Lappeenranta
University of Technology

Sanna Pekkola

PERFORMANCE MEASUREMENT AND MANAGEMENT IN A COLLABORATIVE NETWORK

Thesis for the degree of Doctor of Science (Technology) to be presented with due permission for public examination and criticism in the Cabinet Kuusi at Sibelius Hall, Lahti, Finland on the 15th of November, 2013, at noon.

Acta Universitatis
Lappeenrantaensis 534

Supervisors Professor Hannu Rantanen
School of Industrial Engineering and Management
Lahti School of Innovation
Lappeenranta University of Technology
Finland

Professor Juhani Ukko
School of Industrial Engineering and Management
Lahti School of Innovation
Lappeenranta University of Technology
Finland

Reviewers Professor Mika Hannula
Department of Information Management and Logistics
Tampere University of Technology
Finland

Director, D.Sc. (Tech.) Jouko Toivanen
Tulikivi Ltd.
Finland

Opponents Professor Mika Hannula
Department of Information Management and Logistics
Tampere University of Technology
Finland

Director, D.Sc. (Tech.) Jouko Toivanen
Tulikivi Ltd.
Finland

ISBN 978-952-265-475-5, ISBN 978-952-265-476-2 (PDF),
ISSN-L 1456-4491, ISSN 1456-4491
Lappeenranta University of Technology
Yliopistopaino 2013

ABSTRACT

Sanna Pekkola
PERFORMANCE MEASUREMENT AND MANAGEMENT IN A COLLABORATIVE NETWORK
Lappeenranta 2013
82 pages

Acta Universitatis Lappeenrantaensis 534
Dissertation, Lappeenranta University of Technology
ISBN 978-952-265-475-5, ISBN 978-952-265-476-2 (PDF),
ISSN-L 1456-4491, ISSN 1456-4491

This study concerns performance measurement and management in a collaborative network. Collaboration between companies has been increased in recent years due to the turbulent operating environment. The literature shows that there is a need for more comprehensive research on performance measurement in networks and the use of measurement information in their management. This study examines the development process and uses of a performance measurement system supporting performance management in a collaborative network. There are two main research questions: how to design a performance measurement system for a collaborative network and how to manage performance in a collaborative network.

The work can be characterised as a qualitative single case study. The empirical data was collected in a Finnish collaborative network, which consists of a leading company and a reseller network. The work is based on five research articles applying various research methods. The research questions are examined at the network level and at the single network partner level.

The study contributes to the earlier literature by producing new and deeper understanding of network-level performance measurement and management. A three-step process model is presented to support the performance measurement system design process. The process model has been tested in another collaborative network. The study also examines the factors affecting the process of designing the measurement system. The results show that a participatory development style, network culture, and outside facilitators have a positive effect on the design process.

The study increases understanding of how to manage performance in a collaborative network and what kind of uses of performance information can be identified in a collaborative network. The results show that the performance measurement system is an applicable tool to manage the performance of a network. The results reveal that trust and openness increased during the utilisation of the performance measurement system, and operations became more transparent. The study also presents a management model that evaluates the maturity of performance management in a collaborative network. The model is a practical tool that helps to analyse the current stage of the performance management of a collaborative network and to develop it further.

Keywords: Performance measurement, performance management, performance measurement system, collaborative network

UDC 65.011.2:65.012.6:331.101.6

TIIVISTELMÄ

Sanna Pekkola
SUORITUSKYVYN MITTAAMINEN JA JOHTAMINEN YHTEISTYÖVERKOSTOSSA
Lappeenranta 2013
82 sivua

Acta Universitatis Lappeenrantaensis 534
Väitöskirja, Lappeenrannan teknillinen yliopisto
ISBN 978-952-265-475-5, ISBN 978-952-265-476-2 (PDF),
ISSN-L 1456-4491, ISSN 1456-4491

Tässä tutkimuksessa keskitytään suorituskyvyn mittaamiseen ja johtamiseen yhteistyöverkostossa (engl. collaborative network). Tarve aihepiirin tutkimukselle on viime vuosina kasvanut yritysten välisen yhteistyön lisäännyttyä kiristyvän kilpailun myötä. Tutkimuksen tavoitteena on tuottaa uutta tietoa suorituskyvyn mittausjärjestelmän kehittämisestä ja sen käytöstä suorituskyvyn johtamisen tukena yhteistyöverkostossa. Tutkimustavoite on jaettu kahteen tutkimuskysymykseen: miten suorituskyvyn mittausjärjestelmä voidaan suunnitella yhteistyöverkostoon ja miten suorituskykyä voidaan johtaa yhteistyöverkostossa.

Tutkimus on laadullinen ja tarkastelee yhtä suomalaista yhteistyöverkostoa, joka koostuu päämiesyrityksestä ja jälleenmyyntiverkostosta. Tutkimustulokset on raportoitu viidessä eri artikkelissa, joissa on hyödynnetty erilaisia aineistonkeruumenetelmiä. Työssä tutkimuskysymyksiä on tarkasteltu sekä verkoston että yksittäisten verkostoyritysten näkökulmista.

Tutkimus laajentaa aiempaa tutkimustietoa tarjoamalla uutta, entistä syvempää ymmärrystä verkoston suorituskyvyn mittaamiseen ja johtamiseen. Tutkimus esittelee kolmiportaisen prosessimallin mittareiden suunnittelun ja kehittämisen tueksi. Tutkimuksessa on myös arvioitu ja testattu kehitettyä prosessimallia. Tämän pohjalta on määritelty tekijöitä, jotka vaikuttavat prosessin toteutukseen. Tärkeimmiksi tekijöiksi tunnistettiin osallistava kehittäminen, positiivisen verkostokulttuuri sekä ulkopuolisen prosessin koordinoijan rooli. Toisena keskeisenä kontribuutiona on ymmärryksen lisääntyminen siitä, miten suorituskykyä voidaan johtaa verkostossa ja miten mittausjärjestelmän tuottamaa informaatiota voidaan käyttää hyödyksi verkoston johtamisessa.

Saatujen tulosten pohjalta voidaan todeta, että suorituskyvyn mittausjärjestelmän käyttö soveltuu myös yhteistyöverkoston suorituskyvyn johtamiseen. Tulokset osoittavat muun muassa, että verkoston luottamus ja avoimuus ovat kasvaneet mittausjärjestelmän käyttöönoton myötä ja toiminnasta on tullut läpinäkyvämpää. Tulosten pohjalta on luotu konkreettinen johtamistyökalu, jonka avulla voidaan arvioida suorituskyvyn johtamisen tasoa verkostossa. Työkalu on käytännöllinen väline suorituskyvyn johtamisen ja toiminnan kehittämiselle kohti määriteltyä tavoitetilaa.

Avainsanat: suorituskyvyn mittaus, suorituskyvyn johtaminen, suorituskyvyn mittausjärjestelmä, yhteistyöverkosto

UDC 65.011.2:65.012.6:331.101.6

ACKNOWLEDGEMENTS

Writing this thesis has been an interesting and a most exciting journey with moments of desperation and success, some tears and a lot of laughter. Fortunately, I have been accompanied with a large group of people who have shared these moments with me and who have provided support and encouragement. This part of the thesis is dedicated to these people.

First, I thank Professor Hannu Rantanen for guiding my doctoral thesis and supporting me in various phases of the work. Hannu has given me a lot of freedom and responsibility regarding my research but has always been there when I have needed it. I also wish to thank Professor Juhani Ukko for his guidance and feedback throughout my research work, and for co-operation in writing the papers. Juhani has encouraged me all the way during this research work.

I wish to thank Professor Mika Hannula (Tampere University of Technology) and Director, D.Sc. (Tech.) Jouko Toivanen (Tulikivi Ltd.), the examiners of my thesis. I appreciate their comments, which helped me improve the thesis.

I thank Associate Professor Petri Niemi for his co-operation and valuable input in the co-written paper. I also want to acknowledge M.Sc. Minna Saunila for her remarks and comments. During this research I have been working with the LUT Lahti School of Innovation and I thank my former and present colleagues for providing a pleasant working atmosphere and assisting me in various phases of the research. Special thanks go to a former colleague, M.Sc. Ulla Annala for her valuable help in the beginning of my research work, and Mrs Raija Tonteri, who has assisted me in many practical issues during all these years.

This research was carried out in close contact with the studied case network. I am grateful for the opportunity to carry out research in this particular environment. The support of the network, as well as the opportunity to gather rich research data was very important for me, and I want to express my gratitude to all the people in the collaborative network involved. Especially, I wish to thank Jukka Jaakkola, Ilkka Tiilikainen and Matti Purhonen for participating in the research projects and their valuable comments and support during the various phases of the research and development work.

The financial support of the Finnish Cultural Foundation/Päijät-Häme Regional Fund, the Foundation for Economic Education, and the Industrial Engineering and Management Doctoral Programme has given me freedom to concentrate on the accomplishment of my thesis.

I wish to express my deepest gratitude to my family and dear friends, who have been there for me. I would like to thank all of my friends, who have helped me with this project by providing relaxing and cheerful company at leisure times. I express my sincere gratitude to my mother Riitta and my father Soini. You have always supported and believed in me. I also want to thank my little brother Heikki for just being there. Finally, I thank Matti for his support and encouragement. You all helped me to keep in mind what the really important things in life are.

Lahti, October 21st 2013

Sanna Pekkola

TABLE OF CONTENTS

I Pekkola, S. and Ukko, J. "Designing a performance measurement system for a collaborative network", submitted (2013) to *International Journal of Operations & Production Management*.

II Pekkola, S. and Ukko, J. (2011), "Measuring performance in networked organisations", *Management Service*, Summer 2011, pp. 14-23.

III Pekkola, S. (2013), "Managing a network by utilizing performance measurement information", *Measuring Business Excellence*, Vol. 17, Iss: 1, pp. 72-79.

IV Pekkola, S. and Rantanen, H. "Utilisation of performance measurement information in management: top manager perspective", *International Journal of Business Performance Management* (accepted for publication).

V Pekkola, S., Niemi, P. and Ukko, J. (2013), "Building understanding of the development of performance management for collaborative networks with a knowledge maturity model", *International Journal of Networking and Virtual Organisations*, Vol. 12, No. 3, pp. 179-200.

PART 1 – INTRODUCTORY SECTION

1 INTRODUCTION

1.1 Background

Today, small and medium-sized enterprises are competing in globalised and turbulent markets (Garengo et al., 2005; Cocca and Alberti, 2010; Nudurupati et al., 2011; Barrow and Neely, 2011). To survive in such a competitive environment, companies have to collaborate with each other with the objective of meeting customers' needs more effectively and efficiently (Bititci et al., 2004). Through collaboration, companies aim at sharing resources and exchanging information; reducing risks, costs, time-to-market, and delivery-time; increasing their market share; and enhancing the skills and knowledge of their network partners. Different kinds of collaborative practices, such as collaborative networks, supply chains, extended enterprises, and virtual enterprises have become commonplace. However, collaboration for the sake of collaboration is not feasible. If joint businesses are to maintain their competitive advantage and continue to sustain their performance, collaboration should result in the creation of new and unique value propositions based on a unified approach to value creation. Hence, the main target of collaboration is to create a win-win situation between business partners through creating valuable trust, strong commitment, and improved performance (Bititci et al., 2004).

Even though the networked way of doing business has increased, management accounting research, especially research on performance measurement and management in networks, is at an early stage (see e.g. Bititci et al., 2012; Franco-Santos et al., 2012). For example, Bititci et al. (2012) present a research gap relating to performance management and measurement in the collaborative network. According to them, comprehensive research on performance management of networks and the use of the measurement information is required. In prior research, the need for network-level performance measurement has been perceived; such measurement would be useful to manage the business process, to guide the actors in networks to pursue the common targets of the network, and to boost the success of collaboration (Kaplan et al., 2010; Yin et al., 2011; Bititci et al., 2012; Franco-Santos et al., 2012; Ferreira et al., 2012).

Lack of network-level performance management may have many consequences that could lead to improving the performance of individual companies in a way that will lead to suboptimising or even decreasing the performance of the whole business network (Kulmala and Lönnqvist, 2006). In order to be successful, it is important for the network to evaluate and enhance the performance of the individual partner as well as the entire network continuously (Kaplan et al., 2010). In general, it can be said that the existing literature shows a need for in-depth empirical studies concerning the design of a performance measurement system, and as well as knowledge and tools that facilitate and improve the performance management of a network. The aim of the present

research is to provide new information to fill the research gap and to support the management of a network.

The aim of this thesis is to investigate the development and uses of a measurement system for supporting the performance management of a collaborative network. The empirical examination, carried out as a qualitative single case study, has been conducted in the context of a Finnish collaborative network. The collaborative network consists of a leading partner that manufactures kitchen fitments and partner companies that sell these products to end customers. The thesis is based on five scientific articles, and it consists of two parts. Part I contains five chapters. Chapter 1 is the introduction for this research, where the key concepts of the study are illustrated. Chapter 2 presents existing literature in order to understand the multifaceted research field. This chapter also provides various viewpoints to the theme. The definitions of the research problem and the research questions are presented in chapter 3, together with the scope of the research and the methodological settings. In the end of chapter 3, the composition of the articles and brief summaries of them are provided. Chapter 4 presents the results in relation to the posed research questions. Finally, chapter 5 contains concluding remarks and a discussion on the results provided in the previous chapter. Moreover, chapter 5 summarises the contribution of the research, and it presents remarks concerning the evaluation of the research. In addition, practical implications and further research suggestions are proposed. The original articles are presented in Part II, at the end of the thesis.

1.2 Key concepts

1.2.1 Concepts related to performance

In this section the key concepts related to performance, performance measurement, performance measurement system, and performance management are presented.

Performance

Performance is a complex phenomenon, and a diversity of meanings can be found for the term performance. Basically, the performance of an organisation is about achieving organisational goals (Kaplan and Norton, 1996; Neely et al., 2002; Lebas and Euske, 2002; Lönnqvist, 2004). Performance can be examined from different perspectives, and therefore, the goals between the perspectives may vary. For example the Balanced Scorecard measurement system examines an organisation's performance from four perspectives: financial, customer, process, and learning and growth (Kaplan and Norton, 1996). The Performance Prism framework contains five perspectives on performance: stakeholder satisfaction, strategies, processes, capabilities, and stakeholder

contribution (Neely et al., 2002). Bititci et al. (1997) claim that performance should not only be viewed from the perspective of shareholders but also from the perspective of other concerned entities, such as customers, employees, and suppliers.

According to Sink (1983), Neely et al. (1995), and Rantanen and Holtari (2000), performance can also be identified and equated with effectiveness and efficiency. According to Lönnqvist (2004), performance can be examined from three different aspects: first, performance refers to the actual results of certain activities; second, performance refers to how an activity is carried out (i.e. how something is being performed); and third, performance may also refer to the ability to achieve results. Hence, performance may relate to actual results, activities, or the potential for results. However, performance can be seen as an umbrella concept for all the concepts that examine the success of an organisation and its activities.

Performance measurement

Neely et al. (1995, p. 80) define performance measurement as 'the process of quantifying the efficiency and effectiveness of action'. Effectiveness refers to the extent to which customer requirements are met, whereas efficiency is a measure of how economically the resources are utilised when providing a given level of customer satisfaction. Lebas (1995) describes performance measurement as including measures based on key success factors, measures for detection of deviations, measures to track past achievements, measures to describe the status potential, measures of output, and measures of input. Marshall et al. (1999) define performance measurement as the development of indicators and the collection of the data to describe, report on, and analyse performance.

Ittner et al. (2003) explain that performance measurement provides information (financial and non-financial) that allows the firm to identify the strategies offering the highest potential to achieve the firm's objectives, and aligns management processes, such as target setting, decision making, and performance evaluation, with the achievement of the chosen strategic objectives. Lönnqvist (2004) and Hannula and Lönnqvist (2002) define performance measurement as a process used to determine an attribute or attributes of the measurement object. Performance measurement can also be defined as quantifying the input, output, or level of activity of an event or process (Radnor and Barnes, 2007).

Performance measurement system

According to Neely et al. (1995, p. 80), a performance measurement system is 'a set of indicators used to quantify the efficiency or effectiveness of purposeful actions'. They continue, stating that a performance measurement system can be examined at three different levels: (1) individual

measures that quantify the efficiency and effectiveness of actions, (2) a set of measures combined to assess the performance of an organisation as a whole, and (3) a supporting infrastructure that enables data to be acquired, collated, sorted, analysed, interpreted, and disseminated. Lönnqvist (2004) defines a performance measurement system as a set of measures which are used to determine the status of the attributes of performance measurement targets. However, according to Lönnqvist, this definition is very optimistic because the measurement system may include unused measures, and some important measures may be missing in practice.

Performance management

The concept of performance management has a variety of different applications, depending for example, on the purpose of its use or the level of the organisation where it is utilised. Hannula and Lönnqvist (2002) suggest that performance management is management based on the information produced by using a performance measurement system. According to them, the term performance management emphasises a systematic and active use of measurement in managing and developing the performance of various business activities. Bititci et al. (1997) define performance management as a process by which the company manages its performance in line with its corporate and functional strategies and objectives. They continue, stating that the objective of this process is to provide a proactive closed loop control system, where the corporate and functional strategies are deployed to all business processes, activities, tasks, and personnel, and feedback is obtained through the performance measurement system to enable appropriate management decisions.

Amaratunga and Baldry (2002) define performance management as the use of to cause positive change in organisational culture, systems and processes and by helping to set performance goals. In addition, performance management helps in allocating and prioritising resources, informing managers to either confirm or change the current policy or program directions, and sharing the results of performance. Bourne et al. (2003) argue that performance management is a term that is also widely used within human resources, and that it has a specific meaning associated with reviewing and managing individuals' performance. Radnor and Barnes (2007) define performance management as action based on performance measures and reporting, which results in improvements in behaviour, motivation, and processes, and promotes innovation.

1.2.2 Concepts related to collaboration

Inter-organisational relationships between different organisations have been discussed in the literature with varying and overlapping concepts. The most relevant concepts for this research are introduced and discussed in this section.

Collaboration is a concept which describes the closest relationship between partners (Parung and Bititci, 2006). Collaboration can be defined in many ways, but in general it means working together for mutual benefit (Wernerfelt, 1984; Huxham, 1996; Bititci et al., 2003; Parung and Bititci, 2006; Camarinha-Matos et al., 2009). The concept is typically used when individuals or organisations work together towards a common goal. Other terms often used for describing the phenomenon are relationship, partnership, and alliance. Collaboration has been presented as a way forward for an organisation when working alone is not sufficient to achieve the desired ends (Huxham, 1996). Bititci et al. (2003) list the following characteristics of collaboration:

- it is a positive form of working in association with others for some form of mutual benefits;
- it implies a positive and purposeful relationship between organisations that retain autonomy, integrity, and distinct identity, and thus the potential to withdraw from the relationship;
- it is performed by a number of companies that create and support a service or product;
- it means a focus on joint planning, coordination, and process integration between the supplier, customers, and other partners in a network. It also involves strategic joint decision making about partnership and network design;
- it is a process in which organisations exchange information, alter activities, share resources, and enhance each other's capacity for mutual benefit, as well as a common purpose by sharing risks, responsibilities, and rewards.

Collaboration can also be classified based on what individual participants bring to and share in collaboration, the intensiveness of the collaboration, and the roles of different actors in it. Partly based on those factors, the literature presents different classifications for collaboration (see Table 1).

Table 1 Different classifications for collaboration

Classifications	Author(s) (year)
Collaborative network	Wernerfelt (1984); Bititci et al. (2003); Camarinha-Matos et al. (2009)
Social networks, Bureaucratic networks, Proprietary networks	Grandori and Soda (1995)
Development circle, Loose cooperative circle, Project group, Joint venture, Joint unit	Vesalainen (1996); Varamäki and Vesalainen (2003)
Supply networks, Joint ventures, Regional industrial systems	Nassimbeni (1998)
Strategic network, Virtual enterprise, Regional network, Operative network	Pfohl and Buse (2000)
Collaborative network: Supply chain, Extended enterprises, Virtual enterprises, Clusters	Parung and Bititci (2006)
11 different categories of collaborative networks	Camarinha-Matos et al. (2009)

According to Camarinha-Matos et al. (2009), organisations collaborate, for example, to share data and information, information systems, risks, and benefits. Based on these aspects, the authors present four categories in which the maturity and integration level of collaboration increases:

1) *Network* – A network involves communication and information exchange for mutual benefits. The value of networking originates from sharing information and experiences between the operators and network partners. There is not necessarily any common goal or structure influencing the form and timing of individual contributions.
2) *Coordinated network* – This form of collaboration involves (in addition to communication and information exchange) aligning or altering activities so that more results are achieved. Coordination, which is an act of working harmoniously in a concerted way, is one of the basic building blocks of collaboration. Each network partner may have a different goal and use its own resources and methods for making an impact. Value creation can happen at the individual level.
3) *Cooperative network* – This collaboration involves all the aforementioned and also resource sharing. The network also attains common goals. Cooperation is achieved by division of labour (not extensive) among the participants.
4) *Collaborative network* – A collaborative network is the most advanced and demanding form of collaboration. It involves a joint process where the entities share information, resources, and responsibilities to plan, implement, and evaluate activities to achieve a common goal. Collaboration implies mutual trust, and it takes time, effort, and dedication. It implies risk, resources, and responsibilities, and it gives an outside observer an image

of a joint identity. It is difficult to determine the contribution of an individual network partner to value creation.

It is important to understand what is involved at different levels of collaboration in order to support and manage the process better. Although each one of these concepts forms an important component of collaboration, they are not of equal value and they are not equivalent to each other.

Parung and Bititci (2006) also present four widely accepted types of collaborative networks: supply chain, extended enterprises, virtual enterprises, and clusters. These categories are formed on the basis of what the participants bring and share in collaboration:

1) *Supply chains* are networks that interlink the supplier, manufacturers, and distributors in different processes and activities that produce value in the form of products and service delivered to the end consumer. In this end-to-end process, all channels in the supply chain can bring or share data, information, and resources with their partners in order to achieve their objectives. It is not common to share risks and benefits amongst the participants in the supply chain.
2) *Extended enterprises* are conceptual business units or systems that consist of a purchasing company and a supplier who collaborate closely to maximise the returns to each partner. The extended enterprise is a philosophy where the partner combines their core competencies and capabilities strategically to create a unique competency. In addition, people across a number of organisations participate in the decision-making process. The mutual benefits are the sharing of data, information, resources, and risks.
3) *Virtual enterprises* are dynamic partnerships amongst companies that can bring together the complementary competencies needed to achieve particular business tasks within a certain period of time. Virtual enterprises usually share data, resources, risk, and benefits.
4) *Clusters* are networks of companies, their customers, and their suppliers, including materials and components, equipment, training, and finance. The participants usually share data, information, resources, and sometimes risks.

The concepts of Camarinha-Matos et al. (2009) are utilised in this research. The studied network partners share information, resources, and responsibilities to plan, implement, and evaluate a plan of activities jointly to achieve a common goal. Hence, the characteristics of the studied collaboration fit well with the definition of a collaborative network presented by Camarinha-Matos et al. (2009). A detailed examination of the studied collaborative network and its characteristics is presented section 3.3, empirical context.

1.2.3 Concepts related to performance in a collaborative network

The prior literature does not present widely discussed definitions of performance, performance measurement, performance measurement system, and performance management in a collaborative network or network environment generally. This could be due to the fact that collaboration has many partly overlapping definitions and classifications or network environments generally. However, the conceptual basis is not clearly defined, although the discussion on the research theme is active (see e.g. Leseure et al., 2001; Busi and Bititci, 2006; Kulmala and Lönnqvist, 2006; Cunha et al., 2008; Papakiriakopoulos and Pramatari, 2010). Busi and Bititci (2006) noted that a collaborative network is a kind of 'virtual' organisation, although it is formed from several organisations. Therefore, the general performance-related concept can be applied to performance concepts related to collaborative networks with some modifications. The following definitions are used in this research.

Performance of collaboration means meeting the strategic goal of the collaborators (Beamon, 1999; Parung and Bititci, 2006). Performance can be examined from different perspectives. For example, Varamäki et al. (2008) examine performance from six dimensions: the network culture, the resources and competencies of the network, the models of actions of the network, the performance of internal processes, the customer perspective, and the financial perspective. In this study, performance of collaboration has been defined through the measurement perspectives of a network-level performance measurement system. The selected perspectives are (for more details, see article I) the financial perspective, the future-performance perspective, the customer perspective, and the employees of network perspective.

Parung and Bititci (2006) define the *performance measurement of a collaborative network* by using the definition of Neely (1995, p. 80): 'performance measurement is the process of quantifying the efficiency and effectiveness of action'. In the collaborative perspective these 'actions' are jointly produced. In this research, the concept of *network-level performance measurement* used bears the same definition as that presented by Neely (1995, p. 80).

Papakiriakopoulos and Pramatari (2010) describe *the performance measurement system of a collaborative network* as a set of measures used to quantify the efficiency or effectiveness of purposeful joint actions. The measures are delivered from the objective of the collaboration by monitoring both external relations and the efficiency of internal and extended processes (Busi and Bititci, 2006). The concept of the *network-level performance measurement system* used in this study has the same meaning as the performance measurement system of a collaborative network defined by Papakiriakopoulos and Pramatari (2010).

Busi and Bititci (2006) define *performance management in a collaborative network* as the use of performance measurement information to support management proactively based on both feedback and feedforward operations control. In this study, the performance management in a collaborative network has been understood as defined by Busi and Bititci (2006).

2 THEORETICAL BACKGROUND

2.1 Need for performance management and measurement in a collaborative network

Companies are required to compete in globalised and turbulent markets (Garengo et al., 2005; Cocca and Alberti, 2010; Nudurupati et al., 2011; Barrow and Neely, 2011). In order to survive in a dynamic environment, companies need to be able to adapt to market changes, to satisfy all their stakeholders, and, at the same time, to excel along all performance dimensions (Neely et al., 2002; Garengo et al., 2005; Cocca and Alberti, 2010; Nudurupati et al., 2011; Barrow and Neely, 2011). One way to survive such an environment is to collaborate with companies to meet the customers' needs more effectively and efficiently (Bititci et al., 2004). The literature (see e.g. Parker, 2000; Bititci et al., 2005; Camarinha-Matos et al., 2009; Ferreira et al,. 2012) lists plenty of different motives for and benefits of collaboration. The main reasons motivating companies to join in collaborative networks can be divided into two parts: market-related reasons, such as to increase activities, chances of survival, and potential for innovation; and organisational reasons, such as to increase market share, to enhance customer service, to increased quality of products, and to enhanced skills knowledge (Camarinha-Matos et al., 2009). Collaboration can also produce innovations, and thus create new value by combining resources and technologies, and by creating synergies (Camarinha-Matos et al., ibid.).

Even though collaboration has many benefits, the results of Zineldin and Brewenlöw (2003) show that 70 per cent of collaborative networks fail. Based on that, Bititci et al. (2007) have combined eight key reasons from the existing literature (e.g. Huxham, 1996; Parker, 2001; Zineldin and Bredenlöw, 2003) that may cause a failure:

1) *Lack of commitment* of one or more of participants (Zineldin and Bredenlöw, 2003) may lead to problems with trust and eventually the failure of the relationship.
2) *Failure to identify a common target* for the network (Parker, 2001). The network partners cannot identify failures to see what added value collaboration creates for them or the stakeholders.
3) *Unrealistic objectives* of the partners (Huxham, 1996). The expectations of each partner are not shared and made explicit.
4) *Failure to fulfil the objectives and needs of the partners* (Zineldin and Bredenlöw, 2003). The partner companies lose their commitment because their expectations and wishes are not met.
5) *Failure to focus on the customer needs* (Dryer et al., 2001). The value propositions are forgot.
6) *Focusing on individual short-term benefits rather than collective long-term benefits* (Zineldin and Bredenlöw, 2003).

7) *Unfair distribution of benefits*. This can be caused by the absence of operational business models.
8) *Absence of an operational management system* (Elmuti and Kathawala, 2001). Bititci et al. (2007) explain that each network partner has their own management systems, which they use to manage their own business.

Based on the results of Bititci et al. (1997), when inter-organisational relationships become more intensive and structured (cf. Carmarinha-Matos et al., 2009), there is a need to manage and control the collaboration in some way (see e.g. Yin et al., 2011; Bititci et al., 2012). Collaboration does not have intrinsic value, but it is a method to organise operations between companies. The network partners are interested in the benefits and costs of networking, and the customers are interested in the ability of the network to manage production tasks better than a single company (see e.g. Varamäki et al., 2008; Yin et al., 2011; Bititci et al., 2012). Hence, if companies want to create and sustain competitive advantage through collaboration, the structure of the network needs to be understood and managed. Otherwise, the intended objectives will not be achieved (Bititci et al., 2007; Verdecho et al., 2009). Kaplan et al. (2010) argue that networks are often traditionally organised and managed as single organisations, and there is a need for measurement tools and management practices to get a better view of the operations, and performance of the network.

