, the IT function could prevent conflicts arising from unrealistic expectations, communication gaps and asymmetric information between the stakeholders.

Our findings are in line with earlier IT management literature (e.g. Peppard, 2003), in that stakeholder interaction embeds potential collaboration problems and knowledge gaps throughout service processes. More specifically, problems in social action lead to discrepancies between the users' and other stakeholders' needs and between the expected and perceived benefits of the service and the realized outcomes.

In our view, the IT function has a crucial role in overcoming these gaps in the social encounters and episodes during the service realization process. As our data underscores, this bridging is especially important in the project initiation and system design phases. In the light of our analysis, through supporting collaboration between the stakeholders, the organizational IT function managed to bridge the gaps in the social action between the users, the technology supplier and the decision makers in the procurement agency.

The novelty of our findings is in the characterization of how the IT function governs the interplay that exists between the essential stakeholders when providing IT services. Moreover, our research identifies some essential aspects of value creation through social action in the IT service realization. We see that the IT function creates value primarily by facilitating the interaction between the involved parties. The ways the IT functions facilitated interaction in our cases varied significantly. Aligning the needs, goals, and interests of each stakeholder in the early phase of a service realization process seems to lead to easier collaboration in the development of the solution. Also, building and maintaining consensus between the stakeholders might be better achieved in face-to-face meetings. Based on these experiences, we argue that this task of managing the entire service system is one of the most salient activities in the service that an IT function delivers to the rest of the organization.

5.1 Theoretical implications

Previous research on information systems shows that control over information technology (IT) resources in organizations is typically dedicated to the IT function, which provides IT services to the entire organization (Gordon and Gordon, 2002; Guillemette and Paré, 2012). Whereas prior IT management literature has focused on the business value of IT as an outcome of IT service implementation (Peppard and Ward 2005), we suggest that modern IT function should facilitate value co-creation throughout the service process. This contextual perspective of value, as suggested by Lusch, Vargo and O'Brien (2007) posits that what firms provide should not be understood in terms of outputs with value, but rather as resource inputs for a continuing value creation process. This viewpoint is also acknowledged in recent research on IT-intensive service systems (Kieliszewski, et al., 2012; Sarker et al., 2012).

Our study adds to this knowledge by suggesting that the co-creation of value within a service system can be better understood as social action between essential stakeholders through the concepts of knowledge, interests, and power. The present study highlights the social action in the IT service context as a chain of *encounters* and *episodes* that take place in the IT service realization process. We illustrated how the encounters might lead to consensus, resistance and conflict in value creation through IT. This paper contributes to the research in information technology management by providing a view of information systems

development as management of a service system comprised by the interaction of several interrelated actors. Furthermore, this paper contributes to the discussion on the business value of IT by highlighting that business value is created through a process of collaboration between several parties in the service realization.

Our study shows that in the realization of IT services, managing knowledge differences is key to understanding why service encounters between the stakeholders lead to conflict and resistance. An impetus for these challenges may come from the development of knowledge in technology-intensive fields in time-constrained situations, and when the consumer of the service often holds non-articulable personal knowledge that he or she finds difficult to spell out to the service provider in the form of information system requirements. This seemed to be especially the case in the encounters at the design and implementation phases (en4 to en5) in the case of the procurement agency.

Similarly, as the service system becomes increasingly complex, a conflict of interest between multiple stakeholders is more likely to occur than in simple dyadic service relationships. This seems to be particularly the case in IT services and systems intended for organization-wide use. Hirschheim's (1991) model of social action suggests that conflicts between the associated parties in a system development project (e.g. conflicts over technical quality) can lead to resistance towards the use of a system. Our findings indicate that resistance might arise also in the presence of no apparent conflict, but rather when there is a "false consensus" between the associated actors. This seemed to be the state of affairs in the design phase of the university case.

This biased consensus might exist as a result of knowledge differences between stakeholders or because of shortcomings from a mediating actor, in this case the IT function, and their ability to facilitate knowledge sharing between the actors. Importantly, our findings underscore that such a state may be unnoticed during the service realization process. All parties might therefore be under the belief that good service is being provided during development, yet the outcome may face resistance among eventual users and hence realize poor outcome value to the organization. However, many of the contemporary project management methodologies specify stakeholder signoff lists and meeting memos to avoid this kind of gap.

5.2 Practical implications

Our study identified some crucial tasks for the organizational IT function in managing an IT service system. The findings give rise to a new recipe for IT functions in their pursuance of orchestrating value co-creation in the IT service processes. In practice, orchestrating a complex service system for value creation through IT is challenging, and often difficult. Therefore, on the basis of our findings, we conceptualize three principles to bear in mind in this endeavor.

Principle 1: Create and maintain consensus by linking all stakeholders to the IT-business dialogue

The key step in the business and technology dialog is to link business needs to the IT imperatives and to the opportunities provided by IT. Knowledge of different stakeholders' needs is key to success on this front. First, the IT function should try to find common ground between the (sometimes hidden) needs of system users, and decision makers' viewpoint regarding organizational systems and services. Making sure that all actors (including the users) understand the users' business needs and the consequences of addressing those needs, is a key enabler for value creation through the intended IT service. In our data, the first round of encounters (en1 to en3) seemed to be crucial events in building the breeding ground for a shared vision of the objectives. Second, the IT function needs to communicate with both the users and the IT vendor in a language that they understand to effectively spell out user requirements to external service providers, and to promote technology use in the organization. The role of the IT function is hence to be a "translator" between technical specialists and users with expertise in the application domain, but also an "advocate" of new technology and innovation that support organizational users.