The existing performance measurement research focuses on the design, implementation and use of performance measurement from the point of view of a single organisation – the phases of design and implementation have been especially popular amongst researchers (e.g. Kaplan and Norton, 1992; 1996; Neely et al., 1995; Bititci et al., 1997; Bourne et al., 2003; Lohman et al., 2004; Mettänen, 2005). However, Bititci et al. (2012) have identified some new but rapidly emerging trends that are likely to present practical and theoretical challenges to performance measurement. According to their study, the networked way of doing business has increased, but the research on the current theme is at an early stage (see e.g. Yin et al., 2011; Bititci et al., 2012; Franco-Santos et al., 2012). Hence, the study of Bititci et al. (2012) highlights the research need of focusing on how to concurrently manage the performance of the collaborative organisation while also managing the performance of the participating organisations as a complete system. Bititci et al. (2005) also emphasise that there is a need to identify what should be managed and how it should be managed. In order to develop and manage a business network, continuous performance measurement of a single network partner as well as the entire network is needed to organise the collaboration (see e.g. Yin et al., 2011). The present research contributes to this research gap by increasing the current knowledge on the design and use of a performance measurement system in collaborative network management.

2.2 Performance measurement in collaborative networks

2.2.1 Performance measurement frameworks

Prior literature presents meta-frameworks for overall measurement in networks (e.g. Beamon, 1999; Leseure et al., 2001; Busi and Bititci, 2006; Francisco and Azevedo, 2007; Varamäki et al., 2008), some measurement models for supply chain performance measurement (e.g. Brewer and Speh, 2000; Schmitz and Platts, 2004; Gunasekaran et al., 2004; Bititci et al., 2005; Saiz et al., 2007), and various individual measures for measuring customer-supplier boundaries (e.g. Beamon, 1999; Ellram, 1995). These models and frameworks do not offer practical suggestions on how to design for collaboration networks, but they illustrate a number of approaches, attributes, and characteristics that should be taken into account in network measurement.

The study of Beamon (1999) presents a framework for the selection of a performance measurement system for manufacturing supply chains. The supply chain performance measures that are necessary components in any supply chain performance measurement system are: (i) resource, to measure the efficiency of resource management (e.g. cost); (ii) output, to measure the level of customer service (e.g. punctuality of delivery); and (iii) flexibility, to measure the ability to respond to demand changes. Each type of measures is vital to the overall performance; they have important characteristics, and the measures of each type affect the others. Therefore, the supply chain performance measurement system must contain at least one individual measure from the three identified types.

The study of Leseure et al. (2001) presents a framework for meta-performance to measure the performance of the total network: the capability of each network partner in performing what is expected, and the contribution of each network partner on the overall performance of the network. Meta-performance has two dimensions: aggregate performance and equity. It is important to realise that meta-performance can be evaluated only by measuring both aggregate performance and equity. Some imperfections in this framework have been perceived (Chenhall, 2003). Chenhall states that the framework is too conceptual to be used as a tool by practitioners and that it does not take account of the problem of contingency factors related to the external environment and the network or those factors that are firm-specific.

Francisco and Azevedo (2007) have developed a framework for performance management systems within collaborative networks. The results of the study focus on different uses of performance management systems attending to the collaborative network life cycle. The framework identifies the necessity of aligning the individual enterprise performance measurement system and the collaborative network. It also considers elements of the social

climate, such as trust during the design and start-up phases of the life cycle. The framework is based on two main layers: the data and information layer and the functionality layer. The first layer comprises several services related to data acquiring and repository management. The second layer comprises three main performance functionalities: network performance management to support mainly the design and start-up phase; real-time performance measurement and management to measure the outputs, solve emergent problems, and formulate improvements on the operation and evolution phases; and creating performance analysis to know and understand the performance and knowledge reached during the life cycle.

Varamäki et al. (2008) have developed a framework for a performance measurement system composed of factors that enable action and success of the processes, as well as of the productivity and profitability of the activities. The issues enabling success are (1) the values and culture of the network, (2) resources and competences, and (3) models of action in the networks. The profitability of activities can be divided into (4) the profitability of internal processes, (5) customer satisfaction, and (6) the financial key ratios of the network. In this framework, the values and culture of the network describe the mental state of the network through trust, commitment, partnership values, and communication within the network, such as manners of interaction and openness. Resources and competences are connected in particular to the ability and capacity of the network to produce core output to the business effectively and to create and develop new modes of action. The models of actions of the network describe the ability of the actors to design and exploit different modes of action in the network. Varamäki at al. (ibid.) propose that the listed elements can be evaluated by using the logic of the 'Balanced Scorecard'.

As a whole, collaborative networks as well as networks in general include a huge number of important features to be measured. The models and frameworks presented above concentrate on what should be measured in a networked business environment and how the main partner could have better control of the supply chain process. These frameworks and models do not illustrate how the performance measurement system or individual measures could be designed and implemented in networks, but they give a good starting point to identifying the success factors of collaboration. Most of these frameworks and models are theoretical and partly fragmented, and thus there is a lack of empirical results in a real-life context. There is also a lack of an elaborated explanation of how these issues can be managed and facilitated in collaborative networks. Hence, in-depth empirical solutions and examination is needed, as presented by Bititci et al. (2012) and Yin et al. (2011).

2.2.2 Challenges in performance measurement

Network-level performance measurement and management allow the network partners to gain access to performance information beyond their own organisation and to give access to performance information to the other partners in the network. By sharing performance information with the network partners, the network can identify bottlenecks and 'weak links' in its processes, and act accordingly to improve the overall performance of a single organisation and the entire collaborative network (Kulmala and Lönnqvist, 2006; Parung and Bititci, 2008). As the current literature (see e.g. Yin et al., 2011; Bititci et al., 2012) presents, there is little research and few practical solutions that are especially concentrated on the design process of a network-level performance measurement system. On the contrary, the prior literature (see e.g. Kulmala, 2003; Busi and Bititci, 2006; Kulmala and Lönnqvist, 2006; Cocca and Alberti, 2010) has identified plenty of different challenges and problems related to the performance measurement and management of a network. At a general level, the challenges identified in the prior literature can be divided into four general categories.

The first category includes the challenges that focus on *the structures and dynamics of the network* (Lambert and Pohlan, 2001; Busi and Bititci, 2006; Morgan, 2007; Lönnqvist and Laihonen, 2012). The lack of understanding of collaborative structures and dynamics is considered to be the main cause of the failure of collaborative initiatives (Busi and Bititci, 2006). For that reason, it is necessary to understand what the key elements of collaboration are, how they interact, and how they can be integrated within a performance measurement system. Lambert and Pohlan (2001), Busi and Bititci (2006), and Lönnqvist and Laihonen (2012) state that there are difficulties in defining the measures for network-level performance management. Those difficulties are related to the complexity of the phenomenon itself, as well as the complexity of the overlapping information and material-flow in the network. For example, Lönnqvist and Laihonen (2012) have examined the productivity phenomenon in complex welfare services in a public sector network. Their results reveal that the network partners seem to understand the phenomenon in the context of their own organisation, but at the network-level, the phenomenon becomes abstract and blurred. According to Lönnqvist and Laihonen, this is problematic if the purpose is to engage all network partners in network-level development. The network partners quite easily concentrate on the performance issues of their own organisation and on certain relationships that hinder the development of their own operations. This has a negative influence on the design process of the network-level performance measurement system, because in this process, the development work should focus on the network-level phenomenon and its evaluation (Lönnqvist and Laihonen, ibid.).

The second category is related to the *network culture* (Beamon, 1999; Kulmala, 2003; Lohman et al., 2004; Busi and Bititci, 2006; Tenhunen, 2006; Morgan, 2007; Cunha et al., 2008; Lönnqvist and Laihonen, 2012). Busi and Bititci (2006) state that there are challenges in sharing information between organisations because the network partners do not trust each other. In network measurement, companies should open almost all of their information to the other network partners without limitations (Kulmala, 2003). Hence, trust between the network partners is a key element in network-level performance measurement (Tomkins, 2001; Tenhunen, 2006). The results of Lönnqvist and Laihonen (2012) also point out that openness and transparency in decision making and communication can be a quite different for the different network partners. Busi and Bititci (2006) and Beamon (1999) reveal that there are also difficulties in evaluation and the unit of analysis, which means the level of measurement. Beamon (1999) states that most supply chain performance measurement systems are inadequate because they rely on the use of cost as the primary measure, are not inclusive, and do not consider the effects of uncertainty.

The third category focuses on the *design and implementation process itself* (Lohman et al., 2004; Busi and Bititci, 2006; Tenhunen, 2006). However, Busi and Bititci (2006) suggest that probably the biggest problem in implementing measures is to reach consensus amongst the network partners. Those in the network have to have a clear vision of the roles and targets of the network, as well as understanding of and commitment to shared objectives. Therefore, intensive discussions are needed in order to improve understanding amongst the partners. It is important that the network discover and define the benefits of the common performance measurement system for the network, and this is especially so for the single network partners (Tenhunen, 2006). Tenhunen remarks that the network has to be able to turn the present informal exchange of information into systematic planning and guiding.

The fourth category is *the resources and knowledge of the network partners* (Hudson et al., 2001; Kulmala, 2003; Lohman et al., 2004; Garengo et al., 2005; Singh et al., 2008; Cocca and Alberti, 2010). Kulmala (2003) found that poor accounting and measurement practices, particularly those of smaller network partners, influence the design and implementation process in the network. Regarding this, the literature (see e.g. Singh et al., 2008; Cocca and Alberti, 2010) presents plenty of different challenges and obstacles that should be taken into account when developing a performance measurement system for small and medium-sized organisations (SME). These challenges also pertain to the network-level measurement design process, and they should be taken into account in the starting phase of the design work. The main problem that the literature presents is (see e.g. Hudson et al., 2001; Garengo et al., 2005; Singh et al., 2008; Cocca and Alberti, 2010) lack of human resources, which means that there is not enough personnel, and the managers do not have time or financial stability for added activities such as implementing a

measurement system. Another challenge is limited skills, amongst not only the personnel but also the owner managers, who often do not have enough managerial expertise or organisational capabilities, and this implies poor strategic business planning and human resource management. However, the lack of bureaucracy has a positive impact on flexibility, adaptability, and rapidity in responding to the changing environment.

Managerial capacity and culture are also often lacking in these companies, and, therefore, managerial tools and techniques are perceived as being of little benefit to the company. The reactive approach means that SMEs are characterised by poor strategic planning, and their decision-making processes are not formalised. One of the main barriers is the lack of a managerial system and the formalised management of the processes. The challenge of the misconception of measurement means that a measurement system can only be effectively implemented and used when the company perceives the benefits of the measurement system. SMEs often do not understand the potential advantages of implementing a measurement system (Hudson et al., 2001; Garengo et al., 2005; Singh et al., 2008; Cocca and Alberti, 2010). Finally, the studies of Kaplan et al. (2010) and Kulmala (2003) reveal that managers have limited experiences of managing a network instead of an individual company. Managing a network is different because networks consist of individual companies that can have only transactional ties to the network. In addition, networks also call for some hierarchy in the name of effective and efficient management (Kulmala, 2003).

On the whole, companies and networks face a number of different and fragmented challenges and obstacles when they start to design and implement a network-level performance measurement system. Most of the challenges are related to network-level operations and targets, but some are related to the resources and know-how of a single network partner. It can be concluded that there is a clear research need for a measurement system design process that takes these challenges and obstacles into account and guides the process forwards.

2.2.3 Design of a performance measurement system

General phases of the design and implementation process

The literature contains many different practical and managerial process models for the design and implementation of a performance measurement system for a single organisation (see e.g. Kaplan and Norton, 1992; 1996; Simons, 2000; De Toni and Tonchia, 2001; Gooderham, 2001), and the models are also widely studied in practice. In general, the development of a performance measurement system can be divided to three main phases: design, implementation, and use of

performance measures (Bourne et al., 2000). The first task in designing measures is related to the identification of the purpose of measurement, which is obviously related to the objectives of the organisation. The purpose of measurement is naturally also related to the factors to be measured as well as the actual measures. In general, the design phase can be subdivided into identifying the key targets to be measured and designing the measures themselves (Lynch and Cross, 1995; Kaplan and Norton, 1996). It is important to design the measures in a way that encourages behaviour that will support the strategy of the organisation (Neely et al., 2000).

Implementation is the phase in which systems and procedures are put in place to collect and process the data that enable the measurement to be done regularly. This may involve computer programming to trap data already used in the system and to present them in a meaningful form (Bourne et al., 2000; Lohman et al., 2004; Cunha et al., 2008). There is some evidence that a performance measurement system that lacks information technology does not support the management practices as efficiently and effectively as possible (Kennerly and Neely, 2002; Lohman et al., 2004; Nudurupati et al., 2011; Bititci et al., 2012). Information technologies systems facilitate the gathering of measurement data, the carrying out calculations, and the providing reports and visualisation. Measurement in itself cannot determine social practices. It is therefore also essential to inform and train the employees and managers in order to make them committed and to ensure the efficient use of measurement systems (Wisniewski and Ólafsson, 2004). If the implementation fails, the potential of the measurement system is not realised. In implementing measurement systems, many practical issues have to be determined and documented in order to ensure the successful use of the systems. These include, for instance, the purpose of the measures, the responsible persons related to measuring, the measurement formulas, the frequencies in measurement, the target values for the measures, and the reporting of measurement (Neely et al., 1996).

The use of performance measurement can be divided into two main subdivisions. First, as the measures are derived from the strategy, the initial use is that they measure the success of the implementation of the strategy. Second, the information and feedback from the measures should be used to challenge the assumptions and test the validity of the strategy (Kaplan and Norton, 1996; Bourne et al., 2000). The literature presents numerous other purposes for the use of performance measurement from the perspective of a single organisation and some from the perspective of a network (see section 2.3.1, use of performance measurement information). The basic function of measurement is to provide information about the factors considered important, (e.g. from the point of view of business targets or strategic management). Hence, measurement systems should not be too complicated to serve the very practical needs of management (Hannula, 2002). The results of Hannula (2002) reveal that performance measurement

information should fulfil the criteria of validity, reliability, and relevance. However, the main challenge of performance measurement is the inefficient use of measurement information (Stivers et al., 1998; Jääskeläinen, 2009), which may be caused by lack of time and resources or knowledge related to measurement. The essence of performance measurement, in general, is to produce useful information with reasonable effort.

Designing a performance measurement system for a collaborative network

The practical design process for a network-level performance measurement system has received little attention in the literature (Papakiriakopoulos and Pramatari, 2010; Yin et al., 2011; Bititci et al., 2012). However, Kulmala and Lönnqvist (2006) and Cunha et al. (2008) have proposed some approaches and guidelines on how to design a network-level performance measurement system. Kulmala and Lönnqvist (ibid.) propose that, firstly, the success factors of the network from the end customers' point of view should be identified. This can be carried out in a similar fashion as done when designing performance measures for an individual company. The success factors are likely to consist of both financial and non-financial factors. In the second phase, network-level performance measures should be defined for those success factors. Thirdly, the performance measures should be extended to the level of the network (ibid.). Kulmala and Lönnqvist continue that there are two options for measuring performance: the first option is to divide the network-level performance measures into parts so that the contribution of each network partner can be measured. However, problems may occur whilst dividing all the network-level success factors and measures into the individual contribution of each network partner. The second option is that instead of measuring the activities of each company separately, it may be more beneficial to examine the jointly operated activities of one or more network partners.

Cunha et al. (2008) present a set of requirements that should be met to develop a performance measurement system. First, the definition of measures should be a collaborative activity to be elaborated on. Second, the defined measures should include contemplation of the performance evaluation of collaborative aspects in the network. Third, the vision of each partner of the network should be contemplated, and the individual performance measurement systems should be embedded; hence, the network level and partner level should be considered. Fourth, the technological design of a performance measurement system should provide architecture flexible enough to support the entrance of a new partner. Finally, a methodology to define a well-structured set of performance measures should be considered an important contribution for the management activity (Cunha et al., 2008). Cunha et al. state that the way information is specified and shared will have an important impact on the communication process between the partners and in the performance evaluation of the network. It requires discussion, commitment, and a shared vision to support the validation and implementation plan for each measure, taking

potential conflicts, barriers, and difficulties into account. However, these presented design processes above are both theoretical and there is no research on how these processes could operationalised to the practice.

The literature also presents other separate features and suggestions for selecting the measures and measurement level (e.g. Caplice and Sheffi, 1995; Busi and Bititci, 2006; Kulmala and Lönnqvist, 2006). The studies of Caplice and Sheffi (1995) and Busi and Bititci (2006) analyse the issue of local versus overall performance measures, concluding that collaborative performance measurement systems should evaluate both local measures and business-network-wide measures in order to maintain relevance and effectiveness in the collaborative enterprise business model. The vast majority of measures in use today measure local performance. Busi and Bititci (2006) suggest that when analysing the performance of a collaborative network, the following measures should be used:

- Extended process measures (i.e. how is the extended process performing?)
- Collaborating measures (i.e. are the organisations able to work as a single unit?)
- Collaboration management measures (i.e. does the management of the organisations provide creativity and an environment allowing collaboration to flourish?)

Parung and Bititci (2008) present that there are three kinds of elements that may have an influence on the success of collaborative networks and their measurement: (1) input into the collaboration (i.e. the contribution of each participant); (2) health of the collaboration; and (3) the outcome of the collaboration. Measuring the input is an attempt to confirm what resources the participants contribute to the collaborative network, whereas measuring the health of a collaborative network is an effort to distinguish a healthy collaborative network from unhealthy ones by measuring the dimensions of commitment, coordination, trust, and the quality of communication and participation, as well as the conflict-resolution technique of joint problem solving (Parung and Bititci, 2006; 2008). Measuring the output is an attempt to determine the values gained by the key stakeholders through the collaborative network.

2.3 Performance management in a collaborative network

2.3.1 Use of performance measurement information

The literature reveals (see e.g. Neely, 1999; Simons, 2000; Toivanen, 2001; Franco-Santos et al., 2012) a great variety of different purposes for using performance measurement on management from the perspective of a single organisation. For example, Simons (2000) states that management information can be used in planning, coordination, motivation, evaluation, and

education. He has divided these uses into five broad categories: decision making, control, signalling, education and learning, and external communication. Further, Toivanen (2001) examines the use of the Balanced Scorecard in the 500 biggest Finnish companies. The results reveal that Balanced Scorecard was considered to have made the greatest difference in understanding the whole of the business activities, the realisation of the strategy, and the follow-up of non-financial matters. The companies had also shifted their operations into a more customer-oriented and future-oriented direction. However, the needs for measuring performance differ in different organisations, and the purposes of use depend, for example, on the strategy, organisational culture, and characteristics of the organisation (Lönnqvist, 2004).

However, performance measurement is not just a tool for top management. The result of Ukko (2009) point out that performance measurement also focuses increasingly on operative level performance. Franco-Santos et al. (2012) have investigated the knowledge on the consequences of a performance measurement system by conducting a review of the existing empirical evidence on this topic. They divide the consequences into three categories: people's behaviour, organisational capabilities, and performance consequences. Their results show, for example, that performance systems play a key role in strategy, communication, management processes, and generating organisational capabilities. They continue that performance systems affect communication processes by requiring and providing relevant information that has an influence on how people think, act, and interact. Performance measurement systems also influence organisational routines and management practices by changing the way leaders behave.

The study of Franco-Santos et al. (2012) highlights that the impact and use of performance measurement systems on network performance has received little attention in the literature. Mahama (2006) and Cousins et al. (2008) have explored this phenomenon. Mahama (2006) has found evidence suggesting that s facilitate cooperation and socialisation in supply relationships. In this study, Mahama defines cooperation as information sharing, problem solving, and willingness to adapt to changes in the network, and socialisation as the acquisition of values, attitudes, skills and knowledge that promote goal congruence amongst the network partners. The results of Mahama show that the performance measurement system helps to ensure that performance information is distributed fairly amongst the network partners, which enables learning and problem solving.

Cousins et al. (2008) support Mahama's findings and present that the use of a performance measurement system enhances communication in networks, which, in turn, improves socialisation. These findings suggest that the concept of socialisation has an important role in managing network relationships. The study of Cousins et al. (ibid.) provides evidence that

socialisation practices allow the buyer and supplier firms to establish common norms, and inter-personal linkages, which facilitate joint problem solving and informal integration, and, in turn, leads to improved performance. Such mechanisms as regular team meetings, supplier conferences, cross-functional teams, and collocation are recommended to managers as means of improving business outcomes (Cousins et al., ibid.).

In general, the main underlying motivation for performance measurement in the network environment is obviously performance improvement. Although the literature does not offer comprehensive results of empirical research concerning the use or benefits of a performance measurement system in a network, even though it is seen as an essential tool to successful network management (Kaplan et al., 2010). Busi and Bititci (2006) and Bititci et al. (2012) have identified the research gap related to how collaborative performance measures should be used to maximise the performance of collaborative networks and to optimise the performance of individual partners.

2.3.2 Assessing performance management in a collaborative network

Changes in the operating environment increase the requirements to make rapid and effective decisions in the absence of complete information (Barrows and Neely, 2011; Bititci et al., 2012). Therefore, there is a need for constant evaluation and understanding of the organisation's or the network's own performance to make it possible to achieve targets faster and more efficiency than the competitors can (Niemi et al., 2010; Aho, 2011). This means that collaborative networks and single organisations need a comprehensive performance measurement system including financial and non-financial measures, or they need to able to develop the existing measurement system further to meet these requirements. Hence, collaborative networks and single organisations have needs for models and tools that evaluate, refine, and develop performance measurement and management comprehensively to respond to the changing business environment (Niemi et al., 2009; Aho, 2011).

However, if existing measures are not used or they are used incorrectly, performance measurement fails to deliver any of the promised benefits to performance management (Busi and Bititci, 2006). Performance measurement is not an end in itself but rather a tool for more effective performance management. The results of performance measurement indicate what happened, not why it happened, or what to do about it. In order for an organisation to make effective use of their performance measurement outcomes and survive in a continuously changing business environment, they must be able to make the transition from measurement to management (Kaplan and Norton, 1996; Amaratunga and Baldry, 2002). Nudurupati et al. (2011)

have collected a list of problems that may cause inefficient use of performance measurement information in performance management:

- Performance measurement systems are historical and static, and they do not take account of dynamic and sensitive changes in the internal and external environment (Marchand and Raymond, 2008).
- Lack of support from a management information system results in complex and time-consuming data collection, sorting of maintenance, and reporting (Nudurupati and Bititci, 2005).
- People do not understand the objectives and potential benefits, or the management tends to use the performance measurement system as a command and control mechanism, hence disengaging people (Wisniewsky and Ólafsson, 2004; Davenport et al., 2010).
- Lack of effective communication means that the right information fails to reach the right people at the right time.
- Information is not shared or communicated throughout the organisation.
- Many information systems report only financial performance and do not provide adequate, up-to-date information on non-financial performance.

However, the real success lies in people's behaviour in using performance measurement information (Prahalad and Krishnan, 2002). Many studies indicate that the main reason why performance measurement is short-lived is because of people's behaviour with the information (Bititci et al., 2012). Meekings (1995) points out that making people use measures properly not only delivers performance improvement but becomes a vehicle for a cultural change, which helps in liberating the power of the organisation. As Bourne et al. (2005) pointed out that the full potential of performance management is rarely exploited in practices. For the future, Marchand and Raymond (2008) present some research questions that are important from the perspective of efficient use of performance measurement information: How can we ensure that the information matches the firm's environment, strategy, structure, and culture? How is information actually used in organisations? What are the advantages of using information?

The empirical research on performance measurement systems reveals many potential challenges when implementing or developing these measurement tools further in practice (see e.g. Letza, 1996; Bourne et al., 2002). It is obvious that effective implementation of a new performance system or further development of an old one may require more comprehensive approaches when trying to avoid potential obstacles and gain sustainable results (e.g. Kotter, 1996; Riis et al., 2001). An interesting question is whether it is possible to improve the ability that networks themselves have to adopt new or refine old management tools faster.

One manner to evaluate and development performance management is a maturity-model concept, which has been used widely in various management research fields (Bititci et al. 2012). For example, in the studies of Pascale and Athos (1981); Paulzen and Perc (2002); Niemi et al. (2009; 2010); Cocca and Alberti (2010); and Aho (2011), knowledge-maturity models have been applied to help organisational and managerial practices to accumulate and to utilise the knowledge in the organisation. The results of these studies reveal that it is possible to improve the ability of the organisations and networks themselves to adopt new techniques and tools and to refine old ones, such as the performance measurement system, faster. Not only should the organisation seek a fit with its environment but also, internally, the elements of the organisation should fit together to achieve high performance and the best utilisation of the allocated resources (Niemi et al., 2009; 2010).

According to studies related to knowledge accumulation (e.g. Bohn, 1994; Moore, 1999; Marshall and Mitchell, 2004; Niazi et al., 2005), knowledge development and accumulation can be categorised and described in distinct phases or stages. The literature (e.g. Marshall and Mitchell, 2004; Niazi et al., 2005; Aho, 2011) reveals that maturity models can be described as roadmaps for implementing practices in organisations, and their objective is to help improve the capabilities of an organisation in certain application or management areas. These existing models have been developed from the perspective of a single organisation, and the focus is on the software development process (e.g. Harter et al., 2000); project management process (e.g. Ibbs and Kwak, 2000); inventory management techniques (Niemi et al., 2009; 2010); and performance management from the point of view of information and knowledge management (Aho, 2011). Taking account of the relevancy of performance management in networks, the challenges related to performance management, and the need of more comprehensive performance measurement systems, there is a need for a knowledge maturity model for network-level performance management.

3 RESEARCH DESIGN

3.1 Research gap and questions

This section describes the research gap to which this research aims to contribute, and the research objective and detailed research questions are presented. The underlying motivation for this research is to provide new understanding of measuring and managing performance in a collaborative network. Performance measurement and management in private organisations, as well as in the public sector is a topic that has been studied a lot during the last decades (Nudurupati et al., 2011; Bititci et al., 2012; Franco-Santos et al., 2012). There is both theoretical and empirical research on the design, implementation, and use of performance measurement systems (e.g. Kaplan and Norton, 1992; 1996; Neely et al., 1995), as well as various frameworks of organisational performance (e.g. Kaplan and Norton, 1996; Simons, 2000). In addition, issues related to performance measurement and management in a collaborative network have been examined in various studies which examine the topic especially from the perspectives of measurement challenges (Busi and Bititci, 2006; Cocca and Alberti, 2010) and the characteristics of performance measurement systems (Bititci et al., 2005; Saiz et al., 2007). Yin et al. (2011) emphasise that there is a lack of empirical research focusing on network performance.

Despite the increasing focus on collaboration, the existing literature in the area of performance management is still narrow in the area of networks, and their internal processes (Busi and Bititci, 2006; Kaplan et al., 2010; Yin et al., 2011; Bititci et al., 2012; Franco-Santos et al., 2012). The study of Kaplan et al. (2010) emphasises that the role of performance measurement in a collaborative network is to help companies create better alignment with their collaboration partners. They note that a network-level performance measurement system can help networks to enhance their management focus from contribution and operations to joint strategy and commitment. The study of Bititci et al. (2012) suggests that future research should focus on the understanding of collaboration and its mechanisms. By developing theories, methods, tools, and techniques, it can be ensured that network partners can clearly define and manage common goals, objectives, and responsibilities.

Busi and Bititci (2006) also highlight the need for researching and developing a structured methodology to design a performance measurement system as well as a structured management process for using measures to support decision making in collaborative networks. The results of Yin et al. (2011) support the results of Busi and Bititci (2006) by emphasising that there is limited research concentrating on collaborative design, especially from the design process perspective. In addition, Franco-Santos et al. (2012) argue that in the existing literature, too little attention has been paid to the impacts and use of performance measurement systems on network

performance. Thus, there is a lack of research examining measurement system development in a collaborative network.

There may be several reasons for the research gap. Collaborative networks can be very complex, which increases the challenges in the design and management of such business (e.g. Lambert and Pohlan, 2001; Busi and Bititci, 2006; Morgan, 2007). Moreover, lack of commitment and trust, unrealistic objectives, and challenges in identifying competitive advantages have affected the success of collaboration and its development (see e.g. Bititci et al., 2007). To summarise, there is a clear research gap and practical need regarding performance measurement and management in a collaborative network. Empirical studies in the area are needed. *This research contributes to the existing discussion of performance measurement and management in the context of a collaborative network.*

This research *examines the development and uses of a performance measurement system supporting performance management in a collaborative network*. The research is examined at the network level and at the single network partner level. The structure of study follows mainly the commonly known phases of the development of performance measurement systems, which include the design, implementation, and use of a performance measurement system (cf. Bourne et al., 2000; Neely et al., 2000). First, the research focuses on the design process of a network-level performance measurement system. Second, the whole design process is evaluated, and the factors affecting the design process are identified. Third, the research evaluates the uses of performance measurement information in the management of a collaborative network and a single network partner. Finally, the study continues by focusing on questions of how the state of performance management can be evaluated in a collaborative network. Consequently, this research focuses on two main research questions which are divided into subquestions:

1. How to design a performance measurement system for a collaborative network?

a) How can a performance measurement system for a collaborative network be designed?

b) What factors affect the process of designing a measurement system?

2. How to manage performance in a collaborative network?

a) What kinds of uses for measurement information can be identified at different parts of a collaborative network?

b) How can performance management be evaluated in a collaborative network?

3.2 Scope of the research

This research is carried out in the field of industrial management and engineering. One of the main research themes in this branch is management accounting. The research contributes to the performance management and measurement literature, which is a field of management accounting research (Kaplan and Atkinson, 1998; Malmi and Brown, 2008). Management accounting refers to a collection of practices or activities, including collection, classifying, processing, analysing, and reporting information to managers (Kaplan and Atkinson, 1998; Chenhall, 2003). Management accounting is supported by various management accounting and management control systems, for example a performance measurement system which helps to achieve the organisational goals of the company.

There are usually a number of management accounting systems in operation in a single company, as well as in a network. Malmi and Brown (2008) present a conceptual typology describing a broad model of a management control system as a package. The five types of control in their typology are described as follows: *administrative control* systems, which include organisational design and structure, governance structures, and procedures and policies; *planning control*, which focuses on long-range planning and action planning; *cybernetic control*, which includes budgets, financial measures, non-financial measures, and hybrids that contain both financial and non-financial measures (e.g. Balanced Scorecard); *reward and compensation control*, which includes systems that motivate and increase the performance of individuals and groups by creating congruence between the goals of the employees and the company; and *cultural controls*, which can be defined as 'the set of values, beliefs and social norms which tend to be shared by its partners and, in turn, influence their thoughts and actions'. This management control system package helps to focus the management control system research and interpretation of the results (Malmi and Brown, 2008).

Based on the control package of Malmi and Brown (2008), the existing network research has focused on financial measures, especially the cost management and accounting perspectives (e.g. Ellram, 2002; Kulmala, 2003; Håkansson and Lind, 2004; Tenhunen, 2006). In addition, Dekker (2004), and Pisano and Verganti (2008) have studied administrative controls by examining the control and hierarchy of inter-organisational relationships. The studies of Batt (2008) and Baxter and Matear (2004) focus on cultural controls, such as trust and social capital of networks. The present research focuses on cybernetic controls, especially hybrid measures in the collaborative network context. The other controls of the control package are excluded from this research. However, reward and compensation controls are often linked to cybernetic controls, especially performance measurement and measurement systems (Malmi and Brown, 2008). In this research rewarding is not specifically addressed, even though it is mentioned in some of the articles.

Linking the measurement system to rewarding is a complicated, challenging, and wide theme in itself, and that is why it is excluded from this research.

The research focuses mainly on the design process of measurement systems, the elements that affect the design process, the use of performance measurement information in performance management, and the evaluation of performance management. Busi and Bititci (2006) propose that a collaborative performance measurement system should evaluate both local and network-wide measures in order to maintain the relevance and effectiveness of the collaborative network. Hence, the study examines these themes on both the collaborative network level and single network partner level, as the earlier literature has suggested (Caplice and Sheffi, 1995; Busi and Bititci, 2006).

Because of the managerial perspective of this study, the internal use of measurement in the network, rather than external reporting, is investigated. The design process of the performance measurement system concentrates primarily on satisfying the information needs of the network partners, and not on the satisfaction of the stakeholders' information needs, as the Performance Prism (Neely et al., 2002) proposes.

The research focuses on the positive factors and uses of performance measurement that facilitate and improve the design of a performance measurement system and performance management in a network. The study could also have focused on the negative factors and uses of performance measurement and the elements that hinder the design process of a performance measurement system and performance management in networks. However, the research in the area of network-level performance measurement emphasises the research gap related to the factors that facilitate and improve performance measurement and management in the network environment, which justifies the scope of the current study (e.g. Bititci et al., 2012; Franco-Santos et al., 2012).

The case setting inevitably affects the scope of this research. The empirical context of this study is a collaborative network manufacturing and selling kitchen fitments. This means that the results of the study are of limited use in other kinds of networks, such as more complex supply chain networks.

3.3 Empirical context

This section describes the empirical context of this study and the aims of the practical development work. The research was carried out along with two research and development projects during the years 2008-2010. In addition, complementary interviews concerning the

specific themes were conducted in 2011-2012. The author acted as the main researcher and project manager in both research and development projects. The initiative for the development work came from the studied network. A lack of performance information and a comprehensive performance measurement system has caused unexpected financial challenges for some of the network partners. Hence, the studied network had a practical need for a tool that would evaluate the performance of a single network partner as well as the entire collaborative network. A network-level performance measurement system was recognised as a suitable tool to manage and develop the performance of the collaborative network. This setting enabled various research activities to be linked to the practical development work. In the research tradition of industrial management, this kind of practically-oriented research projects are typical. Hence, the action research approach (see 3.4.2, research methods and data) was chosen to gain access to relevant empirical data and to increase the in-depth understanding of this specific setting.

The empirical data of the research was gathered in a collaborative network that operates nationwide in Finland. The collaborative network consists of a leading partner that manufactures kitchen fitments and partner companies that sell these products to the end-customer. The leading company transports these products to the end customers, and invoices the end customers. As a whole, the leading partner has four trademarks and five selling concepts (i.e. brands). Every trademark has its own selling concept, and there are also selling concepts which sell three of these trademarks. The network partners collaborate with the leading partner by selling the products under five selling concepts. The main company is a part of a larger international consolidated company, and the reselling network partners can also connected to other networks, but this research is limited to the collaborative network level.

The empirical data has been gathered from the partner companies that operate under two different selling concepts (further on called *reselling network 1* and *2*), and from the leading partner. Reselling network 1 operates inside hardware stores where they have their own selling points. There are in total 23 resellers and 28 reselling units in this reselling network. Typically, these reselling units consist of the reseller and 1-3 seller(s). The resellers are independent entrepreneurs and owners of the reseller unit. The owners are responsible for the financial success and operations of their businesses. They might have other businesses along with this business, but the additional businesses are not studied in this research. In this reselling network, most of the sellers are also independent entrepreneurs. This network has one kitchen fitment brand that they sell to end customers. The partners of reselling network 2 operate in their own stores, and they have three brands that they sell in 14 selling points around Finland. In this network, the reselling points consist of resellers (i.e. owner) and 2-20 sellers, depending on the size of the city where they operate. Almost all of the sellers work as hired employees.

There is a contract between the leading partner and the reselling partners. The contract is a loosely adapted franchising concept in reselling network 2. Franchising is a method where an independent operator practices and uses another person's business philosophy (Campbell et al., 2009; Sherman, 2011). The franchisor grants the independent operator the right to distribute its products, techniques, and trademarks for a percentage of gross monthly sales and a royalty fee. Various tangibles and intangibles, such as advertising, training, and other support services are typically made available by the franchisor (Campbell et al., 2009; Sherman, 2011). In reselling network 1, the contract is not as tight as that in reselling network 2. The contracts have the same features, such as franchising contracts and common brand and trademarks, but it differs from the traditional franchising concept in many ways, which are illustrated in figure 1 below.

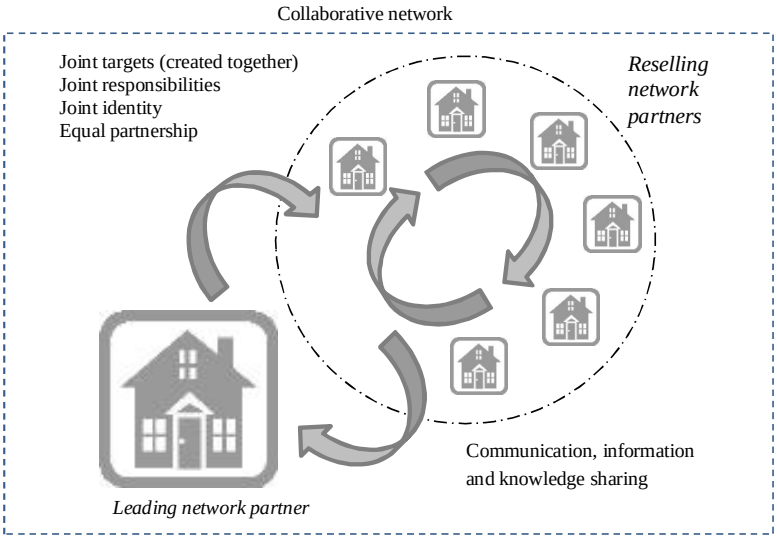


Figure 1 Description of the studied collaborative network

The reselling partners sell kitchen fitments, which are very challenging to sell, because the sales action is unique in each customer service process. Buying a kitchen is an expensive investment, and there are plenty of different variations, as well as tastes and needs, that affect the selling process. The selling process requires strong expertise and knowledge regarding the collection, design, and installation. For the above reasons, the collaborative network – the leading partner and the selling partners – have a strong and shared identity and joint targets, and they collaborate around many issues; for example, on collection and marketing planning (see figure 1). The

leading partner is in a more equal role with the reselling partner compared to the traditional franchising concept. The challenging selling process offers many opportunities to learn from the other partners of the network. The collaborative network has many plans in common, regarding, for example, the action plan and marketing, and they share the risk around these issues. They also have a joint information system, where they are able to participate in the design process. The network also has a common target to maximise the turnover of the entire collaborative network. On the basis of the above facts, it can be stated that the studied collaborative network covers very well the different criteria, such as joint process, information sharing, and the resources and responsibilities to plan, implement, and evaluate the activities to achieve a common goal of the network (cf. Camarinha-Matos et al., 2009).

3.4 Research methodology

3.4.1 Research approach

This section describes the overall research approach of this study. The specific methodological issues and choices are described in the next subsection and the five individual articles. As the methodological literature (see e.g. Yin, 2009) explains, the research approach should be selected after the research questions have been formulated. However, access to research data, available resources, and the background of the researcher influence the choice of the approach.

The primary focus of management studies is to give theoretically grounded recommendations and solutions to the specific problems of a specific company or industry (Kasanen et al., 1993; Gummesson, 2000). Management studies typically try to understand and improve the performance of a business. The methodological literature (see e.g. Gummesson, 2000; Metsämuuronen, 2005; Hirsjärvi et al., 2007) states that management research can be characterised in many ways, such as hermeneutical and positivistic, qualitative and quantitative, and descriptive and normative. These different characterisations are often presented as contrasts to each other, but they are not mutually exclusive, and they can complement each other.

The main differences between the positivistic and hermeneutic paradigms are that positivistic research focuses on description and explanations, and statistical and mathematical techniques are used in data analysis, whereas hermeneutic research concentrates on the understanding and interpretation of a phenomenon. The data is primarily nonquantitative in hermeneutic research (Gummesson, 2000).

Another possibility is to draw a distinction between qualitative and quantitative research. Quantitative research often represents positivistic thinking, and qualitative research is typically related to hermeneutics thinking (Gummesson, 2000). Quantitative research is related to testing and verifying hypotheses and earlier theories rather than understanding a phenomenon (Hirsjärvi et al., 2007). Typical characteristics of quantitative research are, for example, earlier theories, hypotheses, focus on the facts, result orientation, and statistical analysis (see e.g. Hirsjärvi et al., 2007). In qualitative research, the research questions focus on increasing understanding of a particular issue, and the questions are 'why' and 'how' questions (Yin, 2009). According to Hirsjärvi et al. (2007), the starting phase in qualitative research is to describe real life, including the idea of variety of reality and the real world. Qualitative research is very useful in the field of management research, because business and management deals not only with organisations but also with the people in them. However, there are some challenges that should be taken into account in qualitative research: access to reality, pre-understanding and understanding, and the quality of the research (Gummesson, 2000).

Descriptive research aims to illustrate certain phenomena (e.g. by creating concepts, describing processes, classifying phenomena and presenting correlations). Normative research aims to identify results that may be used as instructions for developing operations and designing new constructs (Olkkonen, 1994).

Case research has consistently been one of the most powerful research methods in the field of management research and, particularly, in the development of new theory (Voss et al., 2002). The case study is a research strategy that focuses on creating understanding of a certain phenomenon (Eisenhardt, 1989). The case study method is used in many situations to contribute to knowledge of individual, group, organisational, social, political, and other related phenomena (Yin, 2009). Voss et al. (2002) cite three strengths of case research:

1) The phenomenon can be studied in its natural setting, and meaningful and relevant theory can be generated from observing and understanding actual practice.
2) The method allows the questions of why, what, and how to be answered with a relatively full understanding of the nature and complexity of the complete phenomenon.
3) The case method is useful when the variables are unknown and the phenomenon not fully understood.

In addition, case studies can be used for different types of research purposes. Voss et al. (2002) divide the uses into the following parts: exploration, building, testing, and extension or refinement of theory. Yin (2009) distinguishes three types of uses of case study research: exploratory, descriptive, and explanatory. According to Yin (ibid.), most case studies are

exploratory, where a pilot study is used as a basis for formulating more precise questions or testable hypotheses. The descriptive case study is an attempt to describe a phenomenon by finding answers to who, what, when, and where questions rather than why questions. Explanatory research tries to account for forces that cause a certain phenomenon to occur. An explanatory research calls for higher order of inference and may also include prediction (Yin, 2009).

Case studies can involve either single or multiple cases at numerous levels of analysis (Yin, 2009). A single case may enable the creation of complicated theories, as theory can be fitted exactly, to many details of a particular case (Eisenhardt and Graebner, 2007). However, a single case study can include several units of analysis inside of the case (Eisenhardt and Graebner, 2007). Multiple cases can be used for investigating the same issue in a variety of contexts. It is possible to achieve a more robust, generalisable, and testable theory with multiple cases (Eisenhardt and Graebner, ibid.). Case studies typically combine such data collection methods as archives, interviews, questionnaires, and observations (Eisenhardt, 1989). The evidence may be qualitative, quantitative, or both.

This study can be characterised as a qualitative single case that consists of two units of analysis (reselling networks 1 and 2). There were many reasons for selecting this case study research approach. The starting point for this study was the research and development projects described in an earlier section. In the beginning of the project, it became obvious that the existing literature did not, as such, support development work carried out in a collaborative network. Hence, for practical solutions, there was a need to make a contribution to the research. Yin (2009) presents a five-point rationale for single case design. The first rationale for a single case study is when it presents the critical case in testing a well-formulated theory. The second rationale is where the case represents an extreme or a unique case. The third rationale is that the case is a representative of a typical case. The fourth rationale for case study is that the case is revelatory, and the fifth is that the case is longitudinal. Based on these rationales, the case of this research can be seen as a unique case, because earlier literature does not offer solutions or recommendations for this environment. The research project offered much-needed access to examine the research objective in a unique case environment. The research project was also longitudinal because the case was studied at different points in time.

As mentioned above, performance measurement and management is an extensive challenge in the network environment. Qualitative research is suitable for examining complex issues and phenomena (Yin, 2009). It was clear that the quantitative research approach would not meet the objectives of this research and the requirements of the practical field. This research has also clear

normative features, which is natural when discussing new management models and systems. Case research enables appropriate testing of a measurement system and its design process in practice.

3.4.2 Methods and data

This section describes the methods used in gathering and analysing the empirical data in this study. Table 2 presents the main empirical research tasks carried out in 2008-2012. A detailed description of the methods used in this research is presented next.

Table 2 Summary of the empirical data

	Number of units in the data	*Period*	*Qualitative data*	*Analysis methods*	*Role of the researcher*
A Interview 1	12 interviews	Certain situation (11-12/2008)	Recorded and transcribed interview data	Content analysis, cross-analysis	Empiricist (outside)
B Action research study 1	12 participants	Around the year (2009)	Coded observations, discussions, and results of the development project	Content analysis	Main facilitator in the development project (inside)
C Interview 2	12 interviews	Certain situation (12/2009)	Open-question survey and recorded and transcribed interview data	Content analysis, cross-analysis	Empiricist (outside)
D Action research study 2	6 participants	Around the year (2010)	Coded observations, discussions, and results of the development project	Content analysis	Main facilitator in the development project (inside)
E Interview 3	9 interviews	Certain situation (4/2010)	Recorded and transcribed interview data	Content analysis, cross-analysis	Empiricist (outside)
F Interview 4	3 interviews	Certain situation (4/2012)	Recorded and transcribed interview data	Content analysis, cross-analysis	Empiricist (outside)

Interviews

Interviews are an efficient way to gather rich and wide empirical data (Eisenhardt and Graebner, 2007). Interviews were used in different phases of this research. The interview study examined the network and collaboration as a phenomenon, the success factors, and the challenges in performance measurement, as well as the needs related to measurement information in the network environment. The first interview was carried out at the beginning of the research. The second interview study was conducted in order to evaluate the uses and functionality of the network-level performance measurement system developed in the first action research study process. This interview study was realised by utilising a group interview. The third interview was conducted in year one of the first action research project. The interviews focused on the development of the network after starting the use of the network-level performance measurement

system. The fourth interview study evaluated the role and use of the network-level performance measurement information on a more strategic level of management.

The interviewees of the first interviews were eight reseller representatives from reselling network 1, and four managers from the leading company. In order to gain a comprehensive understanding of the issue, the interviewees were all the key persons from the leading company and a selected group of resellers, some of whom were older resellers, some younger, and some had performed better economically than others. The 12 interviewees were interviewed individually. The interviews were carried out by the author, supported by another researcher in two of the interviews. The themes of the interview were sent beforehand to the interviewees to increase the validity of research. The interviewees were given the possibility of thinking about their answers before the interviews. The duration of one interview was approximately one and half hours. All of the interviews were sound recorded, and a professional transcription company transcribed the interviews. The two researchers analysed the data by utilising codes to analyse the contents of the interviews.

The coding frame of this research was classified into three parts. The first part was related to the network and collaboration phenomenon (e.g. determining what the main challenges and problems in the networked way of doing business are and how the network should be developed in the future). The second part dealt with the issues related to the current state of performance measurement and measures (e.g. the current utilisation of measurement information and its role in management). The third part concerned the needs related to network-level measurement (e.g. what purposes it should support and what are important criteria for the measurement). The questions were chosen due to the goal of developing a network-level performance measurement system. The first interviews were also a pre-step to the action research process to increase understanding of the context and the purpose for the action research process. It was also important to understand not just the measurement targets of the network but also the needs related to measurement. Hence, it was highly important to understand the phenomenon and problems in network measurement in order to solve or improve at least some of them.

The second interview study was conducted by utilising a group interview. The same participants took part in this group interview as in the first interviews. The second interview can be divided in two parts. The first part dealt with the changes and development issues of the developed performance measurement system, including the relevance and practicality of the system. The second part was related to the benefits and uses of the system. Before the group interview, the participants filled in a questionnaire (open-ended questions) containing the same questions as in the interviews. After that the same questions were asked in the group interview. The purpose of

this procedure was to increase the validity of the group interview. The duration of the group interview was two hours. The interviewed participants had been involved in the network-level performance measurement system development and implementation process, and, therefore, they had a comprehensive view of the studied aspects. The interview was carried out by two researchers. The other researcher had not been involved in the development of the measurement system. The group interview was sound recorded, transcribed, and analysed by using codes as in the first interviews.

The third interview study focused on the impacts of the network-level performance measurement system on the collaborative network after starting to use the network-level performance measurement system. The interviews focused on the management attributes of the OSSIC maturity model (Organisation, Systems, Skills, Incentives and performance measurement, and Culture and leadership), and the results of the interviews were also coded by using these five attributes. The interviewees were the ones who were involved in the development project of the measurement system. There were two participants from the leading company, and seven from reselling network 1. The interview themes were sent to the interviewees before the interviews. The interviews were sound recorded and transcribed.

The interviewees of the fourth interview study represented top-level decision making in the main company of the network. Three managers were interviewed as a group. The duration of the interview was two hours. The semi-structured interview focused on the role of network-level performance measurement information in management. The aim of the interview study was to examine the role of network-level measurement information in the management of the leading company and what measurement information the top management uses to support their decision making. The group interview was sound recorded and transcribed, and the data were analysed by utilising codes based on the two research questions of article IV.

All the interviews of this research were analysed by using codes formed on the basis of the research questions in the articles. Analysing the data by using codes runs parallel with the content analysis method by Miles and Huberman (1984). Data analysis is defined as a process of systematically searching and arranging interview transcripts, field-notes, and other materials that have been used to increase the understanding of them to help present what has been discovered to others. According to Miles and Huberman (ibid.), data analysis consists of three activities which occur concurrently. Firstly, data reduction refers to a process of selecting, simplifying, abstracting, and transforming raw case data. Secondly, data display refers to an organised assembly (by coding) of information to enable the drawing of conclusions. Thirdly, conclusion

drawing or verification involves drawing meaning from the data and building a logical chain of evidence.

The purpose of content analysis is to produce knowledge, new insights, a representation of facts, and a practical guide to action. The method has received critique in the quantitative field, which considers that the technique is too simplistic and that it does not lend itself to detailed statistical analysis. Despite the criticism, content analysis has an established position in management research, and it offers researchers several major benefits, it can be used, for instance, to develop an understanding of the meaning of communication, and to identify critical processes (Tuomi and Sarajärvi, 2002). In this research, the selected codes were mainly based on the research questions and the results of the literature review as well as on the existing frameworks and models. This may be referred to as theory-based qualitative content analysis (Tuomi and Sarajärvi, 2009; Miles and Huberman, 1994). The data of interviews 1, 2, and 3 were analysed separately by two researchers by using the codes; next a common view was discussed; and then the final results were elaborated on.

Action research studies

A great part of the empirical data of the research was gathered from two separate action research studies. According to Gummesson (2000), action research is the most demanding and far-reaching method of doing a case study. It is a method in which a researcher participates in an organisation's activities and examines an ongoing situation. Action research always involves two goals: to solve a problem and to contribute to science (Avison et al., 2001; Coughlan and Coghlan, 2002). Actually, action research is a process of joint learning in which the researcher is not solving the problem for others but produces results that are relevant to practitioners, that are applicable to unstructured or integrative issues, and that contribute to theory (Westbrook, 1995). Action research not only investigates and improves management practices but also develops managerial competences of those who are involved in the research. Action research can also include many types of data gathering methods (Avison et al., 2001; Coughlan and Coghlan, 2002).

In action research, the researcher may have different roles (Avison et al., 1999; Gummesson, 2000). In the action research process, researchers are like outside agents who act as facilitators of the action and reflection with an organisation. The action researcher acts as an external helper to the case organisation. The researcher helps the case organisation to inquire into their own issues and to create and implement solutions. The role of the researcher is not only that of an observer but also of an expert making recommendations. Observation is a key feature in action research, along with interviews and questionnaires (Coughlan and Coghlan, 2002).

Coughlan and Coghlan (2002) divide the action research cycle into three main steps. The first step is a pre-step which defines why the project is necessary and identifies what the economic, political, social, and technical forces driving the need for action. The complementary pre-step is to ask what the rationale for the research is, why it is worth studying, and what contribution it is expected to make to knowledge. The second step consists of six more detailed steps: data gathering, feedback and data analysis, and planning, implementing and evaluating action. The third step is a meta-step, meaning that each action research cycle leads to another cycle, and so continuous planning, implementation, and evaluation take place over time. Hence, the opportunity for continuous learning exists (Coughlan and Coghlan, ibid.).

Action research does not have to justify itself in relation to alternative epistemologies and research approaches. In order to maintain validity, action researchers must consciously and deliberately determine the action research cycles, test their own assumptions, and predispose their assumptions to public testing (Coughlan and Coghlan, 2002). Another typical criticism of action research is related to the lack of rigor and the labelling of consultant projects as research. Gummesson (2000) presents four ways in which consultancy and action research differ:

1) Consultants who work in an action research process are required to be more rigorous in their research and documentation.
2) Researchers require theoretical justifications, whereas consultants require empirical justifications.
3) Consultants work under tighter time and budget constraints.
4) Consultation is frequently linear: engage, analyse, act, and disengage. In contrast, action research is cyclical: gathering data, feeding it back to those concerned, analysing the data, planning action, taking action, and evaluating, leading to further data gathering.

In this research, action research was carried out in interactive workshops in which the new measurement systems were mainly designed. The length of one workshop was typically from three to four hours. The author and a researcher colleague, 2-3 persons from the leading partner, and 6-8 resellers from the reselling network attended the workshops. The author acted as the main facilitator of the design process with the researcher colleague. The role of the facilitator was to present a different starting point to measurement from that found in the literature and to ask questions, guide the working in the workshop, direct the discussions, and design workshops.

Action research study I started at the end of 2008 and lasted for 13 months. The network-level performance measurement system was developed in the context of the collaborative network. This work started with interviews (interview study 1) on network measurement as a phenomenon and the identification of the purposes and requirements for measurement. The results of the

interviews generated the pre-understanding on the state of the network and its challenges, focusing on the measurement. The same interviewees also participated in the action research process. There were four managers from the leading company and eight resellers from reselling network 1. The second phase was explored and evaluated by various measurement frameworks, methods, and models in relation to the identified requirements. Based on the results of interview study and experiences of existing frameworks and model, the measurement dimensions were selected. In the third phase, the participants ideated measures relating to these measurement dimensions. After that they selected final measures and evaluated the validity of measures. Finally, the performance measurement system was pre-implemented with a pilot group and then with the entire collaborative network. The pre-implementation involved test calculations, training sessions, and development of an Excel tool and a Customer Relationship Management (CRM)-tool to support performance measurement. The development work required five workshops. After the pre-implementation phase, feedback, comments, and development needs were gathered through interviews (interview study 2 and 3), and, after the corrections and updates were made, the updated measurement system was implemented to the entire reselling network 1.

Action research study II started in January 2010 and lasted for 12 months. In this process, a network-level performance measurement system was developed for reselling network 2. The reasons for dual examination was that the reselling units of this reselling network were larger than in the first action research study, and the developed design process for the network environment had to be tested. The main purpose of this study was to increase the understanding of testing the developed design process and the network-level performance measurement system.

With both action research studies, the implementation of the measurement system was supported by training sessions addressed to all the partners of the collaborative network. All the results, observations and discussions of the 10 workshops were well documented for research purposes. There was also a steering group in the first study. Its role was important in supporting the development work. The steering group included three researchers (the author, another researcher, and a professor), one outside participant, two representatives of the leading company (sales manager and sales director), and one representative of the reselling network (reseller).

3.5 Research structure

This research consists of five research articles in which different perspectives and methods have been used. Figure 2 summarises the relationships between the articles and the research questions. The main contribution of this research can be found in the articles which are briefly summarised below.

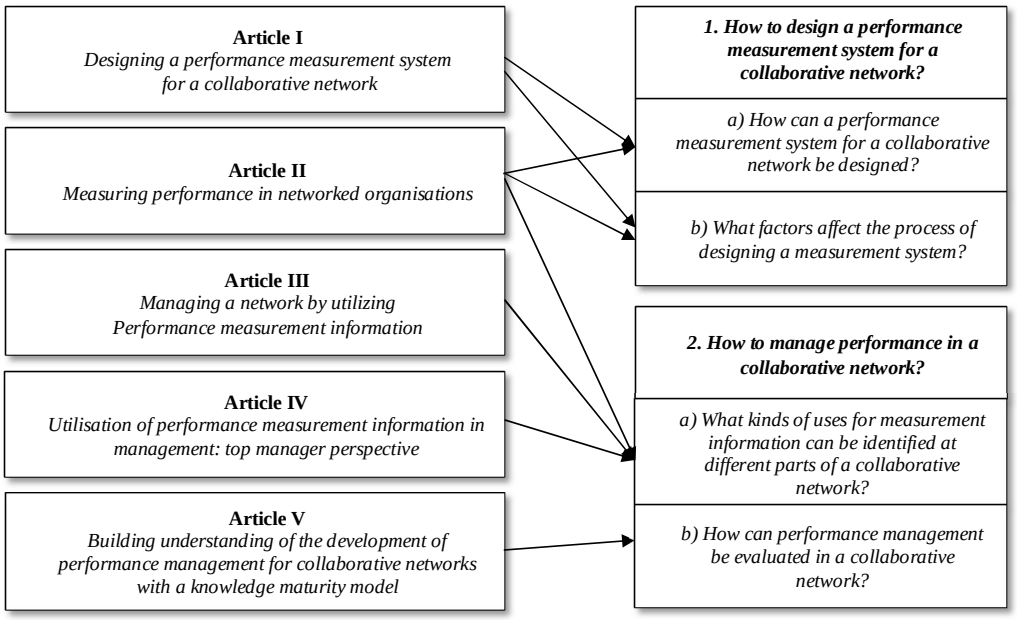


Figure 2 Composition of the articles

The five papers form the main part of the contribution of this research. Summaries of the publications are presented below:

I Designing a performance measurement system for a collaborative network
Pekkola, S. and Ukko, J.
Submitted (2013) to *International Journal of Operations & Production Management*

The paper presents a case study for the design of a performance measurement system for a collaborative network. The objective of the study is to clarify how the three-phase design process works, and what the essential and notable aspects in this process are. The study concludes by noting that the examined design process enables the defining of an appropriate and balanced set of measures for collaborative performance measurement in a way that covers all the essential value generators. The presented approach also allows the evaluation of the health of the collaboration both before and during the design process.

II Measuring performance in networked organisations
Pekkola, S. and Ukko, J.
Management Service, 2011, Summer, pp. 14-23.

The paper describes the comparison of two network-level performance measurement systems, and it identifies the main differences between these two systems. The results of the study are based on two wide action research processes and one interview study. The study reveals that the same measures are used in both collaborative networks, but the use and focus of network-level performance measurement information is emphasised differently in the studied collaborative networks, i.e. the network-level performance measurement information has been utilised more in human resource management in a larger network partner than in smaller ones.

III Managing a network by utilizing performance measurement information
Pekkola, S.
Measuring Business Excellence, 2013, Vol. 17, Iss: 1, pp. 72-79.