One of the key tasks of the IT function is to create and maintain consensus on both the objectives of the intended service and the practical implementation of the solution to meet the stakeholders' needs. Different approaches to achieve consensus in the IT-business dialogue were identified in our data: a user-led approach, a management-led approach, an IT-led approach, and joint development. None of these approaches is automatically better than the other, but depend on the organizational context and call for different management activities.

In the user-led approach, the IT function should effectively communicate the projected user benefits of the system to the decision makers. This may obviate decision maker's resistance towards the project, support implementation decisions and facilitate resource allocation. Conversely, in the management-led approach, in which the implementation decision is made on behalf of the users, the role of the IT function is to develop work processes to support system use and promote system use in the organization. Furthermore, although the IT function essentially executes organizational IT strategy on behalf of the decision makers, strategic choices should also be challenged when they are not properly aligned with users' true needs.

Principle 2: Put leadership and coordination over governance in the service realization

A complex service system that includes multi-party activity and multi-sourcing of technology solutions cannot be managed similarly to in-house IT services. As multi-party IT service systems include autonomous actors, which are beyond the

direct control and decision-making power of the organizational IT management, the IT function needs to pursue network leadership and governance. Such capabilities point to the need to manage boundary-crossing organizational, functional and cultural activities. If an IT function is to orchestrate such a service system, it must be ensured that those boundaries do not become barriers to value creation.

Congruent with the study of Venkatraman and Loh (1993), our study shows that the key tasks of the IT function include the management of multi-party collaboration through indirect leadership of the actors in the service system towards a consensual value realization. Knowledge on the available options, translation of different parties' imperatives to a shared vision of the service, and unification of the independent actor's interests in the realization of the service represent essential challenges for the IT function. In practice, this means influencing the independent actors towards collective aims instead of local and sub-optimal goals. In addition, it means overcoming any behavioral resistance of the autonomous actors through facilitating a shared understanding of each party's interests in the process. Our findings give reason to suggest that such behavior may lead to greater value in the social context as perceived by all the involved parties

Principle 3: Master the infusion of external capabilities for business value creation

The way an organization makes use of external IT capabilities determines its competitive advantage or disadvantage. This has been noted in prior IT management research (e.g. Keen, 1993) as every leading organization has access to the same IT resources in the market. Similarly, the IT function has to master the use of the best available skills in the service realization process. The IT function has a key responsibility in managing the relationships with external parties by choosing the right suppliers, acquiring suitable systems and services, and managing the contractual relationship with the vendors throughout the initiation, design and implementation phases of the service realization process.

Our study shows that identification of the involved parties' capabilities in the early phases of IT service process seems to be a crucial task in the service system coordination. Our cases highlight that successful coordination of the dialogue between involved parties in the design phase releases value in the implementation phase, and less effort needs to be laid on controlling the implementation using the best available resources to the task. A shared understanding of the aims of the intended service, and understanding of the possibilities of the provided IT solution are paramount in managing conflicts between the parties involved and in dealing with potential resistance among the users of the service.

5.3 Conclusions and avenues for further research

Our study highlights one of the grand challenges in orchestrating an IT service through a multi-party service system: Some IT organizations might not possess the social capabilities required to facilitate the business-IT dialogue successfully between the stakeholders involved. As a result, the design and implementation of IT solutions for the service realization is not based on true consensus on the needs and technical imperatives involved. Most large organizations bring in consultants to provide this sort of bridging function. However, we see this somewhat problematic, because the maintenance of a successful business-IT dialogue is arguably one of the core activities of the IT function.

Our findings add to the previous research on IT management and service systems, as well as to the IT service management practice, but no study is free from limitations. We believe that the extent to which IT managers can learn to manage value co-creation in an IT service system will ultimately determine the success or failure of the IT function in achieving its promises. Future research may extend this study in several ways. While we focused on a certain multi-party service system in just two case organizations, at the same time we acknowledge that it may be interconnected to other parties that together form more complex service systems. Depending on how decentralized the IT function is, there can be several similar bundles of IT, users, decision makers, and vendors. It should be noted that the purpose of this paper is not to take a reductionist approach in stating that the findings from this bundle of actors remains the same when it is reintegrated to the whole service system or even to a greater service sphere. Instead, we see value in an in-depth description of how service was created and delivered through social action in specific organizational settings.

In addition, the present study investigated IT service realization in a rather small geographical area in Finland. Management and interaction cultures in the selected case organizations may differ from those in other organizations, countries, or cultures. Thus, the emphasis on the social action may vary between different service systems. Future research may extend this study by testing the findings in different industries and in other countries characterized by different management cultures. Therefore, we call for more research to confirm and compare the identified tasks and roles of the stakeholder groups in the service-realization process as well as the structural configurations of IT service systems.

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In order to survive in the increasingly information-intensive world, organizations need to rely on fact-based decision making. Performance management systems are used in organizations to derive "business intelligence" from a rapidly expanding amount of digital data.
How do firms and public organizations determine relevant performance metrics? How are such metrics integrated to organizations' information systems architecture? Moreover, how can system designers ensure that decision makers are provided with the best possible information when it is needed?
The thesis aims at answering these important questions by outlining an ensemble approach to designing performance management systems. The resulting design framework pinpoints the key tasks and contextual factors that impact successful performance management system development. In doing so, the thesis increases our understanding of this multi-faceted phenomenon and offers relevant recommendations to practitioners.

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