The paper illustrates how a collaborative network utilises performance measurement information in collaborative network management. The study focuses on uses which can be perceived in the operations and management on the network-level and on the level of a single network partner. The empirical data of the study have been gathered by utilising the action research process in the design of a network performance measurement system and its implementation phase, and through interviews conducted a year after the implementation of the network-level. The results of the study reveal that the use of the network-level performance measurement system increased communication, trust, and commitment in the collaborative whole network, as well as in a single reselling partner. The performance measurement information also helped the companies create better alignment with their alliance partners.

IV Utilisation of performance measurement information in management: top manager perspective
Pekkola, S. and Rantanen, H.
International Journal of Business Performance Management, accepted for publication

The main purpose of the study was to analyse the role of performance measurement information in top management, and what performance measurement information the top managers use in decision making. The study contributes to the current understanding by

suggesting the promotion of active use of performance measurement information. The research focus of this study was on the top management of the main company. The results of the study contribute to the current understanding by analysing how performance measurement information has been utilised in the top-level management of the leading company, and it goes a step further by studying the utilisation of performance measurement information in management.

V Building understanding of the development of performance management for collaborative networks with a knowledge maturity model
Pekkola, S., Niemi, P. and Ukko, J.
International Journal of Networking and Virtual Organisations, Vol. 12, No. 3, pp. 179-200.

The aim of the study was to examine how the maturity model OSSIC works in the context of performance management and a collaborative network. The study also generated contents for management attributes from the network perspective. The study was a single case consisting of a leading partner and the reselling partners, forming a collaborative network. The empirical study was based on interviews and the action research process. The results of the study reveal that the OSSIC maturity model is a suitable approach for the adoption of a network-level performance measurement system for several reasons. The use of the modified version of the OSSIC model helps to observe the development issues concerning performance management in a wider scope. The results also emphasise that the essential attributes for the successful adoption of a network-level performance measurement system are the network culture and the skills of the participants.

Co-operation is a typical way of carrying out research. Four of the papers of research were written in co-operation with other authors. Table 3 describes the role of the author of this research in each of these papers.

Table 3 Role of the author in the co-authored papers

Article	Role of the author
I Designing a Performance Measurement System for a Collaborative Network	• Made the research plan with the co-author • Conducted the interviews • Worked as the main facilitator in the action research process • Analysed the data with the co-author • Coordinated the writing of the paper • Wrote and reviewed the paper together with the co-author
II Measuring Performance in Networked Organisations	• Made the research plan • Worked as the main facilitator both action research processes • Analysed the data • Coordinated the writing of the paper • Wrote and reviewed the paper with the assistance of the co-author
IV Utilisation of performance measurement information in management: top manager perspective	• Made the research plan with the co-author • Conducted the interviews • Analysed the data • Coordinated the writing of the paper • Wrote and reviewed the paper with the assistance of the co-author
V Building understanding of the development of performance measurement systems for collaborative networks with a knowledge maturity model	• Make the research plan with the co-authors • Conducted the interviews • Worked as the main facilitator in the case study • Analysed the data with the co-authors • Coordinated the writing of the paper • Wrote and reviewed the paper together with the co-authors

4 RESULTS

4.1 How to design a performance measurement system for a collaborative network?

4.1.1 How can a performance measurement system for a collaborative network be designed?

The prior research in the area presents a number of challenges that hinder the design and implementation of a performance measurement system in a collaborative network. These challenges have been derived from multiple approaches (discussed in section 2.2.2, challenges in performance measurement) without a clear outline of solutions or guidelines to meet these challenges. However, the literature (see e.g. Beamon, 1999; Leseure et al., 2001; Varamäki et al., 2008) presents some frameworks and models for network-level performance management and measurement, but it has been criticised that these frameworks and models are quite theoretical and difficult to operationalise for practical purposes. The lack of empirical results and elaborated explanations of how these challenges can be managed and facilitated in collaborative networks call for qualitative in-depth research (Busi and Bititci, 2006). Qualitative research is a way to increase understanding of how performance measurement can be organised in collaborative networks.

A number of authors have presented a research need for a structured process for the design of a performance measurement system for a collaborative network (e.g. Busi and Bititci, 2006; Yin et al., 2011; Bititci et al., 2012; Franco-Santos at al., 2012). The present research presents a structured design process for a network-level performance measurement system. The construction of the process is described and discussed case-specifically in article I, and the results of the testing of the design process are presented in article II.

Taking into account the presented challenges and earlier proposals for the design process, a three-step design process for a network-level performance measurement system is presented (figure 3). Prior literature (Kulmala and Lönnqvist, 2006; Francisco and Azevedo, 2007; Varamäki et al., 2008) presents some guidelines and suggestions for the perspectives of measurement and the levels of the measures (Lambert and Pohlan, 2001; Busi and Bititci, 2006), but the earlier research does not propose and discuss what would be the suitable development approach for the development of measurement in a collaborative network. For example, Kaplan and Norton (2001) reveal that one of the main reasons for the failure of performance measurement system development projects is that the design work has not been done at an appropriate level of organisation (i.e. the performance measurement systems are often designed by individuals other than their actual users or performance measurement system projects are kept on the top).

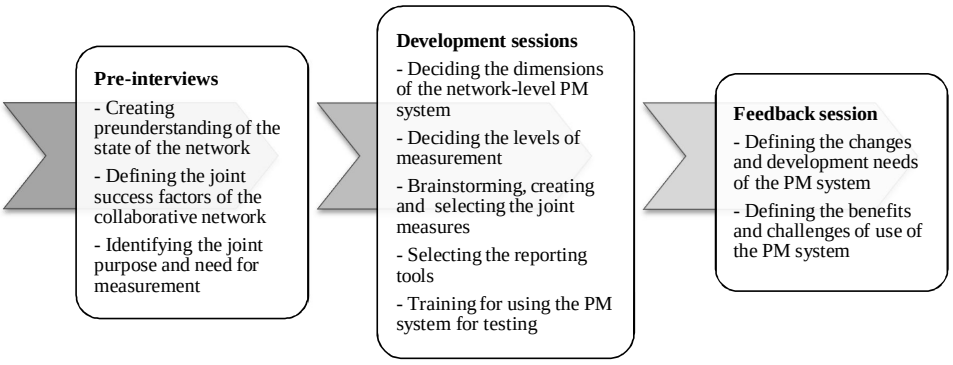


Figure 3 Performance measurement (PM) design process for a collaborative network

This study presents a horizontal performance measurement design approach to develop a measurement design process for a collaborative network. The horizontal approach means that a broad range of network partners have participated in the development work. The work has not been carried out only from the perspective of the leading partner and a few selected partners of the collaborative network, or by a top-down approach in which the leading partner has the main role of the design process. The horizontal approach helps to create a view of the structures and dynamics of the collaborative network, and the actual joint purposes and needs of the measurement are more reliable and comprehensive than the views of only a few network partners.

The first step of the design process is conducting pre-interviews, which have a significant role in the success of the design process of a network-level performance measurement system. This step can be the one of the key contribution to existing literature of performance measurement system design process. The pre-interviews phase provide four key benefits to the design process: firstly, pre-interviews work as a tool aiming at analysing and creating pre-understanding of the state of the collaborative network's dynamics, structures, vision, and targets, and performance management and measurement. The networks can be very complex systems, so it is important to understand the structures and dynamics and to make sure that the network partners have joint understanding of the vision and targets (cf. Lambert and Pohlan, 2001; Busi and Bititci, 2006). However, if the maturity of collaboration (cf. Camarinha-Matos et al., 2009) is at a lower stage, in which collaboration is defined as a network or a coordinated network where collaboration does not have joint goals or responsibilities, the partners of the collaboration should focus on creating the joint goals and identifying the joint responsibilities. After that the network-level performance measurement system can be designed. Based on that, it can be suggested that collaboration should at least be defined as a cooperative network (cf. Camarinha-Matos et al., 2009) before the

network should start the design of a comprehensive network-level performance measurement system. According to the definition by Camarinha-Matos et al. (2009), when the collaboration maturity is a network or a coordinated network, the collaboration involves only communication and information exchange for mutual benefits, and the partners have targets of their own. In that case, there is no need for a comprehensive performance measurement system.

Secondly, pre-interviews can also be used to examine and analyse the health of a collaborative network, as Parung and Bititci (2006) propose. In collaborative networks, the network partners are usually engaged in three actions: strategic decisions, managerial activities, and operational activities. The efficiency and effectiveness of the decisions and activities will depend on how good the interaction is amongst the partners within the collaborative network. The qualities of the interactions amongst the partners will describe the health of the organisation (Parung and Bitici, 2006). The evaluation of the health of the network could be also used to predict the sustainability and potential success of the collaborative network. Parung and Bititci (2006) and Mohr and Spekman (1994) propose the use and adoption of the following five attributes to evaluate the health of the network: commitment, coordination, trust, communication quality and participation, and the conflict resolution technique of joint problem solving. The health of the network also has a strong influence on the success of the design and implementation of the network-level performance measurement system. Without moderate-level commitment, openness, and trust between the collaborative network partners, the design process will fail, because the partners have to be able to share information with each other when measuring the performance of the collaborative network (cf. Beamon, 1999; Lohman et al., 2004; Busi and Bititci, 2006; Tenhunen, 2006).

Thirdly, the purpose of pre-interviews is also to define the joint success factors of the collaboration. Success factors are the essential elements behind the success of joint operations and performance, and they are delivered from the joint strategy and vision of the collaborative network. In particular, the success factors are usually the key value elements in why companies collaborate. The perception of the joint success factors is more coherent when the joint vision and goals are identified and discussed, and all partners have approved and understood them.

Fourthly, the aim of pre-interviews is to identify the joint purpose and needs for network-level performance measurement. The purpose of measurement can be seen as a key factor that affects the design of the performance measurement system (cf. Kaplan and Norton, 1996). The purpose of the performance measurement system can be related to allocating resources, monitoring the performance, benchmarking, and/or the measurement system can also be also connected to a reward. In a collaborative network, it is highly important to create joint consensus on the purpose

of measurement. Without a joint consensus of the purpose, the measurement system can be seen as a tool to control and identify the 'guilty' network partner(s) of bad performance (Kulmala and Lönnqvist, 2006). An unclear purpose of use can increase the lack of commitment, trust, and openness between the network partners. The results of article I show that there are many different needs for a network-level measurement system, and these identified requirements are quite diversified and fragmented. All collaborative network partners have their own needs and opinions concerning the measurement and its purposes. However, when the different needs are identified and analysed, it is easier to discuss and evaluate the different purposes and needs between the partners and to create a joint view of the main purposes of measurement.

Based on the results of this research, it can stated that when the structures and dynamics, purposes and needs, and the success factors of the collaborative network are carefully identified and understood by using pre-interviews, most of the challenges described above (section 2.2.2, challenges in performance measurement) can be bypassed. It can be proposed that a sufficient number of collaborative network partners should participate in the pre-interviews to ensure that all of the needs, opinions, and wishes will be perceived. The pre-interviews can be conducted by an outside consultant, researcher, or a jointly selected person from the collaborative network.

The second step of the design process is the development sessions. The aim of the development sessions is to create and develop measures for the network-level measurement system. At the beginning, the collaborative network partners have to jointly decide on 8-10 representatives (i.e. the development group) that will participate in the development sessions. It is important that the development group is committed to this development task because it takes time resources. The development session phase includes 5-6 clearly targeted and guided development sessions: the aim of the first development session is to create a common view of the dimensions of the network-level performance measurement system on the basis of identified success factors. After that, the level of the measurement has to be decided based on the purposes and needs of the measurement (i.e. the measures can be focused on the process(es), collaboration, collaboration management, or of all of these), as Busi and Bititci (2006) suggest. In the next development sessions, the participants' task is to brainstorm measures and select the final joint measures for the collaborative network.

The participants also have to discuss and analyse which of these measures are local (i.e. measured also at the single network partner level) and which are collaborative network-wide measures (cf. Caplice and Sheffi, 1995). In the collaborative network, the reporting tool has an important role in ensuring information flows and making sure that network-level information is timely and available to all network partners (e.g. Lohman et al., 2004; Cunha et al., 2008). In the final

development sessions, the aim is to train the network partners to use the developed measurement system. After that, the development group pre-tests the measurement system before it is implemented to the entire collaborative network.

The third step of the design process is the feedback session, in which the development group discusses and evaluates the developed measurement system critically. The aim of the feedback session is to define the changes and development needs that the development group have observed during the pre-testing. In addition, the development group defines the benefits and challenges related to the use of the measurement system. These benefits and uses have an essential role when the measurement system will be launched to the entire collaborative network. These identified benefits and uses can be used to motivate other network partners to use the measurement system actively.

The developed performance measurement system design process (figure 3) was tested with another collaborative network. The results of the testing showed that the design process works in practice. The differences between these two design processes are in the solutions of measures and the analysis levels of measurement information (i.e. the larger network partner utilises the network-level measurement information in a more comprehensive management of their own operations). Based on the results of testing phase, the design processes were successful, because the network-level performance measurement system seemed to work in practice, and the results are utilised widely in the collaborative network. Thus, it can be stated that the design process utilised in the study passed the weak market test (cf. Kasanen et al., 1993). Before a wider generalisability is made, the design process should also be tested in a more complex collaborative network (cf. Parung and Bititci, 2006).

The role of pre-understanding is given greater emphasis in a collaborative network than it is in the network-level measurement system design process. The state of the collaborative network has to be identified and analysed carefully. This will help to create more comprehensive understanding of the structures and dynamics of the collaborative network and the needs and purposes of measurement. In a collaborative network, it is also more challenging to synthesise the main purpose and the needs of measurement from a great variety of different propositions and information needs. In particular, a consensus of the measures and the level of measurement could be challenging to reach because it requires an open and committed collaborative network culture.

4.1.2 What factors affect the process of designing a measurement system?

There are numerous studies focusing on the process of developing performance measurement systems that present guidelines and success elements from the perspective of a single organisation (see e.g. Bourne et al., 2000; Lönnqvist, 2004). According to these studies, there are both technical factors (e.g. the validity of the measurement system and the functionality of information technology systems) and organisational factors (e.g. the support from facilitators and commitment of participants) which can enhance the success of the performance measurement system in a single organisation. The prior literature (see e.g. Kaplan et al., 2010; Yin et al., 2011; Bititci et al., 2012) does not include any tested design process for a collaborative network. From the perspective of creating new knowledge, the results of this research are interesting and unique (cf. Yin, 2009) due to specific features, such as the context of the collaborative network and its performance measurement. The results of the research show the developed performance measurement design process for collaborative network works in practice. Therefore, it is valuable to assess this developed three-step design process. Factors affecting the development of performance measurement systems in the case of a collaborative network are examined in articles I and II.

The results of the research showed that there were four key factors that facilitated the success of the measurement system design process. Both technical and organisational factors were essential for the success of the performance measurement development process. The results of this research revealed that organisational factors, such as commitment and trust between the network partners, were even more important in designing the performance measurement system for the collaborative network. The results of research showed that there were four key factors that had a positive effect on the process of designing performance measurement for a collaborative network. The study could have also been focused on the negative factors that hinder the design process of a performance measurement system. However, prior literature (e.g. Bititci et al., 2012; Franco-Santos et al., 2012) calls for empirical evidence of the factors that facilitate and improve performance measurement and management in the collaborative network environment.

The main reason for the successful design process was that a large part of network partners were involved in the design process (horizontal performance measurement system design approach). The participatory style was seen to increase the trust, openness and commitment between the different operators, which is well in line with the researches of Franco-Santos et al. (2012), Mahama (2006), and Cousins et al. (2008). The possibility to participate in the early stage of the process made it possible to bring out the network partners' own opinions and ideas, essential needs for measurement information, and also ask questions about issues concerning the performance measurement system. Based on this, the identification of the managerial needs and

the analysis of the measurement objectives were easier to conduct. The participation also enabled a learning process concerning performance measurement and managing performance in general. This was considered as important, because most of the network partners had moderate-level skills and knowledge of management and financial control. This is a very common challenge in small and medium-sized organisations, as the results of Cocca and Alberti (2010) show. Prior literature (Kulmala et al., 2002; Kulmala, 2003; Tenhunen, 2006; Busi and Bititci, 2006; Bititci et al., 2007) presents challenges of performance management and measurement in collaborative networks: the complexity of the network, the relationships between the partners, the lack of trust and commitment, and the quality of communication. The results of this research indicated that participation in the early stage in a carefully designed and structured design process can alleviate most of the concerns above.

Second, at the end of the design process, it was possible to detect a gleam of a positive development of a network culture. According to the literature, measurement can often be seen as controlling (Simons, 2000), which can be considered a major challenge in the development of performance measurement and management, especially in a collaborative network (Kulmala et al., 2002). For example, the research of Tenhunen (2006) shows that openness is in general the key issue in network-level performance management. Kajüter and Kulmala (2005) state that a firm should open almost all its information to the other network partners without limitations to enhance and develop their collaborative performance and processes. The results of the present research indicated that if the participation is actual instead of nominal, it will lead to a culture of development (not controlling) (i.e. the partners participated actively in the structured design process, leading to willingness of the participants to share information, which was considered as an important issue in the success of the process). This result supports the findings of Mahana (2006) and Cousins et al. (2008), who found that a network-level measurement system enhances communication and improves socialisation, such as commitment and trust between the network partners.

Third, the role of outside facilitators can be also emphasised in the design process of a network-level performance measurement system. One important aspect was that the network partners felt that they came to a development session organised by an outsider, not by the leading partner or a specific group of the collaborative network. The common opinion was that the presence of the facilitators made it possible to bring the understanding and objectives of the network partners closer to each other. The learning process of the participants was also fostered by the facilitators, who are experts in the area of performance measurement. The facilitators were considered as specialists but also as neutral operators from the viewpoint of the collaborative network. This was seen to facilitate the actual participation of the partners and to further the culture of development.

This reinforces the results of Butler et al. (1997), which were that the iterative and consultative process required for the development and implementation of the measurement system enhanced participation.

Fourth, the prioritisation of measurement objectives and the ambition to keep the measurement simple and resource effective facilitated the design work and possibly improved the final results. This means that the network-level performance measurement system includes a number of rational and resource-effective measures, which in turn increases the usefulness of the system. The literature normally reports that the performance systems include a substantial number of measures, which impair the usefulness of the systems (cf. Atkinson et al., 1997; Kaplan and Norton, 2001). In the cases of this research, the objective was a very focused. The network partners also felt that the performance measurement system should be easy to use and that it should be possible to identify the state of the business easily, which meant that there was a clear reason for prioritisation, which facilitated the task. As a whole, the results of this study show that the design process was successful, because the network-level performance measurement system seemed to work in practice, and the measurement information has since been well utilised in the studied collaborative network. Thus, it can be stated that the design process utilised in the study passed the weak market test (see Kasanen et al., 1993), and it covered one perspective of the current research need presented by Bititci et al. (2012).

4.2 How to manage performance in a collaborative network?

4.2.1 What kinds of uses for measurement information can be identified at different parts of a collaborative network?

The research examined what kind of uses performance measurement information has on different levels of the collaborative network management. The uses were examined from the perspective of a single network partner (leading partner and single reselling partner) as well as at the collaborative network level. The findings are presented in detail in articles II, III, and IV. Franco-Santos et al. (2012) point out that the use and impacts of performance measurement on collaborative networks have received little attention in the current literature. Only Cousins et al. (2008) and Mahana (2006) have explored this phenomenon. They have both studied supply chain networks, finding that performance measurement systems enhance the perceived network-level financial and non-financial performance indirectly by improving co-operation and socialisation (i.e. trust and commitment, amongst the network partners). Franco-Santos et al. (2012) continue that this finding is encouraging, but more research in this area is required. In addition, Busi and Bititci (2006) have identified a research gap related to how the networks use network-level

performance measurement information to maximise the performance of a collaborative network as well as the performance of individual network partners. The research offers new knowledge and a contribution to the existing literature.

The research identifies the purposes that performance measurement information can be used for in the management of performance and operations of a network and a single network partner. The uses are presented and discussed separately below.

Use from the perspective of the collaborative network

The findings indicate that the information produced by the network-level performance measurement system is very important for the network management and development of operations. The network-level performance measurement information offers a comprehensive and reliable picture of the performance and joint operations, and it makes joint decision making easier, faster, and more reliable. Carefully defined measurement purposes and supportive information about targets of joint operations have enabled the network to define the development targets and needs at the network level. The improvements in the joint activities and processes, such as marketing campaigns, together with regularly collected and analysed information of operations, have increased productivity and efficiency in the entire network. It has increased, for example, the reclamation costs of the whole collaborative network. Performance measurement information has helped the collaborative network find the actual development needs; for example, for the managers, it is easier to identify actual training and learning needs for developing the skills, know-how, and performance of the network partners.

In addition, the findings of the research study reveal that the new routines (e.g. new meeting and report culture) have had a positive impact on the use of performance measurement information in network management as well as with single network partners. This finding supports the results of Ukko et al. (2007), presenting that the effective use of a measurement system brings about new routines, such as meeting concepts by enhancing information sharing and communication. Moreover, Bourne et al. (2005) conclude that the interactive use of performance information, together with communication about performance intensity, both in formal and informal meetings, will lead to a higher performance of the company. For example, the sales managers pointed out the usefulness of the new concept of sales manager-reseller meetings.

The new meeting concept was implemented in the collaborative network at the same time as the network-level performance measurement system. In these meetings, the sales manager and resellers go through the results of the measurement system from the perspective of a single reselling unit and compare its results to the results of the whole collaborative network. This has

made the discussions and decision making more structured and open between the network partners. The sales managers stated that it is easier for them to support and help the partner companies in their operations when they have understanding of the current state of their own operations as well as collaborative network-wide operations. The experiences of the sales managers show that the new meeting concept has created trust and increased openness between the sales manager and the resellers. The studies of Bititci et al. (2006) and Ukko (2009) confirm the results of this study by stating that successfully implemented and used performance measurement systems lead to a more participative and consultative management style, and vice versa.

As a conclusion, the results of the study reveal that the use of network-level performance measurement information has the following impacts on collaborative network management:

- Constructing an overall and comprehensive picture of the network is clearer (i.e. the financial state of the network is easier to define).
- Following the state of the network is easier and updated (i.e. information of total selling, offers, and deals of the network are always available at the network level).
- Decision making is based on numerical information (i.e. affects campaign planning, budget monitoring, and target setting).
- Developing the targets of the network in easier to identify (i.e. training and courses, as well as development projects).

Use from the perspective of a single collaborative network partner

The performance measurement system produces both network-level information and local, single network partner level information. The same measures are used at both levels, as Busi and Bititci (2006) suggest. The results of the study reveal that the measurement information of a single network partner is analysed in closer detail than at the collaborative network level. The reason for that is that the network-level performance measurement information is commensurate between the network partners, and a single network partner can compare its own results to the results of the entire collaborative network. The comparative information is essential for increasing the understanding and knowledge of the state of operations of the collaborative partner, and it helps to get a more realistic picture of their part in the joint operations. One example of this is the possibility to compare information on network-level reclamation costs to a single network partner's information.

The possibility of using the comparative measurement information gives the results of the measurement system a totally new perspective. For example, some partners had followed the reclamation costs every month, but they did not have any comparative information available.

Hence, they stated that they did not have a realistic picture of their operations. By following their own and the network-level information, the network partners have been able to reduce their reclamation costs. The network partners also highlighted that decision making has become more straightforward and the decisions and choices are easier to explain to the sellers of the partner company. Also, the performance measurement information provides a good basis for development discussions between the reseller and the seller.

According to the results of this research, the purpose of the use of a network-level performance measurement system differs slightly with different network partners. Some network partners utilise the performance measurement system as a tool for human resource management more than some other network partners (i.e. smaller network partners analyse the results of the measurement system at the organisational level and larger partners also at the individual-seller level). All sellers of the network partner company have also their individual-selling information in use, and they can compare this information to the collaborative network-level averages. The performance measurement information is also used in the development discussions between the sellers and resellers.

The role of network-level performance measurement information is significant from the perspective of network management, and also from the management of the leading partner. The network-level performance measurement information guides the decision making of the whole leading partner (i.e. information has a highly important role when the top management team makes decisions that focus on the capacity of the factory and its control). The network-level performance measurement information is not just a tool to analyse the state of the collaborative network, it also directs strongly the decision making of the leading company, along with other measurement information.

As a conclusion, the results reveal that the use of network-level performance measurement information has the following impacts on the collaborative network partner:

- The understanding of the state of the operations and success is more realistic because of the network-level information (i.e. benchmarking).
- Finding the development targets is clearer (i.e. reducing the reclamation costs).
- Understanding and knowledge of performance has increased (i.e. learning).
- Decision making is easier and more straightforward.
- Human resource management is more comprehensive (i.e. motivating, leading, and guiding).
- Supporting and guiding the decision making of the top management team of the leading company (i.e. production capacity of the factory).

The results presented in existing literature (see e.g. Bourne et al., 2000; Kennerly and Neely, 2002; Lohman et al., 2004; Cunha et al., 2008; Bititci et al., 2012; Ferreira et al., 2012) show that performance measurement systems that do not incorporate information technology do not support the management practices as efficiently and effectively as possible, and this is highlighted especially in the collaborative network (Lohman et al., 2004; Busi and Bititci, 2006; Cunha et al., 2008). The results of this research confirm these research results. The network-level performance measurement system is also integrated to the Customer Relationship Management (CRM) system in the studied collaborative network. The network-level and local measurement information are available mainly online in this system, with the exception of non-financial measures. The system integration makes the controlling and following of the results of the performance measurement system efficient for various users. The results also indicate that the network-level measurement system is not rooted in the operations of those network partners who do not actively use the CRM system and do not always have network-level performance measurement information always available: they have only a few measures in use, and the information is not online.

The results of the study reveal that network-level performance information has positive effects on management and management practices. The roles and responsibilities are clearer, work processes are developed, and reported and perceived performance has been seen increased during the use of performance. For example, reclamation costs are decreased and the managers' perceptions were that performance of case network and single network partner has increased. Based on that it can be stated that performance measurement system is workable and applicable tool to utilise to support manage the performance of a network. The comparability of information and information systems are supportive elements of the effective use of that system in the network context.

4.2.2 How can performance management be evaluated in a collaborative network?

A turbulent environment increases the requirements to make rapid and effective decisions in the absence of complete information (Barrows and Neely, 2011; Bititci et al., 2012). For this reason, collaborative networks as well as single organisations should constantly evaluate and understand their own performance to achieve targets faster and more efficiently than their competitors can (Niemi et al., 2009; Aho, 2011). Hence, there is need for more comprehensive and active uses of performance measurement systems on performance management (Nudurupati et al., 2011). Successful performance management needs measurement system that produce performance information, but it also requires that information is timely available, and the culture and tools that support measurement. This research presents a model for evaluating the state of performance

management in a collaborative network, and it helps to identify the full potential of performance measurement exploited in practise. A detailed description is presented in article V.

In this research, the maturity model of Niemi et al. (2009; 2010) has been utilised as a starting point of development. The authors present a maturity model called OSSIC to evaluate how companies can gradually adopt sophisticated management techniques. This model consists of five management attributes that can be seen behind the successful performance management: Organisation; roles and responsibilities (the division of roles and responsibilities to manage and develop the area); Systems and processes (the state-of-the-art of operative ICT (information and communications technology) systems, planning, and control systems in the area); Skills and knowledge (people and their skills and competencies to manage and develop the area); Incentives and performance measurement (the state-of-the-art of goal setting and performance measurement systems, their utilisation especially in the context of rewarding individuals and groups); and Culture and leadership (manifestation of general attitudes and values on the area).

Based on the OSSIC model, and especially its management attributes and maturity stages, a modified version was elaborated from the perspective of collaborative network-level performance management in this research. The aim of this modified version is to help identify the current state of performance management by creating pre-understanding of the state of the collaborative network with the help of management attributes, as well as evaluating the state of the health of the collaboration (cf. Busi and Bititci, 2006). By improving the state of management attributes, the collaborative network can promote the design and implementation process of the performance measurement system successfully. The existing literature (e.g. Pascale and Athos, 1981; Paulzen and Perc, 2002; Niemi et al. 2009; 2010) contains different maturity models, but the OSSIC model was selected for the reason that it is simple by its structure, and the results of the study of Niemi et al. (2009) show that sustainable results have been achieved with this model.

The use of the modified version of the OSSIC helps in the observation of the development issues in the collaborative network in a wider scope (i.e. on the basis of the empirical evidence of this research, five attributes were developed, at least into the establishment stage of the maturity model during the measurement system development process). The maturity stages also help the network management to prioritise and analyse the development objectives for other issues that are important for the performance management of a collaborative network (i.e. identifying the training needs of the network partners and the investments needs to ICT tools that support performance management. The aim of the model is to ensure that one or several areas (management attributes) do not hinder or slow down the overall development, which also focuses on the effort of critical attributes to reach higher stages of development. Before continuing to

higher maturity stages, the lower stages have to be reached completely. In practice, there is usually an imbalance between the different attributes of maturity levels, hence it essential to start balancing all these attributes and move on to next level and thus increase the effectiveness and efficiency of performance management.

The knowledge maturity stages and the management attributes from the perspective of network performance management are presented in Table 4 and described in detail below.

Table 4 Knowledge maturity stages and management attributes from the perspective of collaborative network-level performance management

	Organisation, roles and responsibilities	**Systems and processes**	**Skills and knowledge**	**Incentives and measurement (PM)**	**Culture**
5 – Optimisation	Customer-driven flexible roles	Advanced performance reporting tool, automatic link to network-level information	Overall knowledge of network-level performance and comprehensive use in decision making	Complete, open, causal model-based PM and incentive system of the whole network	Acting as one company
4 – Quantitative management	Bottom-up / Reseller-driven	Advanced performance reporting tool, no link to network-level information	Formalised knowledge on network-level performance	Network-level PM system, open for the network, and a comprehensive incentive system	Learning from others' businesses
3 – Establishment	Top-down / Main company	Systematic local reporting tool	Tacit knowledge on network-level performance	Formal PM and incentive system, partially shared	Interested in others' businesses
2 – Awareness	Negotiational, a more open relationship	Local reporting system	Understanding of one' own business	Some informal measures	Interested in one's own business
1 – Initial	Negotiational, isolated relationship	No reporting system	Tacit understanding of one's own business	No PM and incentive system	Minding one's own business

The organisation, roles and responsibilities management attribute in the network context refers to the roles and responsibilities between the different network partners. This management attribute evaluates how isolated, controlled, or flexible the roles and responsibilities are in the collaborative network. All network partners are individual organisations, hence the organisational structures, roles, and responsibilities at the collaborative network level cannot be regarded as a truism, as in a single organisation.

Systems and processes as a management attribute include operative ICT, planning, and control systems that support performance measurement and management practices in the collaborative

network. There is evidence that a performance measurement system without information technology does not support the management practices as efficiently and effectively as possible (see e.g. Franco-Santos et al., 2007; Nudurupati et al., 2011; Bititci et al., 2012). Especially in a collaborative network, the role of ICT systems is highlighted in supporting information sharing and communication between all the network partners (cf. Lohman et al., 2004; Cunha et al., 2008).

The skills and knowledge management attribute contains aspects related to the knowledge and understanding of the performance, the use of performance measurement information in management, the development of joint operations, and the joint decision making of the collaborative network. This attribute evaluates how comprehensively the collaborative network and its partners understand their performance, and how capable the collaborative network and its partners are to use the measurement information in management.

The incentives and performance measurement attribute evaluates the maturity of the performance measurement system; for example, what kind of measurement system the collaborative network uses or whether the measures are just informal and local, or whether the measurement practices are identified at the collaborative network level. This attribute takes into account the role of rewarding and incentive planning alongside of performance measurement. However, the maturity of the performance measurement attribute should be on a high level together with other attributes before linking the incentive plan to the performance measurement system can be recommended. Rewarding is a very demanding issue, and there are plenty of different criteria for a successful reward system (e.g. the reward policy should be motivating, equitable, and fair). There is a huge hidden risk that a poor reward policy disbands the positive network culture.

The culture attribute is related to the network culture, including elements such as trust, openness, and commitment between the collaborative network partners. The state of the elements behind the network culture attribute describes the health of the collaboration, as Busi and Bititci (2006) propose. As the prior literature shows, the network culture has a significant role at the starting point of the measurement design process, but the development of these elements is a difficult task for every network (Cunha et al., 2008; Varamäki et al., 2008).

Based on the results of this research and the existing literature (e.g. Bourne et al., 2002; Busi and Bititci, 2006), the most essential attributes for the successful adoption of a network-level performance measurement system are the network culture and the skills and knowledge of the network partners. In the network culture, and openness are emphasised in order to commit all the network partners to the common target. The result is in line with the findings of Bourne et al.

(2002) and Franco and Bourne (2003), which highlight that a paternalistic culture that encourages actions and improvement and does not punish for errors will lead to a successful implementation and use of a performance measurement system. The situation is quite similar to the skills and knowledge concerning the understanding of the purpose and benefits of the system and the use of measurement information. If the skills and knowledge of using the measurement information amongst different network partners are at different stages, the benefits of the measurement system will not be spread equally.

4.3 Summary

The purpose of this research was to examine the development and uses of a performance measurement system supporting performance management in a collaborative network. The first research question focused on how to design a performance measurement system for a collaborative network. This was examined through two subquestions. The first subquestion concerned how can a performance measurement system for a collaborative network be designed. The result of the research presents a three-step process model for designing a performance measurement system for a collaborative network. The aim of the first step of the model was to gain comprehensive pre-understanding of the state of the collaborative network by using pre-interviews. The second step focused on the actual design of measures, and the third step evaluated the designed network-level performance measurement system after testing. The horizontal design approach has been utilised, which means that many of the collaborative network partners participated in the design process.

The second subquestion focused on what factors affect the process of designing a measurement system. The results showed that the developed performance measurement design process for the collaborative network worked in practice. Therefore, it is valuable to assess what factors that affect the design of performance measurement systems in collaborative networks. The findings showed that a participatory development style, network culture, an outside facilitator, and keeping the measurement simple and resource effective had positive effects on the performance measurement design process for a collaborative network. Collaborative networks should especially pay attention to these factors during the design process.

The second main research question focused on how to manage performance in a collaborative network. The first subquestion examined what kinds of uses for measurement information can be identified at different parts of the network. The findings showed that performance measurement information is widely utilised at the collaborative level as well as the single network partner level. Based on the benefits and impact of the network-level performance measurement system, it

can be said that network-level performance measurement system is a workable tool to manage performance in a collaborative network and at the single network partner level. At the collaborative level, performance measurement information is offered, for example, as a more comprehensive picture of the performance of collaborative networks, and it helps to identify the essential development needs. At the single network partner level, understanding of one's own performance is increased, and decision making will become easier.

The second subquestion analysed was how can performance management be evaluated in a collaborative network. The findings led to a maturity model for evaluating the state of the performance management in the collaborative network. The model helps to assess the current state of performance management by utilising five management attributes. By developing these management attributes stage by stage, the collaborative network can manage their performance more widely and meet strategic targets and the challenges of the turbulent environment effectively.

5 CONCLUSIONS

5.1 Contribution to prior research

Prior research has paid much attention to identifying the challenges and research needs for the management and measurement of performance in collaborative networks. However, the existing literature does not provide much evidence of practical applications of measurement and management models. It therefore seems that collaborative networks are not adopting models or frameworks to support their performance management. The aim of this research was to examine the development and uses of a performance measurement system supporting performance management in a collaborative network. The contribution is based on the examination of the research topic by means of two main research questions and four subquestions. First, the research enhances knowledge about how to design a performance measurement system for a collaborative network. It also presents the factors affecting the process of designing the measurement system by evaluating the developed performance measurement system design process for a collaborative network. Second, this research enhances knowledge about how to manage performance in a collaborative network. The study examines how the performance measurement information has been utilised on management of a collaborative network and a single network partner. The study also presents a management tool that evaluates the maturity of the performance management of the network.

The main contribution of the research is related to the description of a horizontal performance measurement design approach for a collaborative network. The choice of this approach was motivated by the existing literature identifying different challenges and pitfalls that should be taken into account when designing the performance measurement system for a collaborative network. It was noted that this approach may facilitate the commitment and create trust between the different network partners, which will increase the relevance of the measurement. In addition, prior experiences in the studied collaborative network, and the results from interview studies 1 and 2 supported this decision. Earlier studies describing empirical applications of a similar approach were not found in the literature. The experiences of the empirical application of the approach were positive. The approach has potential to solve many existing problems, such as a lack of commitment within the design process and the willingness to share business information within collaborative networks. The detailed results are presented in article I and II.

Based on the horizontal approach, the study has presented a three-step process model for designing a performance measurement system for a collaborative network. The contribution of the research is the presentation of a process model containing various factors that should be taken into consideration when operationalising performance measurement within a collaborative

network. Much of existing research on the design of a performance measurement system has been carried out from the perspective of a single organisation. The developed process retells these processes in general, but emphasises the pre-interview state of the process. This is one of the main contributions to the current literature. This process is very practical, and it ensures that joint targets of the network, and the purposes and needs of the measurement system are clearly and jointly defined at the beginning of the design process. The study also highlights that if the maturity of collaboration is not at least at the cooperative network level (cf. Camarinha-Matos et al., 2009), the network should concentrate on creating joint targets and vision of the collaboration before starting to design a more comprehensive performance measurement system for network purposes.

Due to the fragmented literature, it is difficult to perceive what the key factors in the design process are that facilitate the success of performance measurement in collaborative networks. Further, prior studies do not describe an explicit presentation of how the different factors are connected to each other. The present study explores the important factors when designing a collaborative performance measurement system and how they can be arranged and managed in a way that facilitates the design and implementation of a measurement system. The key factors affecting the development process are identified in article I. The first factor is a participatory style, which is seen to create trust and increase openness and commitment between the different operators. The possibility to participate in the early stage of the process makes it possible to bring out one's own opinions and ideas and also to ask questions about issues concerning the measurement system. Participation also enables a learning process concerning performance measurement, target setting, and managing performance in general.

The second factor is positive development of the network culture. The current study indicates that if the participation is actual instead of nominal, it will lead to a culture of development (not controlling). In the study, the partners participated actively in the structured design process, which led to willingness of the participants to share information, which was considered as an important issue in the success of the process.

The third factor is an outside facilitator who can be seen as one of the key factors having a positive effect on the success of the design process. The results of this research reveal that the presence of the facilitators made it possible to bring the understanding and objectives of the different network partners together. The learning process of the participants was also fostered by the facilitators, who are experts in the area of performance measurement.

The fourth factor is the prioritisation of measurement objectives and the ambition to keep the measurement as simple and resource effective. This facilitated the design work and possibly improved the final results. This means that the network-level performance measurement system includes a number of rational and resource-effective measures, which in turn increases the usefulness of the system.

The research contributes to the discussion of the uses of measurement information on management of a network and a single reseller partner. The existing literature presents plenty of uses and impacts that focus on the use of performance measurement in a single organisation, but there is a lack of studies concerning the uses of performance measurement information within a collaborative network. This study identified uses that focus on network-level performance management as well as the management of a single network partner (article II, III, and IV). By examining these uses, the benefits and impacts of performance management to the network and a single partner organisation can be seen. As a whole, it can be said that the network-level performance measurement system has developed the performance management of a single network partner as well as the management at the collaborative network level (i.e. the current management processes and the roles and responsibilities are clearer between the network partners). The network culture has also become more open, and the commitment between the different network partners has developed as well because of benchmarking opportunities. Based on these results, the performance of collaborative network (e.g. reclamation costs are decreased) has been increased.

Finally, the research also shows that it is possible to evaluate the state of the performance management of a collaborative network (i.e. to create pre-understanding of the state of the network) as well as to evaluate the state of the health of the collaboration. The earlier literature also suggests that an organisation, as well as collaborative networks, have to monitor and understand their own performance constantly to achieve their goals faster and more efficiently. As a contribution to prior literature, this research presents an application of the maturity model OSSIC for a collaborative network. This model can be used as a tool for analysing the state of the performance management of a collaborative network through five management attributes. These attributes can be seen as the main elements behind successful performance management (article V). There has to be a balance between these identified management attributes before the organisation or network can move up through these five levels. This helps to see the main weaknesses of the performance management and to identify the key development issues (e.g. unclear roles between network partner and ICT systems does not support measurement) of the performance management of a collaborative network. It also helps to promote rooting of

performance measurement and more maturity performance management to the network operations.

5.2 Contribution to practice

As an essential part of this research was based on case research carried out as action research, it is necessary to examine the practical contribution of the results (Gummesson, 2000; Voss et al., 2002). As a practical research approach, the theoretical contribution discussed in the previous section may quite easily be turned into a practical contribution. It can be identified at least four practical contributions.

The first practical contribution is related to knowledge about the process of designing a performance measurement system for a collaborative network that can support the measurement-related development projects in the network. This knowledge is related to the steps and various factors supporting and preventing the design process of a performance measurement system. The case descriptions can be regarded as illustrative examples for the design process of a performance measurement system for a collaborative network. There are no perfect performance measurement systems, but there are many systems that satisfy the defined managerial needs reasonably well. Based on the positive experiences and the extent of the implementation in the studied collaborative network, it can be argued that the developed design process is a very promising choice for designing a performance measurement system in any similar collaborative network.

Second, this research provides information on important factors from the perspective of a successful performance measurement design process in a collaborative network. Even though some of more detailed factors may be considered case specific, but in general the participatory style, positive development of the network culture, outside facilitator, and aim to keep measurement system simple can be seen as key factors that had a positive effect on the success of the design process. By understanding and prioritising these factors, a collaborative network can avoid some of the main challenges and increase the success of the design process.

Third, this study mapped a list of different impacts of the use of performance measurement in different parts of the collaborative network. The managers of a collaborative network can identify possible benefits of a network-level performance measurement system. In addition, these practical contributions can be seen as encouragement for collaborative network managers to start the development of performance management and measurement practices in the collaborative network where they participate.

Fourth, the research presents a further developed version of the maturity model OSSIC. The model evaluates the stage of the performance management of the collaborative network. The model consists of the five management attributes behind successful performance management. The attributes also helps to promote the rooting of performance measurement system. The basic idea of the model is that the development of the attributes should proceed stage by stage. The aim of the model is to ensure that one or several management attributes do not hinder or slow down the overall development. Before continuing to higher maturity stages, the lower stages have to be reached completely. In practice, there is usually an imbalance between the different attributes of the maturity levels, so it essential to start balancing all of these aspects and move on to next level, and thus increase the effectiveness and efficiency of the performance management. By analysing the state of the performance management of a collaborative network by utilising the maturity-model approach the network managers are better able to prioritise the development actions; for example, when focusing on when to train people, invest in tools that support performance management, and reorganise and to improve performance measurement and incentive systems.

5.3 Assessment of the research

5.3.1 Relevance

The first of the four criteria in assessing this research is its relevance, which is also related to its contribution from the perspectives of research and practice (see e.g. Gummesson, 2000). Relevance can be argued to be one of the advantages of case research. The relevance of this research can be justified from three viewpoints. First, performance is an important success factor for every organisation and collaborative network. Without managing and measuring the performance of the collaborative network or a single network partner, the collaborative network does not have enough knowledge of the state of their joint operations to develop them. In the collaborative network context, performance can be seen as a specifically abstract, complex, and challenging phenomenon (cf. Busi and Bititci, 2006; Lönnqvist and Laihonen, 2012). Joint understanding of the issue by both a single network partner and at the collaborative network level is crucial in order to develop an appropriate performance measurement and management system for that context.

Second, performance measurement is problematic because the structures of the processes can be complex, and the need and purposes of measurement fragmented. Many different challenges have been identified in the existing literature (see e.g. Kulmala 2003; Busi and Bititci, 2006; Kulmala and Lönnqvist, 2006; Cocca and Alberti, 2010). However, the literature reveals that there is a lack of reported solutions and managerial linkage. This research describes an approach and tools

for measuring and managing performance in the collaborative network context supported by the identified design process, empirical testing, and evaluation of users.

The final and essential factor improving the relevance of this research is the connection to a long and intensive development project with high practical relevance. This factor provides a natural setting for examination and access to reality, which can be regarded as essential in management research, as Gummesson (2000) points out.

5.3.2 Validity

At the general level, the validity of the research is concerned with the question of whether the researcher is studying the phenomenon she or he purports to be studying (cf. Gummesson, 2000; Yin, 2009). Yin (2009) divides validity into two parts: construct validity and internal validity, where the construct validity of the research describes whether the measures selected are measuring what was intended or something else, and internal validity seeks to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguished from a spurious relationship. Internal validity has not been evaluated in this study because it is meaningful only for explanatory and causal studies, not for descriptive or explorative studies such as this research (Yin, 2009).

This section examines the validity of this research from the perspective of the two main research questions as well as the data collection methods. The first research question was related to the design process of a performance measurement system in the collaborative network context, which was investigated at the network level with interview studies 1 and 2 as well as action research studies 1 and 2. The second main research question was related to performance measurement supporting performance management in a collaborative network. The use of measurement information on management and the state of performance management were identified at the collaborative network level as well as at the level of a single collaborative network partner. The state of performance management was investigated in interview studies 1 and 3, and the use of measurement information was examined in interview studies 2 and 4 and action research studies 1 and 2.

The questions for interview study 1 as a whole were not directly delivered from the literature. However, they were partly connected to the issues of measurement system development (e.g. the definition of the measurement object and the needs for measurement) and the state of the collaborative network (e.g. commitment, trust, and openness in the collaborative network). Another factor affecting the design of the interviews was a practical need to gain support for the

development work of performance measurement in a collaborative network. The author designed the questions with the help of another researcher, and the questions were also evaluated by two researchers, which should have had a positive impact on validity. In addition, a factor that could have improved the validity of the results of the interviews was that the themes related to the questions were sent to the respondents beforehand.

Interview study 2 was utilised in answering questions such as what factors affect the success of the performance measurement system design process and what kind of uses does performance measurement information have in a collaborative network. The validity of the results is fairly good within the general case-related limitations of this research. The respondents represented different network partners in the studied collaborative network widely. The choice of respondents was practical: they were personnel who had been involved in the development project and they were most familiar with the issue investigated in the interview. The interview was conducted as a group interview. The group interview was carried out in such way that the first interviewees answered open-ended questions by themselves, writing down their answers on a questionnaire, and, after that, the questions were discussed amongst the group members, which can be seen to have increased the validity of the group interview session.

Interview study 3 was conducted with the same group of participants as the previous interviews by using individual interviews. The questions of the interviews were elaborated from the literature related to maturity development and maturity models. The author elaborated the interview questions together with a researcher who is a specialist of this theme. The research themes were also sent to the interviewees before the interviews to increase the validity of the research.

Interview study 4 was also conducted by utilising a group interview as in interview study 2. The respondents represented the top management group of the company, and they had a good view of the theme of the interview. The author formulated the questions from the literature by using the framework of the information management process of Choo (2000). In the group interview, first every interviewee answered the questions from their own point of view, and, after that, all answers to every question were discussed together amongst the group.

All the interview studies were sound recorded and transcribed before the analysis. Except for interview study 4, all the data were analysed by at least two researchers. In every interview study, the research questions were coded based on the literature and practical needs. After that, the contents were analysed by using codes, as Miles and Huberman (1994) propose. The researchers did the analysis separately, and then the results were discussed and elaborated on.

The design process of the network-level performance measurement system was identified through the workshop events of action research study 1, and they were tested in action research study 2 for increasing the validity of the research. Whereas the validity of the design process was impaired by the limited view of only two studied collaborative networks, all of the discussions, observations, and results were well documented during the workshops. After the workshops, the documentations were also discussed with another researcher to increase the validity of the collected data. Although there were only two researchers in the majority of the workshops, which could have increased errors and misunderstandings in data collection during the workshops, there was, however, a constant possibility to correct misunderstandings and erroneous assumptions during the workshops in close interaction between the author and the participants of the collaborative network.

In general, the research focused on those issues that it was intended to. With regard to both main research questions, the validity of the research is enhanced by examination at both the single network partner and the collaborative network levels. This provides a more comprehensive picture of the research issue. As a possible weakness, it can be stated that the examination of the development group of the performance measurement system received more emphasis than did the entire collaborative network. In addition, the network-level performance measurement examination was limited to a single case study. However, this is typical for any case research due to practical limitations. Finally, the research procedures and methods were described in as close of detail as possible, enabling validity evaluation by an external evaluator (cf. Gummesson, 2000).

5.3.3 Reliability

Reliability means that two or more researchers studying the same phenomenon with similar purposes should reach approximately the same results (Gummesson, 2000). The main goal of reliability is to minimise the errors and biases in a study (Yin, 2009). To repeat the case study, there is a need to document the procedures followed in the earlier case carefully. Without documentation, the study cannot be repeated.

In general, several methods and data sources supporting each other were used in the study (i.e. linkages between the results of the interview studies and the action research studies can be identified). The participation of several researchers and interaction between the researchers and the representatives of the studied collaborative network should also have a positive effect on the reliability. These two aspects should reduce the role of the subjectivity of the author in the interpretation.

The reliability of the results of the interviews can always be criticised due to possible variations in the respondents' interpretations of the questions (Yin, 2009). The purpose of the interviews of this study was explorative. The number of interviewees was reasonable in all interview studies when comparing the total of the network partners in the collaborative network, and this should improve the reliability of the research. When analysing the results of the interview studies, responses of a similar nature could be identified, indicating satisfactory saturation. In the analysis of the interview data, the interpretations of the researchers were needed to analyse the responses, which inevitably had an effect on the reliability of the results.

The action research study was carried out in two different case networks. The experiences from both cases were of a similar nature, which also supported the simultaneous examination. This increases the level of reliability of the perceptions. The reliability of action research is impaired in two aspects: first, the author may have a too dominant role in the workshop events, and hence affect the results. However, in the study, this was not the case, as the results presented in article I illustrate. Even though the author acted as a facilitator of the development work, the decision making of the process was democratic, and the participants' opinion and views had a highly important role. The second factor is that the perceptions and written notes could have been distorted by the author's earlier experience, in, for example, other cases. However, the intense interaction between the participating researchers and the representatives of the studied collaborative network in all phases of the research reduced the risks related to the reliability of the results.

5.3.4 Generalisation

The fourth criterion used to evaluate is generalisation, which is related to the areas to which the results may apply (Gummesson, 2000). In contrast, Yin (2009) refers to generalisability as an external validity. According to Gummesson (2000), generalisation cannot be made on the basis of case studies. However, the idea of single case studies is to provide in-depth illustration of the case in a specific context. The main findings of the case studies are often applicable at least to some other organisations with a similar context, as Lukka and Kasanen (1995) suggest.

The generalisation of the results may be evaluated from the perspective of a similar collaborative network in Finland. Even though the studied collaborative network has certain specific characteristics, such as branch, size, and intensiveness features, there are plenty of similar collaborative networks in Finland in different branches. More specifically, it may be stated that issues related to the design process of a performance measurement system for a collaborative

network and performance management examination has considerable potential for generalisation in a collaborative network.

The generalisation of the results relating to the use of the performance measurement information should be evaluated carefully. The results may be applied in a similar collaborative network, but generalisation to other types of collaborative networks should be done with caution. Collaborative networks can be more complex and more multi-challenged than the studied collaborative network. This is especially the case with the second subquestion of the second main research question. With regard to the first main research question and its subquestions, the potential for generalisation should be better. For example, the design process was quite general, and it was tested once. Thus, it can be stated that the developed design process passed the weak market test (see Kasanen et al., 1993). Moreover, the application of the OSSIC model for the collaborative network can be considered suitable for any kind of a collaborative network because the maturity stages of the model are general. However, more research and testing are needed in order to understand better the applicability of the results in such a collaborative network.

5.4 Suggestions for further research

The study has provided new knowledge about the topic of measuring and managing the performance of a collaborative network. However, there remain issues requiring more research. Three main paths for future research are presented in this section.

First, the design process of a performance measurement system for a collaborative network presented in article I and the application of the OSSIC model for a collaborative network in article V would require more testing and experiences from a different empirical context. These have potential to be widely applicable in a similar collaborative network, but this can be verified only with further experiences. Some adjustments are inevitably needed in further applications of the design process of performance measurement in a more complex collaborative network. In addition, the application of the OSSIC model needs more testing to increase the validity of the model.

The second theme is the use of measurement information in the management of a collaborative network. This could be studied more widely than in articles II, III, and IV. In further research, more comprehensive measurement data and their use during a longer time period would be useful to analyse, to determine, for example, how efficiently performance information is utilised, what measures are important, and what are useless. There may be some information that is not efficiently utilised. Systematic analysis of this information may provide more understanding about

practical means to improve the use of performance information in a collaborative network. This topic could support the utilisation of measurement information related to the improvement of existing measurement and management systems. In addition, the impacts of the measurement system should be examined from different perspectives, such as people's behaviour, organisational capabilities, and financial and non-financial performance, as Franco-Santos et al. (2012) propose. The behavioural implications and human actions are associated with the use of performance measurement and management control systems (Ukko et al., 2007; Franco-Santos et al., 2012). These systems do not work in a vacuum; rather, they guide and motivate how people behave. The intersection between management tools and human action is a central aspect in these research fields that should also be studied in a collaborative network (Franco-Santos et al., 2012).

In addition, the link between rewarding and performance measurement should be examined in a collaborative network in the future. The main purpose of linking the measurement system to the reward system is to guide and motivate the employees to focus on issues that are in line with the strategic targets of the company (Franco-Santos et al., 2007). These results can be seen as applicable also within the collaborative network context. However, there are many criteria concerning the reward measures that should be taken into account: the joint measures should be commonly understandable, measurable, attainable, fair, and in line with the joint strategy. In further research, more comprehensive in-depth research and discussions related to the reward policy, its applications, and its impacts on a collaborative network are needed.

One specific topic that needs more research is related to the role of the customer of the network and the customer service process in the collaborative network. In this research, the quality of the customer service process was measured only from the perspective of customer satisfaction by using a satisfaction questionnaire. This perspective is limited, and there is a need to improve the measurement of the customer service process and customer satisfaction more comprehensively in order to support the development and management of the customer service process.

REFERENCES

Aho, M. (2011), *Konstruktio suorituskyvyn johtamisen kypsyyden arviointiin*, Doctoral dissertation, Tampere University of Technology, Publication 1000, Tampere. (in Finnish).

Amaratunga, D. and Baldry, D. (2002), "Moving from performance measurement to performance management", *Facilities*, Vol. 20, Iss: 5/6, pp. 217-223.

Atkinson, A.A., Waterhouse, J.H. and Wells, R.B. (1997), "A stakeholder approach to strategic performance measurement", *MIT Sloan Management Review*, Vol. 38, No. 3, pp. 25-37.

Avison, D., Baskerville, R. and Myers, M. (2001), "Controlling action research projects", *Information Technology & People*, Vol. 14, No. 1, pp. 28-45.

Avison, D., Lau, F., Myers, M. and Nielsen, P. (1999), "Action research", *Communications of the ACM*, Vol. 42, No. 1, pp. 94-97.

Barrows, E. and Neely, A. (2011), *Managing Performance in Turbulent Times Analytics and Insight*, John Wiley & Sons Inc., New Jersey, USA.

Batt, J.P. (2008), "Building social capital in networks", *Industrial Marketing Management*, Vol. 37, Iss: 5, pp. 487-491.

Baxter, R. and Matear, S. (2004), "Measuring intangible value in business-to-business buyer-seller relationships: An intellectual capital perspective", *Industrial Marketing Management*, Vol. 33, No. 6, pp. 491-500.

Beamon, B.M. (1999), "Measuring supply chain performance", *International Journal of Operations and Production Management*, Vol. 19, No. 3, pp. 275-292.

Bititci, U.S., Carrie, A.S. and McDewitt, L. (1997), "Integrated performance measurement systems: A development guide", *International Journal of Operations & Production Management*, Vol. 17, No. 5, pp. 522-534.

Bititci, U., Garengo, P., Dörfler, V. and Nudurupati, S. (2012), "Performance measurement: Challenges for tomorrow", *International Journal of Management Reviews*, Vol. 14, No. 3, pp. 305-327.

Bititci, U.S., Martinez, V., Albores, P. and Mendibil, K. (2003), "Creating and sustaining competitive advantage in collaborative systems: The what and the how", *Production Planning and Control*, Vol. 14, No. 5, pp. 410-425.

Bititci, U.S., Martinez, M., Albores, P. and Parung, J. (2004), "Creating and managing value in collaborative network", *International Journal of Physical Distribution & Logistics Management*, Vol. 34, Iss: 3, pp. 251-268.

Bititci, U.S., Mendibil, K., Albores, P. and Martinez, M. (2005), "Measuring and managing performance in collaborative enterprises", *International Journal of Operations and Production Management*, Vol. 25, No. 4, pp. 333-353.

Bititci, U.S., Mendibil, K., Nudurupati, S., Turner, T. and Garengo, P. (2006), "Dynamics of performance measurement and organizational culture", *International Journal of Operations and Production Management*, Vol. 26, No. 12, pp. 1325-1350.

Bititci, U., Turner, T., Mackay, D., Kearney, D., Parung, J. and Walters, D. (2007), "Managing synergy in collaborative enterprises", *Production Planning & Control*, Vol. 18, No. 6, pp. 454-465.

Bohn, R. (1994), "Measuring and managing technological knowledge", *Sloan Management Review*, Vol. 36, No. 1, pp. 61-73.

Bourne, M., Kennerley, M. and Franco-Santos, M. (2005), "Managing through measures: A study of impact on performance", *Journal of Manufacturing Technology Management*, Vol. 16, Iss: 4, pp. 373-395.

Bourne, M., Mills, J., Wilcox, M., Neely, A. and Platts, K. (2000), "Designing, implementing, and updating performance measurement systems", *International Journal of Operations & Production Management*, Vol. 20, No. 7, pp. 754-771.

Bourne, M., Neely, A., Mills, J. and Platts, K. (2003), "Implementing performance measurement systems: A literature review", *International Journal of Business Performance Management*, Vol. 5, No. 1, pp. 1-24.

Bourne, M., Neely, A., Platts, K. and Mills, J. (2002), "The success and failure of performance measurement initiatives: Perceptions of participating managers", *International Journal of Operations & Production Management*, Vol. 22, No. 11, pp. 1288-1310.

Brewer, P.C. and Speh, T.W. (2000), "Using the balanced scorecard to measure supply chain performance", *Journal of Business Logistics*, Vol. 21, No. 1, pp. 75-93.

Busi, M. and Bititci, U.S. (2006), "Collaborative performance management: present gaps and future research", *International Journal of Productivity and Performance Management*, Vol. 55, No. 1, pp. 7-25.

Butler, A., Letza, S.R. and Neale, B. (1997), "Linking the balanced scorecard to strategy", *Long Range Planning*, Vol. 30, No. 2, pp. 242-253.

Camarinha-Matos, L.M., Afsarmanesh, H., Galeano, N. and Molina, A. (2009), "Collaborative networked organizations – Concepts and practice in manufacturing enterprises", *Computers & Industrial Engineering*, Vol. 57, Iss: 1, pp. 46-60.

Campbell, D., Datar, S.M. and Sandino, T. (2009), "Organizational design and control across multiple markets: The case of franchising in the convenience store industry", *The Accounting Review*, Vol. 84, No. 6, pp. 1749-1779.

Caplice, C. and Sheffi, Y. (1995), "A review and evaluation of logistics performance measurement systems", *International Journal of Logistics Management*, Vol. 6, Iss: 1, pp. 61-74.

Chenhall, R.H. (2003), "Management control system design within its organizational context: Findings from contingency-based research and directions for the future", *Accounting, Organizations and Society*, Vol. 28, Iss: 2-3, pp. 127-168.

Choo, C.W. (2002), *Information Management for the Intelligent Organization*, Art of Scanning the Environment, Information Today, USA.

Cocca, P. and Alberti, M. (2010), "A framework to assess performance measurement systems in SMEs", *International Journal of Productivity and Performance Management*, Vol. 59, No. 2, pp. 186-200.

Coughlan, P. and Coghlan D. (2002), "Action research for operations management", *International Journal of Operations & Production Management*, Vol. 22, No. 2, pp. 220-240.

Cousins, P.D., Lawson, B. and Squire, B. (2008), "Performance measurement in strategic buyer-supplier relationships: The mediating role of socialization mechanisms", *International Journal of Operations & Production Management*, Vol. 28, No. 3, pp. 238-258.

Cunha, P.F., Ferreira, P.S. and Macedo, P. (2008), "Performance evaluation within cooperate networked production enterprises", *International Journal of Computer Integrated Manufacturing*, Vol. 21, No. 2, pp. 174-179.

Davenport, T.H., Harris, J.G. and Morison, R. (2010), *Analytics at work: Smarter decisions, better results*, Harvard Business School Press, Boston, USA.

Dekker, H. (2003), "Value chain analysis in interfirm relationship: A field study", *Management Accounting Research*, Vol. 14, Iss: 1, pp. 1-23.

De Toni, A. and Tonchia, S. (2001), "Performance measurement systems – Models, characteristics and measures", *International Journal of Operations & Production Management*, Vol. 21, Iss: 1/2, pp. 46-71.

Dryer, J.H., Kale, P. and Singh, H. (2001), "How to make strategic alliances work", *MIT Sloan Management Review*, Vol. 42, No. 4, pp. 37-43.

Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14, No. 4, pp. 532-550.

Eisenhardt, K.M. and Graebner, M.E. (2007), "Theory building from cases: Opportunities and challenges", *Academy of Management Journal*, Vol. 50, No. 1, pp. 25-32.

Ellram, L.M. (1995), "A managerial guideline for the development and implementation of purchasing partnerships", *International Journal of Purchasing and Materials Management*, Vol. 31, No. 2, pp. 9-16.

Elmuti, D. and Kathawala, Y. (2001), "An overview of strategic alliances", *Management Decision*, Vol. 39, Iss: 3, pp. 205-218.

Ferreira, P.S., Shamsuzzoha, A.H.M., Toscano, C. and Cunha, P. (2012), "Framework for performance measurement and management in a collaborative business environment", *International Journal of Productivity and Performance Management*, Vol. 61, Iss: 6, pp. 672-690.

Francisco, R. and Azevedo, A. (2007), "Dynamic performance management in business networks environment", *Digital Enterprise Technology*, Vol. 4, pp. 401-408.

Franco, M. and Bourne, M. (2003), "Factors that play role in managing through measures", *Management Decisions*, Vol. 41, No. 8, pp. 689-710.

Franco-Santos, M., Kennerley, M., Micheli, P., Martinez, V., Mason, S., Marr, B., Gray, D. and Neely, A. (2007), "Towards a definition of a business performance measurement system", *International Journal of Operations & Production Management*, Vol. 27, Iss: 8, pp. 784-801.

Franco-Santos, M., Lucianetti, L. and Bourne, M. (2012), "Contemporary performance measurement systems: A review of their consequences and a framework for research", *Management Accounting Research*, Vol. 23, No. 2, pp. 79-19.

Garengo, P., Biazzo, S. and Bitici, U. (2005), "Performance measurement in SMEs: A review for a research agenda", *Journal of Enterprise Information Management Reviews*, Vol. 7, No. 1, pp. 25-47.

Gooderham, G. (2001), "The top 10 lessons of implementing performance management systems", *Journal of Cost Management*, Vol. 15, No. 1, pp. 29-33.

Grandori, A. and Soda. G. (1995), "Inter-firm networks: Antecedents, mechanisms and forms", *Organization Studies*, Vol. 16, No. 2, pp. 183-214.

Gummesson, E. (2000), *Qualitative methods in management research*, Second Edition, Sage publications, Inc., Thousand Oaks, USA.

Gunasekaran, A., Patel, C. and McGaughey, R.E. (2004), "A framework for supply chain performance measurement", *International Journal of Production Economics*, Vol. 87, Iss: 3, pp. 333-347.

Hannula, M. (2002), "Total productivity measurement based on partial productivity ratios", *International Journal of Production Economics*, Vol. 78, Iss:1, pp. 57-67.

Hannula, M. and Lönnqvist, A. (2002), *Suorituskyvyn mittauksen käsitteet*, Metalliteollisuuden kustannus, Helsinki. (in Finnish).

Harter, D.E., Krishnan, M.S. and Slaughter, S.A. (2000), "Effects of process maturity on quality, cycle time and effort in software product development", *Management Science*, Vol. 46, No. 4, pp. 451-466.

Hirsjärvi, S., Remes, P. and Sajavaara, P. (2007), *Tutkija ja kirjoita*, Tammi, Otavan kirjapaino Oy, Keuruu. (in Finnish).

Hudson, M., Smart, A. and Bourne, M. (2001), "Theory and practice in SME performance measurement systems", *International Journal of Operations & Production Planning*, Vol. 21, No. 8, pp. 1096-3577.

Huxman, C. (Ed.) (1996), *Creating Collaborative Advantage*, Sage Publications Inc., London, UK.

Håkansson, H. and Lind, J. (2004), "Accounting and network coordination", *Accounting, Organizations and Society*, Vol. 29, pp. 51-72.

Ibbs, C.W. and Kwak, Y.H. (2000), "Assessing project management maturity", *Project Management Journal*, Vol. 31, No. 1, pp. 32-43.

Ittner, C.D., Larcker, D.F. and Randall, T. (2003), "Performance implications of strategic performance measurement in financial services firms", *Accounting, Organizations and Society*, Vol. 28, pp. 715-741.

Jääskeläinen, A. (2009), "Identifying a suitable approach for measuring and managing public service productivity", *Electronic Journal of Knowledge Management*, Vol. 7, No. 4, pp. 447-458.

Kajüter, P. and Kulmala, H.I. (2005), "Open-book accounting in networks: potential achievements and reasons for failures", *Management Accounting Research*, Vol. 16, Iss: 2, pp. 179-204.

Kaplan, R.S. and Atkinson, A.A. (1998), *Advanced Management Accounting*, Third edition, NJ: Prentice Hall, Upper Saddle River, USA.

Kaplan, R.S. and Norton, D.P. (1992), "The Balanced Scorecard – Measures that drive performance", *Harvard Business Review*, Vol. 70, No. 1, pp. 71-79.

Kaplan, R.S. and Norton, D.P. (1996), *The Balanced Scorecard: Translating Strategy into Action*, Harvard Business School Press, Boston, USA.

Kaplan, R.S. and Norton, D.P. (2001), *The Strategy-Focused Organization. How Balanced Scorecard Companies Thrive in the New Business Environment*, Harvard Business School Press, Boston, USA.

Kaplan, R.S., Norton, D.P. and Rugelsjoen, B. (2010), "Managing alliances with the Balanced Scorecard", *Harvard Business Review*, Vol. 88, No.1, pp. 68-75.

Kasanen, E., Lukka, K. and Siitonen, A. (1993), "The constructive approach in management accounting research", *Journal of Management Accounting Research*, Vol. 5, No. 1, pp. 243-264.

Kennerly, M. and Neely, A. (2002), "A framework of the factors affecting the evolution of performance measurement systems", *International Journal of Operations & Production Management*, Vol. 22, No. 11, pp. 1222-1245.

Kotter, J. (1996), *Leading Change*, Harvard Business School Press, Boston, USA.

Kulmala, H.I. (2003), *Cost management in firm networks*, Doctoral dissertation, Tampere University of Technology, Publication 418, Tampere.

Kulmala, H.I. and Lönnqvist, A. (2006), "Performance measurement of networks: Towards a non-financial approach", *International Journal of Networking and Virtual Organisations*, Vol. 3, No. 3, pp. 299-316.

Kulmala, H.I., Paranko, J. and Uusi-Rauva, E. (2002), "The role of cost management in network relationships", *International Journal of Production Economics*, Vol. 79, Iss: 1, pp. 33-43.

Lambert, D.M. and Pohlen, T.L. (2001), "Supply chain metrics', *International Journal of Logistics Management*, Vol. 12, No. 1, pp. 1-19.

Lebas, M.J. (1995), "Performance measurement and performance management", *International Journal of Production Economics*, Vol. 41, Iss: 1-3, pp. 23-35.

Lebas, M. and Euske, K. (2002), "A conceptual and operational delineation of performance", In: Neely, A. (ed.), *Business performance measurement: Theory and Practice*, Cambridge University Press, Cambridge, UK.

Leseure, M., Shaw, N. and Chapman, G. (2001), "Performance measurement in organizational networks: An exploratory case study", *International Journal of Business Performance Management*, Vol. 3, No. 1, pp. 30-46.

Letza, R.S. (1996), "The design and implementation of the balanced business scorecard", *Business process Re-engineering & Management Journal*, Vol. 2, No. 3, pp. 54-76.

Lohman, C., Fortuin, L. and Wouters, M. (2004), "Designing a performance measurement system: A case study", *European Journal of Operational Research*, Vol. 156, Iss: 2, pp. 267-286.

Lukka, K. and Kasanen, E. (1995), "The problem of generalizability: anecdotes and evidence in accounting research", *Accounting, Auditing and Accountability Journal*, Vol. 8, No. 5, pp. 71-90.

Lynch, R.L. and Cross, K.F. (1995), *Measure Up! Yardsticks for Continuous Improvement*, Second Edition, Blackwell, Cambridge, UK.

Lönnqvist, A. (2004), *Measurement of Intangible Success Factors: Case Studies on the Design, Implementation, and Use of Measures*, Doctoral dissertation, Tampere University of Technology, Publication 475, Tampere.

Lönnqvist, A. and Laihonen, H. (2012), "Welfare service system productivity: The concept and its application", *International Journal of Productivity and Performance Management*, Vol. 61, No. 2, pp. 128-141.

Mahama, H. (2006), "Management control systems, cooperation and performance in strategic supply relationships: A survey in the mines", *Management Accounting Research*, Vol. 17, No. 3, pp. 315-339.

Malmi, T. and Brown, D.A. (2008), "Management control systems as a package – Opportunities, challenges and research directions", *Management Accounting Research*, Vol. 19, No. 4, pp. 287-300.

Marchand, M. and Raymond, L. (2008), "Researching performance measurement systems – An information systems perspective", *International Journal of Operations and Production Management*, Vol. 28, No. 7, pp. 663-686.

Marshall, S. and Mitchell, G. (2004), "Applying SPICE to e-learning: An e-learning maturity model?", In: Lister, R. and Young, A. (eds.), Computing Education 2004. *Proceedings of the Sixth Australasian Computing Education Conference (ACE2004)*. CRPIT. Vol. 30, pp. 185-191, Dunedin, New Zealand.

Marshall, M., Wray, L., Epstain, P. and Grifel, S. (1999), "21st Century community focus: Better results by linking citizens, government, and performance measurement", *Public Management*, Vol. 81, No. 10, pp. 12-18.

Meekings, A. (1995), "Unlocking the potential of performance measurement: A practical implementation guide", *Public Money & Management*, Vol. 15, No. 4, pp. 5-12.

Metsämuuronen, J. (2005), *Tutkimuksen tekeminen perusteet ihmistieteissä*, International Methelp Ky, Jyväskylä. (in Finnish).

Mettänen, P. (2005), "Designing and implementing of a performance measurement system for a research organization", *Production Planning & Control*, Vol. 16, No. 2, pp. 178-188.

Miles, M.B. and Huberman, A.M. (1994), *Qualitative data analysis: An expanded sourcebook*, Second Edition, Sage Publications, Inc., Thousand Oaks (CA), USA.

Mohr, J. and Spekman, R. (1994), "Characteristics of partnership success: Partnership attributes, communication behaviour, and conflict resolution techniques", *Strategic Management Journal*, Vol. 15, pp. 135-152.

Moore, C. (1999), "Performance measures for knowledge management", In: Liebovitz, J. (ed.), *Knowledge Management Handbook*, CRC Pree, Boca Raton, USA.

Morgan, C. (2007), "Supply network performance measurement: Future challenges", *International Journal of Logistics Management*, Vol. 18, No. 2, pp. 255-273.

Nassimbeni, G. (1998), "Network structures and co-ordination mechanisms", *International Journal of Operations & Production Management*, Vol. 18, No. 6, pp. 538-554.

Neely, A. (1999), "The performance measurement revolution: Why now and what next?", *International Journal of Operations & Production Management*, Vol. 19, No. 2, pp. 205-228.

Neely, A., Adams, C. and Kennerley, M. (2002), *The Performance Prism: The Scorecard for Measuring and Managing Business Success*, FT Prentice Hall, London, UK.

Neely, A, Gregory, M. and Platts, K. (1995), "Performance measurement system design: A literature review and research agenda", *International Journal of Operations & Production Management*, Vol. 14, No. 3, pp. 80-116.

Neely, A., Mills, J., Platts, K., Gregory, M. and Richards, H. (1996), "Performance measurement system design: Should process based approach be adopted?", *International Journal of Production Economics*, Vol. 46-47, Iss: 1, pp. 423-431.

Neely, A., Mills, J., Platts, K., Richards, H., Gregory, M., Bourne, M. and Kennerley, M. (2000), "Performance measurement system design: Developing and testing a process-based approach", *International Journal of Operations & Production Management*, Vol. 20, Iss: 10, pp. 1119-1145.

Niazi, M., Wilson, D. and Zowghi D. (2005), "A maturity model for the implementation of software process improvement: An empirical study", *The Journal of Systems and Software*, Vol. 74, pp. 155-172.

Niemi, P., Huiskonen, J. and Kärkkäinen, H. (2009), "Understanding the knowledge accumulation process – Implications for the adoption of inventory management techniques", *International Journal of Production Economics*, Vol. 118, No. 1, pp. 160-167.

Niemi, P., Huiskonen, J. and Kärkkäinen, H. (2010), "Supply chain development as a knowledge development task", *International Journal of Networking and Virtual Organisations*, Vol. 7, No. 2/3, pp. 132-149.

Nudurupati, S.S. and Bititci, U.S. (2005), "Implementation and impact of IT enabled performance measurement", *Production Planning and Control*, Vol. 16, No. 2, pp. 152-162.

Nudurupati, S.S., Bititci, U.S., Kumar, V. and Chan, F.T.D. (2011), "State of the art literature review on performance measurement", *Computers & Industrial Engineering*, Vol. 60, Iss: 2, pp. 279-290.

Olkkonen, T. (1994), *Johdatus teollisuustalouden tutkimustyöhön*, Second Edition, Teollisuustalous ja työpsykologia, Report 152, Helsinki University of Technology, Espoo. (in Finnish).

Papakiriakopoulos, D. and Pramatari, K. (2010), "Collaborative performance measurement in supply chain", *Industrial Management & Data Systems*, Vol. 110, No. 9, pp. 1297-1318.

Parker, H. (2000), "Interfirm collaboration and the new product development process", *Industrial Management & Data Systems*, Vol. 100, Iss: 6, pp. 255-260.

Parung. J. and Bititci, U.S. (2006), "A conceptual metric for managing collaborative network", *Journal of Modelling in Management*, Vol. 1, Iss: 2, pp. 116-136.

Parung, J. and Bititci, U.S. (2008), "A metric for collaborative networks", *Business Process Management Journal*, Vol. 14, No. 5, pp. 654-674.

Pascale, R. and Athos, A. (1981), *The Art of Japanese Management*, Penguin Books, London, UK.

Paulzen, O. and Perc, P. (2002), "A maturity model for quality improvement in knowledge management", In: Wenn, A., McGrath, M. and Burstein, F. (eds.), Enabling organizations and society through information systems, *Proceedings of the 13th Australasian conference on information systems* (ACIS 2002), pp. 243-253, Melbourne, Australia.

Pfohl, H.-C. and Buse, H.P. (2000), "Inter-organizational logistics systems in flexible production networks: An organizational capabilities perspective", *International Journal of Physical Distribution & Logistics Management*, Vol. 30, Iss: 5, pp. 388-408.

Pisano, G.P. and Verganti, R. (2008), "Which kind of collaboration is right for you?", *Harvard Business Review*, Vol. 86, Iss: 12, pp. 78-86.

Prahalad, C.K. and Krishnan, M.S. (2002), "The dynamic synchronisation of strategy and information technology", *MIT Sloan management review*, Summer, pp. 24-33.

Radnor, Z.J. and Barnes, D. (2007), "Historical analysis of performance measurement and management in operations management", *International Journal of Productivity and Performance Management*, Vol. 56, No. 5, pp. 384-96.

Rantanen, H. and Holtari. J. (2000), *Suorituskyvyn analysointi päijäthämäläisessä pkt-yrityksissä*, Research Report 120, Lappeenranta University of Technology, Department of Industrial Engineering and Management, Lappeenranta. (in Finnish).

Riis J., Hildebrandt S., Andreasen M. and Johansen J. (2001), "Implementing change: Lessons from five development projects", *International Journal of Technology Management*, Vol. 22, No. 1-3, pp. 13-27.

Saiz, J.J.A., Bas, A.O. and Rodríguez, R.R. (2007), "Performance measurement system for enterprise networks", *International Journal of Productivity and Performance Management*, Vol. 56, No. 4, pp. 305-334.

Schmitz, J. and Platts, K.W. (2004), "Supplier logistics performance measurement: Indications from a study in the automotive industry", *International Journal of Production Economics*, Vol. 84, No. 2, pp. 231-243.

Sherman, A.J. (2011), *Franchising & licensing: two powerful ways to grow your business in any economy*, Fourth Edition, American Management Association, USA.

Simons, R. (2000), *Performance Measurement & Control Systems for Implementing Strategy*, Prentice Hall, Upper Saddle River, USA.

Singh, R.K., Garg, S.K. and Deshmukh, S.G. (2008), "Strategy development by SMEs for competitiveness: A review", *Benchmarking: An International Journal*, Vol. 13, No. 5, pp. 525-547.

Sink, D.S. (1983), "Much ado about productivity: Where do we go from here", *Industrial Improvement*, Vol. 15, No. 10, pp. 36-48.

Stivers, B.P., Covin, T.J., Hall, N.G. and Smalt, S.W. (1998), "How nonfinancial performance measures are used", *Management Accounting*, February, pp. 44-48.

Tenhunen, J. (2006), *Johdon laskentatoimi kärkiyritysverkostossa: Soveltamismahdollisuudet ja yritysten tarpeet*, Doctoral dissertation, Lappeenranta University of Technology, Acta Universitatis Lappeenrantaensis 241, Lappeenranta. (in Finnish).

Toivanen, J. (2001), *Balanced Scorecardin implementointi ja käytön nykytila Suomessa*, Doctoral dissertation, Lappeeranta University of Technology, Acta Universitatis Lappeenrantaensis 108, Lappeenranta. (in Finnish).

Tomkins, C. (2001), "Interdependencies, trust and information in relationships, alliances and networks", *Accounting Organization and Society*, Vol. 26, Iss: 2, pp. 161-191.

Tuomi J. and Sarajärvi, A. (2002), *Laadullinen tutkimus ja sisältöanalyysi*, Tammi, Gummerus kirjapaino Oy, Jyväskylä. (in Finnish).

Ukko, J. (2009), *Managing through measurement: A framework for successful operative level performance measurement*, Doctoral dissertation, Lappeenranta University of Technology, Acta Universitatis Lappeenrantaensis 348, Lappeenranta.

Ukko, J., Tenhunen, J. and Rantanen, H. (2007), "Performance measurement impacts on management and leadership: Perspectives of management and employees", *International Journal Production Economics*, Vol. 110, Iss: 1-3, pp. 39-51.

Varamäki, E., Kohtamäki, M., Järvenpää, M., Vuorinen, T., Laitinen, E.K., Sorama, K., Wingren, T., Vesalainen, J., Helo, P., Tuominen, T., Pihkala T. and Tenhunen J. (2008), "A framework for a network-level performance measurement system in SME networks", *International Journal of Networking and Virtual Organizations*, Vol. 5, No. 3/4, pp. 415-435.

Varamäki, E. and Vesalainen, J. (2003), "Modelling different types of multilateral co-operation between SMEs", *Entrepreneurship & Regional Development*, Vol.15, Iss: 1, pp. 27-47.

Verdecho, M.J., Alfaro, J.J. and Rodriguez-Rodriguez, R. (2009), "Foundations for collaborative performance measurement", *Production Planning & Control*, Vol. 20, No. 3, pp. 193-205.

Vesalainen, J. (1996), *Yritysyhteistyön malleja – käsikirja yhteistyön edistäjille*, Kauppa- ja teollisuusministeriön tutkimuksia ja raportteja, 18/1996. (in Finnish).

Voss, C., Tsikriktsis, N. and Frohlich, M. (2002), "Case research in operations management", *International Journal of Operations & Production Management*, Vol. 22, No. 2, pp. 195-219.

Wernerfelt, B. (1984), "A resource-based view of the firm", *Strategic Management Journal*, Vol. 5, Iss: 2, pp. 171-180.

Westbook, R. (1995), "Action research: A new paradigm for research in production and operations management", *International Journal of Operations & Production Management*, Vol. 15, No. 12, pp. 6-20.

Wisniewski, M. and Ólafsson, S. (2004), "Developing balanced scorecard in local authorities: A comparison of experience", *International Journal of Productivity and Performance Management*, Vol. 53, No. 7, pp. 602-610.

Yin, R.K. (2009), *Case Study Research – Design and Methods*, Fourth Edition, Sage Publications Thousand Oaks, USA.

Yin, Y., Qin, S. and Holland, R. (2011), "Development of a design performance measurement matrix for improving collaborative design during a design process", *International Journal of Productivity and Performance Management*, Vol. 60, No. 2, pp. 152-184.

Zineldin, M. and Bredenlöw, T. (2003) "Strategic alliance: synergies and challenges: A case of strategic outsourcing relationship "SOUR"", *International Journal of Physical Distribution & Logistics Management*, Vol. 33, Iss: 5, pp. 449-464.

PART 2 – PUBLICATIONS

ARTICLE I

Pekkola, Sanna and Ukko, Juhani

Designing a performance measurement system for a collaborative network

Submitted (2013) to International Journal of Operations & Production Management

Designing a Performance Measurement System for a Collaborative Network

Sanna Pekkola & Juhani Ukko
Lappeenranta University of Technology
Lahti School of Innovation

Purpose – The purpose of the study is to examine how can a performance measurement system be designed for a collaborative network and what factors affects the design of a performance measurement system for a collaborative network.

Design/methodology/approach – The study is a single-case study, where a collaborative network forms the case. The data of the study has been gathered from an action research process of network performance measurement system design and its implementation phase in 2009, interviews in 2010, and discussions with the interviewees in 2012.

Findings – The result of the research presents a three-step process model for designing a performance measurement system for a collaborative network. The findings showed that a participatory development style, positive development of a network culture, an outside facilitator, and keeping the measurement simple and resource effective had positive effects on the performance measurement design process for a collaborative network.

Practical implications – The practical contribution is related to knowledge about the process of designing a performance measurement system for a collaborative network that can support the measurement-related development projects in the network. This knowledge is related to the steps and various factors supporting and preventing the design process of a performance measurement system.

Originality/value – The study presents a performance measurement system design process for the case network, which can be utilised in other collaborative networks in a similar context. It also highlights the most essential practical experiences related to this design process.

Keywords: Performance management, performance measurement system, collaborative network, collaboration

1 Introduction

Recently, collaboration among companies has increased. Therefore, the design of performance measurement systems for the use of collaborative networks has been a topic of increasing concern in both academic and managerial circles (Cohen and Lee, 1988; Beamon, 1999; Leseure et al., 2001; Gunasekaran et al., 2004; Busi and Bititci, 2006; Kulmala and Lönnqvist, 2006; Camarinha-Matos and Abreu, 2007; Saiz et al., 2007; Kaplan et al., 2010; Yin et al., 2011; Bititci et al., 2012). Unfortunately, limited empirical research has been conducted on performance measurement systems and their design in small and medium enterprise (SME) networks (Yin et al., 2011; Bititci et al., 2012). It is important to apply system-level control mechanisms and performance measurement tools to a network while attempting to manage the network. A network is not an intrinsic value, but a tool for organising operations among companies; therefore, the ability of networks to succeed in their tasks has been receiving considerable attention (Kulmala and Lönnqvist, 2006; Bititci et al., 2007; Varamäki

et al., 2008). Companies in a collaborative network are interested in the benefits and costs of networking, the investors are interested in the revenue opportunities involved in the network and the customers in the value chain are interested in the ability of the network to manage production tasks as well as or better than an integrated single company. This leads to the following question: how are networks considered in measurement systems?

Previous literature contains frameworks for the overall performance measurement of networks (Beamon, 1999; Leseure et al., 2001; Busi and Bititci, 2006; Varamäki et al., 2008) and presents some measurement models for supply chain performance measurement (Brewer and Speh, 2000; Schmitz and Platts, 2004; Gunasekaran et al., 2004; Bititci et al., 2005; Saiz et al., 2007) and individual measures for measuring customer-supplier boundaries (Beamon, 1999; Ellram, 1995); however, thus far, the need for a structured methodology for the design of a performance measurement system for the network environment has not been addressed (Busi and Bititci, 2006; Yin et al., 2011). Kulmala and Lönnqvist (2006) reveal that the importance of business networks and inter-organisational co-operation is acknowledged by many organisations. The performance measurement systems often include issues related to customer relationships (e.g. customer satisfaction), supplier relationships (e.g. supplier's delivery accuracy) and other stakeholders (e.g. stakeholder communication). The strengthening of inter-organisational relationships create the need for managing and controlling these relationships. A network-level performance measurement system, for example, could be used to manage the business processes and guide the actors in the network to pursue the common targets of the network (Cohen and Lee, 1988; Beamon, 1999; Leseure et al., 2001; Busi and Bititci, 2006; Kulmala and Lönnqvist, 2006). Furthermore, information on network-level performance measurement is required for decision making, for example, to avoid organisation-level suboptimisation.

Generally, the question regarding collaboration is no longer about whether to collaborate, but rather about the need to understand and select the suitable collaboration options (Pisano and Verganti, 2008; Bititci et al., 2011). According to Bititci et al. (2012), the literature on performance measurement recognises the trends towards inter-organisational working and warrants the study of performance measurement in collaborative organisations. The measurement of collaborative networks is challenging because they are very complex environments (Lambert and Pohlen, 2001; Bititci et al., 2005; Busi and Bititci, 2006). There are different-level information needs and various opinions concerning the importance of different information. The boundaries and relationships among network members also influence the network-level performance measurement. Moreover, a lack of trust and commitment has been considered a key reason for the failure of the design process. The results presented in previous literature (Busi and Bititci, 2006) indicate that there is a need for developing a deeper understanding of how and what to measure in collaborative networks. Further, Busi and Bititci (ibid.) present a research need for developing a structured methodology to design a performance measurement system for collaborative networks. Based on this research gap, two research questions are addressed in this paper:

1. How should a performance measurement system be designed for a collaborative network?
2. What factors influence the design of a performance measurement system for a collaborative network?

This study presents a case study for designing a performance measurement system for a collaborative network. Furthermore, this study can be described as a qualitative and action research study. The objective of the study is to elucidate how a three-phase design process functions and determine the essential and notable features of this process. In addition, the study presents a complete performance measurement system for the case network, which can be utilised in other collaborative networks in a similar context. The study concludes by illustrating how a performance

measurement system can be designed for a collaborative network, highlighting the most essential practical experiences related to this design process.

2 Literature review

2.1 Classification of collaborative networks

Networking and collaboration can be defined in many ways. According to Wernerfelt (1984), a collaborative network organisation comprises two or more companies that collaborate their tangible and intangible resources. Collaboration can also be classified based on what individual participants bring to and share in collaboration, the intensiveness of the collaboration, and the roles of different actors in it. According to Camarinha-Matos et al. (2009), organisations collaborate, for example, to share data and information, information systems, risks, and benefits. Based on these aspects, the authors present four categories in which the maturity and integration level of collaboration increases:

- *Networking* involves communication and exchange of information for mutual benefit. The value of networking comes from the exchange of information and sharing of experiences among the participants; however, there may not be any common goal or structure influencing the form and timing of individual contributions.
- *Coordinated networking* involves, besides communication and information exchange, aligning/altering activities for achieving more efficient results. Coordination, which is an act of working harmoniously in a concerted manner, is one of the basic building blocks of collaboration.
- *Cooperation* involves not only communication, information exchange and adjustment of activities but also resource sharing for achieving compatible goals. Cooperation is achieved through division of some labour (not extensive) among the participants.
- *Collaboration* is a more demanding process, where the entities share information, resources and responsibilities to jointly plan, implement and evaluate a program of activities to achieve a common goal, thereby generating value. Collaboration involves mutual engagement of the participants to resolve the problem together, which implies mutual trust and takes time, effort and dedication.

In this study, the case network partially uses the franchising concept. A franchising network refers to the methods of practicing and using another person's business philosophy. The franchisor grants an independent operator the right to distribute its products, techniques and trademarks for a percentage of the gross monthly sales and a royalty fee. Various tangible and intangible resources, such as national or international advertising, training and other support services, are usually provided by the franchisor (Sherman, 2004).

Camarinha-Matos et al.'s (2009) definition ,this study can be viewed as an collaborative network. The case network is a franchising network; however, it differs from the traditional franchising concept in many ways. The franchisees in the case network sell kitchen fitments, which are very challenging to sell, because the sales action is unique in each case. Purchasing a kitchen is an expensive investment, and there are not only numerous different variations but also customers' preferences and tastes that influence the selling process. Therefore, the members of the network have a strong and shared identity and they collaborate around many issues. The role of the franchisor is more consistent with that of the franchisees compared to the traditional franchising concept. The challenging products and selling processes offer many opportunities to learn from the other members of the network. The network has many common plans, for example, the action plan and marketing strategy, and network

members share the risks that may arise from the implementation of these plans. They also have a joint information system, which allows them to participate in the design process. The network has a common target, that is, to maximise the turnover of the entire network. Based on the above facts, it can be stated that the case network effectively covers the different criteria of a collaborative network.

2.2 Performance measurement in collaborative networks

When a network becomes more structured, it should be able to manage and measure its performance to avoid failure. According to Kaplan et al. (2010), network-level performance measurement can enable networks to enhance the focus of network management from contribution and operations to joint strategy and commitment. The study of Mahama (2008) reveals that a performance measurement system facilitates cooperation and socialisation in inter-organisational relationships. Furthermore, Mahama (2008) indicates that a performance measurement system helps to ensure that performance information is distributed fairly among the participants, thereby facilitating learning and problem solving within the network. Bititci et al. (2012) emphasize that future research should focus on understanding collaboration and its mechanisms and developing theories, methods and techniques to ensure that all network partners can not only define and manage the common goals and responsibilities but also measure and evaluate them. Furthermore, Busi and Bititci (2006) state that there is a need to study and develop a structured methodology to design a performance measurement system and structured management process for using measures to support decision making in a collaborative network. Yin et al. (2011) emphasise that thus far, only a few studies have focused on collaborative design, especially from the design process perspective. According to Franco-Santos et al. (2012), the impact of a performance measurement system on inter-firm performance has also received little attention in the existing literature. Rey-Marston and Neely (2010) suggested that future research should focus on the scope of the current performance measurement system beyond the boundaries of the organisation. Based on the extant literature and the considerable empirical experience of the authors, a managerial need is perceived for a straightforward and practical design process of a performance measurement system, considering the characteristics and challenges of the network environment.

The literature reveals various reasons as to why performance management and measurement are considered challenging in the network context (Kulmala, 2003; Lambert and Pohlan, 2001; Busi and Bititci, 2006; Kulmala and Lönnqvist, 2006). The lack of understanding of the collaborative structure and dynamics is considered the main cause of the failure of collaborative initiatives (Busi and Bititci, 2006). Therefore, it is necessary to determine the key elements of collaboration, how they interact and how they can be integrated within a performance measurement system. Busi and Bititci (ibid.) emphasize that the difficulty of developing a collaborative culture and appropriate performance measures have been identified as the major barriers to the successful implementation of a network-level performance measurement system. Busi and Bititci (2006), Lambert and Pohlan (2001) and Lönnqvist and Laihonen (2012) show that difficulties in defining the measures for network-level performance management are related to the complexity of the overlapping business network. Furthermore, Busi and Bititci (2006) reveal that organisations find it challenging to share information with their partners. In network measurement, it is essential that companies share almost all their information with the other network partners (Kulmala, 2003). Busi and Bititci (2006) and Beamon (1999) state that networks face difficulties in evaluation and determining the unit of analysis, that is, the level of measurement. Busi and Bititci (2006) highlight that probably the biggest problem in implementing measures is a lack of consensus among the network members. The network must have a clear vision regarding the roles and targets of the network and an understanding of and commitment to the shared objectives. Therefore, intensive discussions are required for improving

the understanding among the partners. It is important that the network determines and defines the benefits of a common performance measurement system for the entire network in general and for each of the network members in particular.

Extant literature presents frameworks for the overall performance measurement of networks (Beamon, 1999; Leseure et al., 2001; Busi and Bititci, 2006; Varamäki et al., 2008), some frameworks for supply chain performance measurement (Brewer and Speh, 2000; Schmitz and Platts, 2004; Gunasekaran et al., 2004; Bititci et al. 2005; Saiz et al., 2007) and some individual measures for measuring customer-supplier boundaries (Beamon, 1999; Ellram, 1995). These analyses show that networks and their member interfaces include many important features that need to be considered when designing and selecting the measures. For example, Beamon (1999) presents an overview and evaluation of the performance measures used in supply chain models and presents a framework for the selection of a performance measurement system for manufacturing supply chains. Leseure et al. (2001) present a framework for meta-performance to measure the performance of the total network, capability of each network member in performing what is expected, and the contribution of each network member to the overall performance of the network. Varamäki et al. (2008) have developed a framework for performance measurement, which comprises the factors that enable action and success of processes and ensure the productivity and profitability of activities. The factors enabling success are the values and culture of the network, resources and competences and the models of action in the network. According to Busi and Bititci (2006), the factors that influence performance management are enterprise collaboration, operations management and business process management or engineering, performance measurement or management and decision support, information and communication management, and organisational behaviour and knowledge management. Busi and Bititci (ibid.) claim that all these elements should be analysed to develop collaborative performance management measures. Bititci et al. (2005) also present an extended enterprise performance measurement model (EEPMM), which comprises a series of scorecards, including enterprise scorecard, business unit scorecard, extended enterprise or meta-level scorecard, and extended business process scorecard. However, their study does not provide a complete design and implementation process of the model. Most of the earlier studies are either theoretical in nature or based on supply chain case studies (Bititci et al., 2012). Moreover, it is rather difficult to apply the models and frameworks provided in these studies to practical problems and they do not consider the challenges related to the design and implementation phases.

2.3 Design of a performance measurement system

Various frameworks have been presented in the literature for designing a performance measurement system for a manufacturing or service organisation (Kaplan and Norton, 1992; 1996; Olve et al., 1998; Simons, 2000; De Toni and Tonchia, 2001; Gooderham, 2001; Mettänen, 2005). These frameworks comprise a varying number of phases and use different methods. However, in most cases, the design process is quite similar: the first phase elucidates the strategy and determines the critical success factors and the second phase aims at defining the measures for these success factors. Kaplan and Norton (1996) describe a typical and systematic implementation plan to develop a Balanced Scorecard for an organisation. The process model, which comprises four main steps, aims to encourage commitment to the Scorecard among senior and mid-level managers, which is considered as a prerequisite for successful implementation. Kaplan and Norton's (1996) Balanced Scorecard model was created to meet the needs of a large organisation. As mentioned above, there are many other process models for designing and implementing a performance measurement system (e.g. Gooderham, 2001). However, the their utilisation has not been widely studied. Furthermore, most of the presented models disregard the specific nature of collaborative networks.

Busi and Bititci (2006) state that future operations management research should initiate the research process by understanding collaboration and its mechanisms, and researchers should consider the aspects involved in collaboration and the collaborative enterprise business model, namely operational, infrastructural (technical) and behavioural issues. In collaborative networks, the measurement systems should be designed to utilize a balanced set of performance measures that monitor both external relationships and the efficiency of internal and extended processes, which will support proactive management based on both feedback and feed-forward operations control. Furthermore, a suggestion has been made to study team performance management and develop extended process, collaborative and collaboration management performance measures (Busi and Bititci, 2006). There is also a need for developing suitable communication infrastructure, because the sharing of information among organisations has posed a problem in defining an appropriately balanced set of measures for collaborative performance management (Busi and Bititci, 2006). Furthermore, Parung and Bititci (2006; 2008) suggest numerous value generators (e.g. physical assets, human capital, organisational capital, relational capital) besides financial assets because the extant literature (Kald and Nilsson, 2000; Leseure et al., 2001; Håkansson and Lind, 2004) and empirical evidence on network-level performance measurement seem to be limited to financial measures.

Parung and Bititci (2008) indicate that there are three kinds of measurements that may influence the success of collaborative networks and its measurement: (1) input to the collaboration, that is, the contribution of each participant, (2) the health of the collaboration and (3) the outcome of the collaboration. Measuring the input is a means of determining the resources that the participants contribute to the collaborative network, whereas measuring the health of a collaborative network is an effort to distinguish a healthy collaborative network from an unhealthy one by measuring the dimensions of commitment, coordination, trust, quality of communication and participation and the conflict resolution technique of joint problem solving (Parung and Bititci, 2006; 2008). Measuring the output is an attempt to determine the benefit accrued to the key stakeholders as a result of their participation in the collaborative network. According to Parung and Bititci (2006), the outcome of the organisation is usually associated with its performance, and performance measurement is often linked to the efficiency and effectiveness of an organisation to satisfy its customers (Neely, 1999). Further, effectiveness refers to the extent to which customer requirements are met, whereas efficiency is a measure of how economically the firm's resources are utilised when providing a given level of customer satisfaction. To evaluate the participants' benefits in joining collaborative networks, output should be measured before and after collaboration (Parung and Bititci, 2006).

Despite the fact that many models and guidelines have been provided for designing a performance measurement system, none of these models, except the one presented in Kulmala and Lönnqvist (2006), have been designed for a network. Kulmala and Lönnqvist (2006) have proposed the following approach for designing a performance measurement system for a network: In the first phase, the success factors of the network should be identified from the end customer's perspective. These success factors can be defined in the same manner as performance measures are defined for an individual company. The success factors are likely to comprise both financial and non-financial factors. In the second phase, network-level performance measures should be defined for these success factors. Moreover, Cunha et al. (2008) have identified a set of requirements that should be met when developing a performance measurement system for production networks to satisfy the stakeholders' information needs. Firstly, the process of defining indicators should be a collaborative activity, which should be performed during the network set-up and redefined periodically during the operation phase. Secondly, the defined indicators should enable the performance evaluation of the collaborative aspects in the network. In the third phase, the vision of each member of the network should be considered and the individuals' performance measurement systems should be embedded into the network's performance measurement system. Thus, both the network-level and member-

level performance measures should be considered. In the fourth stage, the technological design of the performance system should provide an architecture that is flexible enough to support the entry and exit of new members. In the fifth and final stage, a methodology to define a well-structured set of performance measures is considered an important contribution to the management activity. In practice, designing and implementing a performance measurement system does not necessarily proceed as smoothly as described in the existing literature. For example, according to Bourne et al. (2002), many of the factors that cause problems in the implementation of a performance measurement system can be attributed to a poor design process.

2.4 Summary of prior research

In summary, it can be stated that prior research on this topic presents many factors that facilitate the design and implementation of performance measurement in collaborative networks (Table 1). However, these factors have been derived from multiple approaches, without clearly outlining issues that may arise at different levels (i.e. the network level or member level). The lack of empirical results in the real-life context, together with the lack of elaborate explanation of how these issues can be managed and facilitated in collaborative networks reveals the need for in-depth research (e.g. action research). Such an approach will contribute to the understanding of how performance can be measured in collaborative networks. Owing to the fragmented literature, it is also difficult to determine the most important issues in designing and facilitating performance measurement in collaborative networks. Further, the prior studies lack an explicit presentation of how the different factors are connected to each other. The present study attempts to investigate the issues that are most important when designing a collaborative performance measurement system and how they can be arranged and managed to facilitate the design and implementation of such a system.

Table 1. Factors facilitating the design and implementation of a performance measurement system in collaborative networks

Factors related to the design and implementation of a performance measurement system in a collaborative network	*Prior studies*
Understanding collaboration, mechanism and business model	Busi and Bititci, 2006; Lambert and Pohlan, 2001; Lönnqvist and Laihonen, 2012
Joint strategy, goals, measures, responsibilities and commitment	Busi and Bititci, 2006; Cunha et al., 2008; Kaplan et al., 2010
Collaborative culture, behaviour and trust	Busi and Bititci, 2006; Parung and Bititci, 2006, 2008; Varamäki, 2008
Information, communication and knowledge sharing	Busi and Bititci, 2006; Kulmala, 2003
Structured design of the performance measurement system	Busi and Bititci, 2006; Franco-Santos et al., 2012; Kulmala and Lönnqvist, 2006
Structured management to support decision making	Busi and Bititci, 2006
Participation, socialisation, learning and problem solving	Mahama, 2008; Parung and Bititci, 2006, 2008
Resources and competences	Varamäki et al., 2008

The need for a structured process for designing a performance measurement system in a collaborative network has been emphasized by numerous authors (Busi and Bititci, 2006; Franco-Santos et al., 2012; Kulmala and Lönnqvist, 2006). A structured design process for a network-level performance measurement system has been developed in this study. The study presents how the different process steps have been realised and identifies the essential issues that should be considered when utilising the system developed in this study. The study also investigates how the different factors related to the design of a performance measurement system have been combined. For example, it is interesting to examine whether a certain type of participation will lead to a higher level of trust, commitment, communication or understanding of collaboration.

3 Research design

3.1 Data and research methods

We present a case study focusing on the design of a performance measurement system for a collaborative network. This study adopts a qualitative and action research approach. The study adduces experiences of the design process in the network context and presents the final version of a performance measurement system. It is based on a single case study conducted between autumn 2008 and spring 2009. Case studies are the preferred strategy when 'how' or 'why' questions are being posed, the investigator has little control over the events and the focus is on a contemporary phenomenon within some real-life context. Case studies are conducted to holistically examine certain phenomena in selected cases. Although a case study is occasionally considered a single research method, it should be viewed as a research approach that can employ various qualitative and quantitative research methods, such as analysing archives, conducting interviews or using questionnaires (Gummesson, 2000).

The use of a single case study is an appropriate research design in several circumstances. Firstly, a single case study is analogous to a single experiment, because many of the conditions that justify the use of a single experiment also justify the use of a single case study. One rationale for a single case is when a critical case is used for testing a well-formulated theory. Another rationale for a single case is when the case represents an extreme or unique case. From the perspective of the present case, the existing literature reveals that there is very little practical experience of the use of performance management and performance measurement systems at the network level. Thus, the case is unique because it provides new and practical information regarding the design of network-level performance measurement. The third rationale for a single case study is when a revelatory case is used. This situation exists when an investigator has an opportunity to observe and analyse a phenomenon previously inaccessible. The revelatory nature of the case justifies the use of a single case study (Yin, 2009). Occasionally, for example, in extreme or polar situations, successful and unsuccessful cases are selected (Eisenhardt, 1989).

The data collection for the paper comprised three elements. The first element included developing a preliminary understanding of the state of the case network and its performance measurement. The second element entailed the development of a network-level performance measurement design process. The third element involved developing a better understanding of the factors that play an important role in the design process of the network-level performance measurement system. The data was gathered from initial interviews, an action research process and a questionnaire, which was used after the active part of the data collection was completed.

Before the design process, two researchers acquired some background information of the case network. The researchers interviewed eight resellers (shopkeepers) and four persons from the main company. The semi-structured interview technique was used for conducting interviews, where the topics and issues were decided beforehand. The interviews focused on the success factors of the network, health of the collaboration, current measures and their weaknesses and strengths, information requirements from the perspective of the entire network, information regarding the resellers and the sales management of the main company and expectations from the design process. These initial interviews increased the understanding of the state of the network and its performance measurement as well as the members' expectations for the future. Furthermore, the current stage of the health of collaboration (commitment, coordination, trust and communication quality) was evaluated on the basis of the perceptions of interviewed participants. Each interview took approximately one hour thirty minutes. The interviews were initially analysed independently by two

researchers by using codes related to the state of the network, information needs, current measures, etc. and subsequently, a common view was discussed.

The main line of research in the study was action research, where the researcher, who also played the role of a facilitator, had access to the design process. The key benefit of action research is that it offers in-depth information of a process (Gummeson, 2000). Action research is a methodological approach that comprises two parts: an action project, in which action is generated, and a research project, which aims at creating knowledge about the action (Avison et al., 2001). In action research, although the question 'why' is asked, the question 'how' is constructed during the action research process, because the result depends on all the participants and chance events. The role of the researcher is significant, as he/she can, if not totally control, at least guide the process in a certain direction. In every case, the researcher influences the results in one way or another. Action research is strongly linked to contemporary events within real-life contexts (Avison et al., 1999). In the present case, the researcher can eventually be described as a facilitator whose primary responsibility is not the production of new scientific knowledge, but the facilitation of the participants in the case network to engage in the performance measurement design process and promote the entire process (Wadsworth, 2008).

Three researchers participated actively in the action research process. Researcher 1 was the main facilitator of this process. She kept in touch with the network members and was primarily responsible for planning and organising the design process. Researchers 2 and 3 were co-facilitators who were responsible for observing and documenting the discussions and results of the sessions for research purposes. In this case, the researchers were not involved in content creation. The researchers only facilitated the design process by asking the questions and organising the sessions and their structures. At the end of every session, the researchers also asked general questions relating to the participants' views and experiences of the session. In the feedback session, the participants evaluated the whole design process and its effects on the operations, knowledge and culture of the network. The current state of the health of the collaboration was evaluated by asking the participants to analyse and describe, for example, the current state of their commitment to the network. After the action research process, the participants participated to the group interview. First, the participants filled in a questionnaire (open-ended questions) containing the same questions as in the interviews. After that the same questions were asked in the group interview. The questions, which were based on the extant literature, were related to the design process as well as the network-level performance measurement system and its impact on the operations and business. The participants has been re-interviewed in 2012, where confirmed the earlier results.

After each session, all the researchers reviewed the documentation and formed a common perspective. After the design process, all the data (obtained through interviews, descriptions of the design process and documentation of discussions, results and observations) was analysed by using the following research questions of this study: 'How is a performance measurement system for a collaborative network designed?' and 'What factors influence the design of a performance measurement system for a collaborative network?' The researchers initially analysed the data separately by using content analysis, suggested by Miles and Huberman (1994), and subsequently formulated a common view and drafted the results of the study.

Eight resellers were selected for the network-level performance measurement design process. There was a mix of old and new resellers and some had better economic performance than others. This was believed to provide a comprehensive picture of network activity. Moreover, the sales director, sales manager, area sales manager and financial manager of the main company participated in the design process. These participants formed the project group and participated in the initial interviews and responded to the feedback questionnaire.

Our design process is partially based on the existing literature and empirical studies on the design process of the performance measurement system for single organisations (Kaplan and Norton, 1996; De Toni and Tonchia, 2001) and the general-level design process provided by Kulmala and Lönnqvist (2006). Since the design process of Kulmala and Lönnqvist's (2006), which comprises three separate phases, is a general-level one, it was utilised as a starting point of the study. In the present study, the three phases of the design process of Kulmala and Lönnqvist (2006) were divided into five detailed steps to make the process more robust. Thus, the design process used in our case network comprised the following steps: (1) analysing the state of the network, (2) clarifying the network strategy, (3) defining the success factors for the network, (4) defining and evaluating the measures for the network and (5) defining the reporting principles and data sources of the network. Because the state of the network and the network strategy were fairly clearly defined at the beginning of the research project, the main focus of this study is on steps 3, 4 and 5. Our design process for a performance measurement system for a collaborative network and the factors that were found to influence the design process (see table 1) were elaborated at beginning of action research process. Subsequently, the action research process was used to test and validate the design process.

The case in this study is a collaborative network, which operates nationwide in Finland. The case network comprises a main company that primarily manufactures kitchen fitments and resellers who sell these products. The main company has five trademarks; however, the empirical research was based on one trademark where the network formed the case. The case network can be described as follows: the resellers operate inside a hardware store, where they have their own selling points. There are a total of 23 resellers and 26 selling units in the case network and the reseller units comprise a shopkeeper and 1–3 seller(s). Furthermore, all the shopkeepers and most of the sellers are independent entrepreneurs. In the case network, the resellers sell the products and the main company bills the customer and transports the products.

Many researchers have emphasized the lack of generalisability of the output of action research. However, to justify the use of action research over other approaches, the reflection and data collection process – and therefore the emergent theories – should be focused on the aspects that cannot be captured easily by other approaches (Eden and Huxman, 1996). In this context, our current study is an explorative study in an area that lacks empirical evidence, because it is difficult for researchers to obtain access to or information about this type of a network. However, to justify the results, the study needs to meet the criteria for the action research (Eden and Huxman, 1996).

4 Results of the study

The chapter presents the results of the design processes of the network-level performance measurement system and the complete performance measurement system for the case network. Kulmala and Lönnqvist's (2006) approach that proposes a general model for a network and the existing literature on the design process of a performance measurement system for single organisations were utilised in the study. The results are based on steps 3, 4 and 5 presented in the research design chapter above: (3) defining the success factors for the network, (4) defining and evaluating the measures for the network and (5) defining the reporting principles and the data sources of the network. The research and development progress of the design process is presented in Table 2. Steps 3 to 5 of the design process of network-level performance measurement are outlined and analysed below.

Table 2. Design process for a network-level performance measurement system

Step 3	Step 4			Step 5
Initial interviews	*Development sessions* *1st session*	*2nd session*	*3rd session*	*Feedback session*
- Analysing the state of the network - Defining the success factors - Defining the dimensions of the performance measurement system	- Ideating for the measures - Selecting the measures	- Defining the measures in detail	- Presentation of the reporting tool - Implementation of the performance measurement system in the project group	- Defining the changes and development issues - Identifying the benefits and uses of the performance measurement system

4.1 Experiences from the design process

Initial interviews

Success factors are factors that are delivered from the strategy of the network and are the essential factors that ensure successful operations and performance. In the beginning, the researchers conducted initial interviews to confirm and define the success factors of the network. Moreover, the interviewees were asked to describe the information needs concerning their own business and the network-level performance measurement system. The analysis of the results of the interviews revealed the following five success factors: being the most professional in the business branch, present in the domestic market, a well-known trademark, good business outline and trustfulness of the supplier. The results of the interviews revealed some important measures, measurement objects and measurement dimensions. Although the network was already using some important information, there was a lack of relevant information and some information was considered difficult to use. For example, customers were the key stakeholders of the network; therefore, their needs and contributions were essential for the success of the business. The interviewees stated that although they had a large amount of customer data, their biggest concern was a lack of knowledge of how to use it and determine what information was most relevant from the performance management and network development perspectives. Furthermore, the information was very fragmented and located in different systems. For example, some information was stored in the main company and the shopkeeper or their bookkeeper held some part of the information. Overall, the interviewees seemed to have different information needs and perspectives regarding what should be measured and what was important.

Another challenge was that the results of the existing measures to those of the entire network could not be compared. In the network context, openness and trust are key issues (Tenhunen, 2006). The results of the interviews revealed that some resellers did not want to share their financial results with the other resellers or the sales managers of the main company. Financial results of the business are considered confidential information and entrepreneurs cannot be compelled to share these with others. One target of the performance measurement system is to create a more open and confidential environment in the entire network. These aspects were considered in the design process of the performance measurement system.

One of the objectives of this part of the design process was to define the dimensions to be measured. Based on the results of the interviews, the researchers constructed the dimensions of the measurement system, which were decided by the project group comprising the interview participants. The four dimensions of the measurement system were as follows: the financial perspective, which provides information on the financial performance; future dimension, which includes measures focusing on the future sales view; customer perspective, which measures customer satisfaction, feedback, etc.; and employee perspective, which concentrates on the well-

being and welfare of the resellers and sellers. The financial, future and customer dimensions can be examined from the perspective of not only each franchisor but also the entire network. The employee perspective, that is, the resellers' (shopkeeper and seller) perspective is measured only at the network level, because examining the results of each reseller unit separately was considered irrelevant.

The interviews played an important role as the starting point of the design process of the performance measurement system. The important aspects of these interviews were that each interviewee had the opportunity to share their own opinions and ideas and participate uninhibitedly in the process from the beginning. Holding these interviews with the participants also ensured and strengthened their commitment to the design process. Extant literature (Kaplan and Norton; 1992, 1996; Simons, 2000) shows that the commitment of not only the top management but also the other participants plays a significant role in ensuring the success of the design process of the performance management system. These face-to-face interviews also highlighted the targets and benefits of the performance measurement system, because the interviewees had the opportunity to ask questions regarding the aspects of performance measurement, the performance measurement system and performance management.

1st development session

The interviewed resellers participated in the first development session, the objective of which was to ideate and select the measures by using different group work methods. Initially, the participants were divided into small groups, and they were asked to ideate a large number of measures for each dimension, without considering any special characteristics, such as usability or cost-benefit relationship. Then, the participants were asked to selected one to three of the most important indicators to follow and measure. Each measure was evaluated by using a cost-benefit relationship, (e.g. the practicality of the measure). Subsequently, all the participants worked together to selected the final measures for the performance measurement system.

In this development session, the participants realised that they were genuinely participating in the design process and they had themselves developed the measures for the performance measurement system with the assistance of the researchers. After the session, the participants commented that the session was an effective way to develop the performance measurement system, because it enabled them to sincerely participate in the development of the system. The resellers, sales managers and researchers believed that it was appropriate to have a session organised by a specialist (researcher) to align the understanding and objectives of the resellers and sales managers.

2nd development session

In the second development session, initially the selected measures were revised and introduced to the participants. Subsequently, the participants designed the first version of the network-level performance measurement system based on the final measures. The participants' task was, for example, to focus on how often the results of the measures should be followed and analysed, what the target levels should be, and how to obtain information. The final performance measurement system is presented in Table 3. It strives to resolve the problems in the information flow between the franchisor and the resellers and within the reseller's company.

Table 3. Performance measurement system for a collaborative network

Dimensions	Measures	Metrics
Financial	Contribution margin	Contribution margin (%)
	Reclamation costs	Percentage of revenue (%)
	Sale/seller	Sales (€)
	Staff expense	Percentage of revenue (%)
	Marketing costs	Percentage of revenue (%)
Future	Volume of orders	€/month
	Volume of offers	€/month
	New customers	Number of people/month
Customer	Satisfaction	Percentage of satisfied customers (%)
	Lost deals	€/month
	Profiling	Percentage of different customer groups (%)
Employees	Satisfaction	Development discussions
	Well-being	Satisfaction/well-being survey (network-level)
	Know-how	Survey

Together with the future dimension, the financial dimension was seen as the most important dimension from the project group perspective. The network was already using some financial measures. However, the participants provided a few specific reasons as to why they were dissatisfied with the company's and network's present view of the financial state. Firstly, the manner in which different costs were calculated was not equalised; therefore, the results of the measures were not comparable. Another and a more significant challenge was that owing to a lack of know-how, the resellers did not use these financial measures actively. They did not understand how to interpret the results obtained by using the financial measures and the implications of these results on their business. This lack of know-how was perceived to negatively influence the actions of the resellers (e.g. lead to bankruptcy). Therefore, financial measures were considered crucial measures. Based on these challenges, the project group selected the most vital measures for monitoring the financial state of the network participants. In the financial perspective, steps were also taken to enable the comparability of the financial measures among the companies of the network. This allows the resellers in the network to compare their own results to the average of the entire network, thereby enabling benchmarking among the resellers. Moreover, based on the results of the measures, the main company can develop the processes of its own business (e.g. marketing, process of the factory) and support the resellers' actions and decision making.

The results of the interviews revealed that the current measures mainly measured actions performed in the past; therefore, the resellers did not have any future-oriented information on their operations. Thus, the importance of forecasting the feasibility of the operations was highlighted in the performance measurement system. The future dimension permits the estimation of how much income the business will generate by including measures that evaluate the number of offers that have been made. The results of these measures are reflected on the network, for example, by indicating whether the marketing effort needs to be enhanced to get new customers. At its best, the results of the future measures will lead to development actions, which positively influence the financial performance of the companies and the network.

The network had already employed a tool for measuring customer satisfaction. The measures of this tool provided considerable information regarding customer satisfaction, service quality, customer behaviour, etc. The main challenge was that there was too much customer information. The customer satisfaction measures indicated in Table 3 are the most essential measures for the resellers with regard to the development of their service processes. By only considering these measures, resellers will be able to sort through the customer information to obtain the most relevant information and focus their development operations on the most vital aspects of the business.

In the employee dimension, the importance of the resellers' human resources was emphasised, because differences were observed in the welfare and well-being of the resellers and sellers. All the resellers and most of the sellers were independent entrepreneurs who were responsible for their own businesses and its success. Busy schedules and increasing operational responsibilities of these entrepreneurs have worsened their stress and exhaustion levels. The employee's perspective will focus on the expertise of the resellers and sellers in an attempt to decrease their stress and exhaustion levels. The employees' perspective will consider the information obtained from the questionnaire regarding the welfare and well-being of the resellers and sellers as well as from a new type of development discussion that will be held between the reseller and the seller and between the sales manager and the reseller. Moreover, a survey for examining the resellers' and sellers' level of know-how and determining their training needs will be launched.

In general, during the second development session, the measures were carefully defined and a consensus was achieved between the resellers and sales managers with respect to these measures. Furthermore, the resellers will have the opportunity to benchmark the results of their own measures to the average results of the entire network. Owing to the design process, the participants obtained considerable information regarding performance measurement and especially about the characteristics of single measures. Various different workshop methods were used in the development session. Every participant had an opportunity to participate in the development session, which increased trust and openness between the resellers and sales managers and, to some extent, among the resellers. The facilitators/researchers played an important role in promoting trust and openness. They were considered not only as specialists but also as neutral operators by both the resellers and the sales managers.

3rd development session

The objective of the third development session was to create procedures for data collection and reporting. The following questions were answered by the project group: frequency of reporting results, parties responsible for reporting results, sources for obtaining data for the measures, and target value of the measure. One of the main criteria for determining the data sources was to take advantage of the tools that were already in use. However, the data required for many measures was already available, but not in an appropriate format. Therefore, in some cases, the data had to be processed before it could be used. Moreover, a new customer relationship management tool was already in use in the network, which was an essential data source to get information on, for example, the future dimension. In the development session, the participants reached a consensus that the shopkeepers and sellers should be primarily responsibility for analysing the results of the measures and putting the development objects into practise because they were all independent entrepreneurs and were responsible for the success of their own businesses. Furthermore, it was decided that the shopkeepers would analyse and discuss the results of the measures with the sales manager of the main company every three months and with the sellers of the reseller unit every week. The participants believed that these analyses and discussions would facilitate the management of the reseller unit's operations.

The primary objective of this session was to develop the practices for using and exploiting the measurement system by involving all the participants in this development. The result was a shared vision regarding the format and frequency of releasing the measurement results and determining who would release these results. After the development session, there was a four-month test period, during which the participants tested the performance measurement system and gathered comments on the development proposals and potential problems.

Feedback session

The main objective of the feedback session was to evaluate the results of the test phase of the performance measurement system. The participants' experiences of the use of the performance measurement system were that the selected indicators were accurate and practical. The feedback session played an important role in the development of the performance measurement system. Based on the feedback and other development proposals, which were related to the data collection process and its efficiency as well as the reporting period of some of the measures, the performance measurement system was developed further. The results of the feedback session showed that the performance measurement system works in practice and the results are easily available and exploitable. For example, based on the measurement information of the system, the reclamation costs were reduced in many selling units. One reseller stated that he successfully reduced reclamation costs by 50% by following the measurement information and averages of the network and developing his kitchen planning process accordingly. Overall, the reclamation costs decreased by 20% in the reseller units that had started utilizing the network-level performance measurement system. Furthermore, the feedback session was also considered the final session for the project, which was considered as important by the participants. This way, the network-level performance measurement system design process had a clear beginning and end. Once the design process was complete, the implementation process of the entire network began. The feedback session of the design process was essential, because it provided information regarding the state of the collaboration and the success and challenges of the design process. Measures were revised during this session.

5 Discussion

The importance of network-level performance measurement systems and their benefits in enhancing the success of the network have been widely recognised by researchers and practitioners. However, thus far, very few empirical studies have addressed the topic of the use or design of such a system. For example, Busi and Bititci (2006) indicate a research need for developing a structured methodology to design a performance measurement system for collaborative networks, which was the starting point of the current study. Furthermore, Bititci et al. (2012) highlight the lack of grounded empirical research for exploring issues related to performance measurement and performance management in collaborative networks. The study attempts to address these research gaps by developing the design process of a performance measurement system for a collaborative network. Because there were no concrete process models for this design process, the proposition presented by Kulmala and Lönnqvist (2006) was utilised as the basis of this study. The results of this study revealed that the design process was successful because the network-level performance measurement system seemed to work in practice and the results were utilised in the network. Therefore, it can be said that the design process utilised in the study passed the weak market test (Kasanen et al., 1993) and covers one perspective of the research need highlighted by Busi and Bititci (2006).

The design process presented in this study answers our first research question, 'How is a performance measurement system for a collaborative network designed?' The design process comprised three phases: initial interviews, performance measurement development sessions and a feedback session. Initial interviews are an appropriate way to measure whether the health of a collaboration is satisfactory or not, which is a prerequisite for conducting development sessions and designing collaborative measures. Initial interviews also provide a comprehensive picture of the specific needs of the network (cf. Busi and Bititci, 2006). The development of the dimensions of the health of the collaboration (Parung and Bititci, 2006; 2008) can also be evaluated, at least indirectly, during the development sessions by utilising interviews or maturity models (Niemi et al. 2009; 2010).

Maturity models enable the analysis of the state of the elements behind the health of collaboration and help to prioritise the development actions if there is a need to enforce the health of collaboration. Since an organisation cannot implement all the best practices in one phase, a maturity model can be used to introduce them in stages (Niemi et al., 2009; 2010). Parung and Bititci (2006; 2008) also suggest a number of value generators that should all be measured to obtain a balanced view of the performance of the collaborative network. The present study confirms that development sessions are an appropriate way for defining collaborative measures for more challenging value generators (see table 3) and network-level measurement does not have to be limited only to financial measures, which are usually easier to define. Because the business models and processes were very similar in the collaborative organisations considered in this study, the measurement of the input to collaboration was not as critical as presented by Parung and Bititci (2006; 2008). However, the contribution of the different organisations can be evaluated based on their willingness to share information in their joint information system. The lack of a suitable communication infrastructure and problems in the sharing of information among organisations were found to cause difficulties in defining an appropriate balanced set of measures for collaborative performance management (Busi and Bititci, 2006). Regarding the design process developed in this study, the development sessions were found to be effective channels for enabling the flow of communication and information sharing among the collaborative organisations. The feedback session of the design process was considered essential because it provided information regarding the state of the collaboration, success and challenges of the design process and final revisions of the measures. Furthermore, the feedback session concluded the design process and paved the way for the initiation of the implementation process.

Regarding the second research question, 'What factors influence the design of a performance measurement system for a collaborative network?', the results of the study highlighted three factors that play an important role in the design process of a network-level performance measurement system. These factors are also recognised when launching performance measurement systems for single organisations; however, the study highlighted the significance of these elements in a complex collaborative network environment.

First, the main reason for the successful design process was that both the resellers and the key persons from the main company were involved in the initial interviews, development sessions and feedback session. The participatory style was seen to increase the trust, openness and commitment among the different network members. The opportunity to participate in the early stage of the process enabled the participants to voice their own opinions and ideas, and ask questions about issues concerning the performance measurement system. Their participation also enabled a learning process concerning performance measurement, target setting and managing performance in general. This was considered important because most of the resellers did not have any kind of management or financial education. Many researchers have highlighted the following challenges regarding the performance management and measurement of collaborative networks: complexity of the network, relationships among the members, lack of trust and commitment, quality of communication, and common knowledge regarding performance management (Kulmala et al., 2002; Kulmala, 2003; Tenhunen, 2006; Busi and Bititci, 2006; Bititci et al. 2007). The results of the study indicated that participation in the early stages of a carefully designed and structured design process could address most of the concerns listed above. This result is consistent with the findings of Mahama (2006) and Cousins et al. (2008). The results of these studies reveal that the use of performance measurement systems improves communication among the network members, which in turn improves socialisation.

Second, the end of the process indicated a positive development of a network culture. The literature reveals that measurement can often be perceived as controlling (Simons, 2000). This is also

applicable to collaborative networks. Varamäki et al. (2008) state that the values and culture of a network describe its mental state. Tenhunen (2006) shows that openness is, in general, a key issue in network-level performance management. The results of the current study indicated that if participation is actual instead of nominal, it would create a culture of development (not controlling). In the study, the members actively participated in the structured design process and willingly shared information, which is important for ensuring the success of the process.

Third, facilitators, i.e. researchers play a very important role in the design process of a network-level performance measurement system. One important aspect was that the resellers felt that they came to a development session organised by the researchers, not by the main company. All the participants felt that the presence of the facilitators enabled the resellers and sales managers to develop mutual understanding and align their objectives. The learning process of the participants was also fostered by the facilitators, who were experts in the area of performance measurement. Both the resellers and sales managers viewed the facilitators as not only specialists but also neutral operators. This was found to facilitate the actual participation of the members and further the culture of development.

6 Conclusions

Researchers have emphasized the need for a structured design process for a performance measurement system of a collaborative network. To address this need, the current study defined and tested a structured design process for collaborative networks. This study contributes to the extant literature on this subject by presenting that the structured design process works effectively in at least those collaborative networks in which the business models and processes of the collaborative organisations are similar. The examined design process enables the defining of an appropriate and balanced set of measures for collaborative performance measurement in a way that covers all the essential value generators. As an innovative contribution, this study suggests that the initial interviews should be included in the design process for evaluating the health of the collaboration both before and during the design process. If the health of the network is unsatisfactory, there is a need to consider whether the design process should be continued. As another main contribution, the study presents the essential features that should be considered when designing a performance measurement system for a collaborative network. The participation of the network members at the early stage of the design process, actual (not nominal) participation, and roles played by the facilitators were perceived to lead to a culture of development, more open relationships and information sharing among the members, increase of trust and commitment, improved quality of communication, and common knowledge about performance management. Although these features are not so important when designing performance management systems for single organisations, this study suggests that it is necessary to consider them in a complex collaborative network environment.

As a managerial implication, the study highlights a participatory style that involves all the key members of the network from the very beginning of the design process. The study indicates that a carefully conducted design process, which utilises a participatory style, ensures greater success of the performance measurement system in the collaborative network. The role of the researchers as facilitators, together with the participatory design process, can also enhance the learning process of the participants, break the ice between the different members of the network, and lead to openness, trust and commitment among the different network operators.

The design process and associated features are applicable in the type of collaborative network presented in this study. However, the use of a single case study necessitates further research of the

same types of collaborative networks. It will also be useful to investigate whether this type of a design process is applicable to other types of collaborative networks. Furthermore, future studies could focus on conducting an in-depth analysis regarding the implementation and use of the collaborative performance measurement system.

References

Avison, D., Lau, F., Myers, M. and Nielsen, P. (19999, "Action research", *Communications of the ACM*, No.42 Vol. 1, pp. 94-97.

Avison, D., Baskerville, R. and Myers, M. (2001), "Controlling action research projects", *Information Technology & People*, No. 14, Vol. 1, pp. 28-45.

Beamon, B.M. (1999), "Measuring supply chain performance", *International Journal of Operations and Production Management*, No. 19, Vol. 3, pp. 275-292.

Bititci, U.S., Mendibil, K., Albores, P. and Martinez, M. (2005), "Measuring and managing performance in collaborative enterprises", *International Journal of Operations and Production Management*, No. 25, Vol. 4, pp. 333-353.

Bititci, U., Turner, T., Mackay, D., Kearney, D. Parung, J. and Walters, D. (2007), "Managing synergy in collaborative enterprises", *Production Planning & Control*, No. 18, Vol. 6, pp. 454-465.

Bititci, U., Garengo, P., Dörfler, V. and Nudurupati, S. (2012), "Performance measurement: challenges for tomorrow", *International Journal of Management Reviews*, Vol. 14, No. 3, pp. 305-327.

Bourne, M., Neely, A., Platts, K., and Mills, J. (2002), "The success and failure of performance measurement initiatives: Perceptions of participating managers", *International Journal of Operations & Production Management*, Vol. 22. No. 11, pp. 1288-1310.

Brewer, P.C. and Speh, T.W. (2000), "Using the balanced scorecard to measure supply chain performance", *Journal of Business Logistics*, No. 21, Vol. 1, pp. 75-93.

Busi, M. and Bititci, U.S. (2006), "Collaborative performance management: present gaps and future research", *International Journal of Productivity and Performance Management*, Vol. 55, No. 1, pp. 7-25.

Camarinha-Matos, L.M. and Abreu, A. (2007), "Performance indicators for collaborative networks based on collaboration benefits", *Production Planning & Control*, Vol. 18 , No. 7, pp. 592-609.

Camarinha-Matos, L.M., Afsarmanesh, H., Galeano, N. and Molina, A. (2009), "Collaborative networked organizations – Concepts and practice in manufacturing enterprises", *Computers & Industrial Engineering*, Vol. 57, Iss: 1, pp. 46-60.

Cohen, M.A. and Lee, H.L. (1988), "Strategic analysis of integrated production-distribution systems: Models and methods", *Operations Research*, Vol. 36, No.2, pp. 216-228.

Cousins, P. D., Lawson, B., and Squire, B. (2008), "Performance measurement in strategic buyer-supplier relationships: The mediating role of socialization mechanisms", International Journal of Operations & Production Management, Vol. 28, No. 3, pp. 238-258.

Cunha, P.F., Ferreira, P.S. and Macedo, P. (2008), "Performance Evaluation within Cooperate Networked Production Enterprises", *International Journal of Computer Integrated Manufacturing*, Vol. 21, No. 2, pp. 174-179

Dekker, H. (2003), "Value chain analysis in interfirm relationship: A field study", *Management Accounting Research*, Vol. 14, Iss:1, pp. 1-23.

De Toni, A. and Tonchia, S. (2001), "Performance measurement systems – Models, characteristics and measures", *International Journal of Operations & Production Management*, Vol. 21, No. 4, pp. 50-55.

Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, No. 14, Vol. 4, pp. 532-550.

Ellram, L.M. (1995), "A managerial guideline for the development and implementation of purchasing partnerships", *International Journal of Purchasing and Materials Management*, Vol. 31. No. 2, pp. 9-16.

Franco-Santos, M., Lucianetti, L. and Bourne, M. (2012), "Contemporary performance measurement systems: A review of their consequences and a framework for research", *Management Accounting Research*, Vol. 23, No. 2, pp. 79-19.

Gooderham, G. (2001), "The top 10 lessons of implementing performance management systems", *Journal of Cost Management*, Vol. 15, No. 1, pp. 29-33.

Gummesson, E. (2000), *Qualitative methods in management research,* Sage publications, Inc., Thousand Oaks, USA.

Gunasekaran, A., Patel, C. and McGaughey, R. E. (2004), "A framework for supply chain performance measurement" *International Journal of Production Economics*, Vol. 87, Iss: 3, pp. 333-347.

Håkansson, H. and Lind, J. (2004), "Accounting and network coordination", *Accounting, Organizations and Society*, Vol. 29, Iss: 1, pp. 51-72.

Kald, M. and Nilsson, F. (2000), "Performance measurement at Nordic companies", *European Management Journal*, Vol. 18, No. 1, pp. 113-127.

Kaplan, R.S. and Norton, D.P. (1992), "The Balanced Scorecard – Measures that Drive Performance", *Harvard Business Review*, Vol. 70, January-February, pp. 71-79.

Kaplan, R.S. and Norton, D.P. (1996), *The Balanced Scorecard: Translating Strategy into Action*, *Harvard Business School Press*, Boston, USA.

Kaplan, R.S., Norton, D.P. and Rugelsjoen, B., 2010. "Managing Alliances with the Balanced Scorecard", *Harvard Business Review*, Vol. 88, No 1, pp. 68-75.

Kasanen, E., Lukka, K. and Siitonen, A. (1993), "The constructive approach in management accounting research", *Journal of Management Accounting Research*, No. 5, Vol. 1, pp. 243-264.

Kulmala, H.I., Paranko, J. and Uusi-Rauva, E. (2002), "The role of cost management in network relationships", *International Journal of Production Economics*, Vol. 79, Iss: 1, pp. 33-43.

Kulmala, H.I. and Lönnqvist, A. (2006), "Performance measurement of networks: Towards a non-financial approach", *International Journal of Networking and Virtual organizations*, Vol. 3, No. 3, pp. 299-316.

Lambert, D.M. and Pohlen, T.L. (2001), "Supply Chain Metrics", *International Journal of Logistics Management*, Vol. 12, No. 1, pp. 1-19.

Leseure, M., Shaw, N. and Chapman, G. (2001), "Performance measurement in organizational networks: An exploratory case study", *International Journal of Business Performance Management*, Vol. 3, No. 1, pp. 30-46.

Lönnqvist, A. and Laihonen, H. (2012), "Welfare service system productivity: The concept and its application", *International Journal of Productivity and Performance Management*, Vol. 61, No. 2, pp. 128-141.

Mahama, H. (2006), "Management control systems, cooperation and performance in strategic supply relationships: A survey in the mines", *Management Accounting Research*, Vol. 17, No. 3, pp. 315-339.

Mettänen, P. (2005), "Designing and implementing of a performance measurement system for a research organization", *Production Planning & Control*, Vol. 16, No. 2, pp. 178-188.

Miles, M.B. and Huberman, A.M. (1994), Qualitative data analysis: An expanded sourcebook, 2nd Edition, Newbury Park, CA, USA.

Neely, A. (1999), "The performance measurement revolution: Why, now and what next?", *International Journal of Operations & Production Management*, Vol. 19, No. 2, pp. 205-228.

Niemi, P., Huiskonen, J. and Kärkkäinen, H. (2009), "Understanding the knowledge accumulation process - Implications for the adoption of inventory management techniques", *International Journal of Production Economics*, Vol. 118, No. 1, pp. 160-167.

Niemi, P., Huiskonen, J. and Kärkkäinen, H. (2010), "Supply chain development as a knowledge development task", *International Journal of Networking & Virtual Organisations*, Vol. 7, No. 2/3, pp. 132-149.

Parung. J. and Bititci, U.S. (2006), "A Conceptual metric for managing collaborative network", *Journal of Modelling in Management*, Vol. 1, No. 2, pp. 116-136.

Parung, J. and Bititci, U.S. (2008), "A metric for collaborative networks", *Business Process Management Journal*, Vol. 14, No. 5, pp. 654-674.

Pisano, G.P. and Verganti, R. (2008), "Which kind of collaboration is right for you?", *Harvard Business Review*, Vol. 86, Iss: 12, pp.78-86.

Rey-Marston, M. and Neely, A. (2010), "Beyond words: Testing alignment among inter-organizational performance measures", *Measuring Business Excellence*, Vol. 14, No. 1, pp. 19-27.

Saiz, J.J.A., Bas, A.O. and Rodríguez, R.R. (2007), "Performance measurement system for enterprise networks", *International Journal of Productivity and Performance Management*, Vol. 56, No. 4, pp. 305-334.

Schmitz, J. and Platts, K.W. (2004), "Supplier logistics performance measurement: Indications from a study in the automotive industry", *International Journal of Production Economics*, Vol. 84, No. 2, pp. 231-243.

Sherman, A. J. (2004), *Franchising & licensing: two powerful ways to grow your business in any economy,* American Management Association, USA.

Simons, R. (2000), *Performance Measurement & Control Systems for Implementing Strategy*, Prentice Hall, Upper Saddle River, USA.

Tenhunen, J., 2006. *Johdon laskentatoimi kärkiyritysverkostossa: Soveltamismahdollisuudet ja yritysten tarpeet*. Acta Universitatis Lappeenrantaensis 241, Dissertation, Lappeenranta University of Technology, Finland. (in Finnish).

Varamäki, E., Kohtamäki, M., Järvenpää, M., Vuorinen, T., Laitinen, E.K., Sorama, K., Wingren, T., Vesalainen, J., Helo, P., Tuominen, T., Pihkala T. and Tenhunen J. (2008), "A framework for a network-level performance measurement system in SME networks", *International Journal of Networking and Virtual Organisations*, Vol. 5, No. 3/4, pp. 415-435.

Wadsworth, Y. (2001), "*The mirror, the magnifying glass, the compass and the map: Facilitating participatory action research"*, In: Reason, P., and Bradbury, H. (eds.), The Handbook of Action Research: Participative Inquiry and Practice, Sage, pp. 420-432, London.

Wenerfelt, B. (1984), "A resource-based view of the firm", *Strategic Management Journal*, Vol. 5, Iss: 2, pp. 171-180.

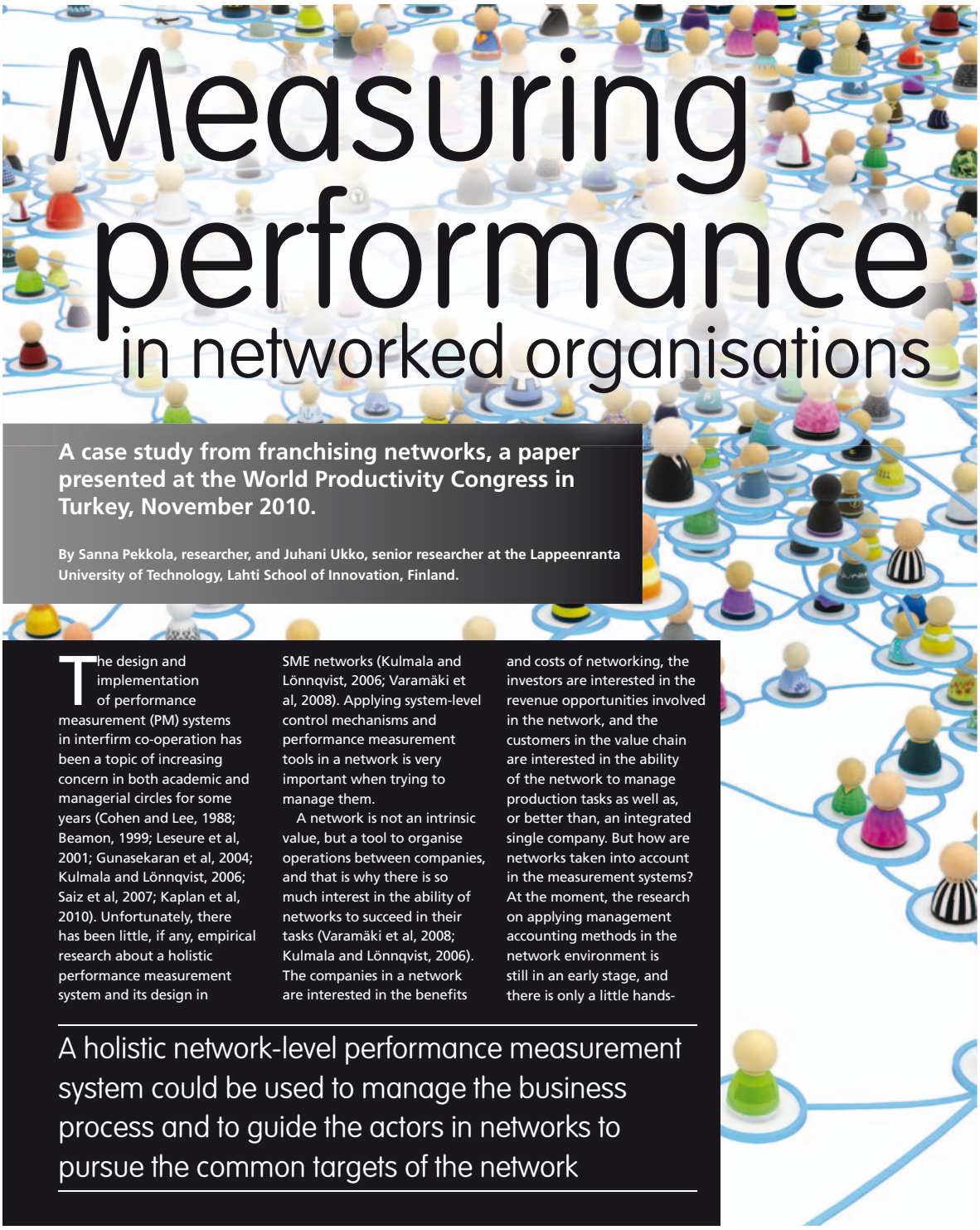
Yin, R.K. (2009), *Case Study Research – Design and Methods*, 4th Edition, Thousand Oaks, Sage Publications, USA.

Yin, Y., Qin, S. and Holland, R. (2011), "Development of a design performance measurement matrix for improving collaborative design during a design process", *International Journal of Productivity and Performance Management*, Vol. 60, No. 2, pp. 152-184.

ARTICLE II

Pekkola, Sanna and Ukko, Juhani (2011)
Measuring performance in networked organisations

Management Service, Summer 2011, pp. 14-23.



Measuring performance in networked organisations

A case study from franchising networks, a paper presented at the World Productivity Congress in Turkey, November 2010.

By Sanna Pekkola, researcher, and Juhani Ukko, senior researcher at the Lappeenranta University of Technology, Lahti School of Innovation, Finland.

The design and implementation of performance measurement (PM) systems in interfirm co-operation has been a topic of increasing concern in both academic and managerial circles for some years (Cohen and Lee, 1988; Beamon, 1999; Leseure et al, 2001; Gunasekaran et al, 2004; Kulmala and Lönnqvist, 2006; Saiz et al, 2007; Kaplan et al, 2010). Unfortunately, there has been little, if any, empirical research about a holistic performance measurement system and its design in SME networks (Kulmala and Lönnqvist, 2006; Varamäki et al, 2008). Applying system-level control mechanisms and performance measurement tools in a network is very important when trying to manage them.

A network is not an intrinsic value, but a tool to organise operations between companies, and that is why there is so much interest in the ability of networks to succeed in their tasks (Varamäki et al, 2008; Kulmala and Lönnqvist, 2006). The companies in a network are interested in the benefits and costs of networking, the investors are interested in the revenue opportunities involved in the network, and the customers in the value chain are interested in the ability of the network to manage production tasks as well as, or better than, an integrated single company. But how are networks taken into account in the measurement systems? At the moment, the research on applying management accounting methods in the network environment is still in an early stage, and there is only a little hands-

A holistic network-level performance measurement system could be used to manage the business process and to guide the actors in networks to pursue the common targets of the network

on experience of applying management accounting at the network level (Tenhunen, 2006; Kulmala, 2003; Kulmala et al, 2002). The study of Kulmala and Lönnqvist (2006) reveals that the importance of business networks and inter-organisational co-operation is acknowledged in many organisations. The performance measurement systems often include issues related to customer relationships (eg customer satisfaction), supplier relationships (supplier's delivery accuracy) and other stakeholders (eg stakeholder communication) (Kulmala and Lönnqvist, 2006).

When inter-organisational relationships become tighter, there will emerge a need to manage and control the relationships in some way. A holistic network-level performance measurement system, for instance, could be used to manage the business process and to guide the actors in networks to pursue the common targets of the network (Cohen and Lee, 1988; Beamon, 1999; Leseure et al, 2001; Kulmala and Lönnqvist, 2006). Additionally, network-level performance measurement information is needed for decision making, eg in order to avoid organisation-level suboptimisation.

The aim of this study is to compare two different network-level performance measurement systems: how the use of the developed network-level performance measurement system is perceived in the networks, what the reasons behind the positive or negative perceptions are, and how the use of the measurement system differs in the case networks. The study is a multiple case study, where case study A was carried out in 2009 and case study B in the spring and autumn 2010. Both case networks are franchising networks selling kitchen fittings. The study focuses on the implementation and testing process of the network-level performance measurement system.

Literature network-level performance measurement

Different promoters of networking have limited knowledge on how to contribute to successful development in co-operative groups. Evidently, practitioners do not have effective enough tools at their disposal when they try to form networks. There has been hardly any research about the management tools and holistic performance measurement of SME networks. The current literature (eg Kald and Nilsson, 2000; Leseure et al, 2001; Håkansson and Lind, 2004) and empirical evidence on network-level performance measurement seem to be limited to financial measures.

The most frequently studied area in the field of network management control is cost management (eg Kulmala et al, 2002; Kulmala, 2003; Dekker, 2003; Morgan, 2007). Networking sets special challenges for cost accounting; single companies should be aware of their product costs as a precondition for further analysis. Furthermore, open book costing and wide dissemination of cost information are required (Tomkins, 2001; Kulmala et al, 2002).

In this area, the overall goal of these analyses, based on the concept of the extended value chain, is to minimise the total costs and to maximise the revenues in the network. On the other hand, financial and cost measures are not adequate for determining overall performance in the network context. The growing interest in non-financial performance measurement can be partly attributed to the realisation that financial measures alone cannot provide sufficient information for managing an organisation and a network (Johnson and Kaplan, 1987; Kaplan and Norton, 1992; Kulmala and Lönnqvist, 2006).

Companies and networks aiming at being profitable in the long run have to track not only their financial performance but also other variables, such as customer satisfaction, quality, innovation, the efficiency and effectiveness of processes, and the linkages between departments or units, as well as the measurement used for each of these (Brinker, 1997).

Some frameworks for overall measurement in networks have been presented (Beamon, 1999; Leseure et al, 2001; Varamäki et al, 2008), some for supply chain performance measurement (Brewer and Speh, 2000; Gunasekaran et al, 2004; Saiz et al, 2007) and some individual measures for measuring customer-supplier boundaries have been suggested (Beamon, 1999; Ellram, 1995). All these analyses show that company interfaces include a huge number of important features that have to be taken into account when designing and selecting measures.

The study of Beamon (1999) presents an overview and evaluation of the performance measures used in supply chain models, and it also presents a framework for the selection of a performance measurement system for manufacturing supply chains. Beamon categorises supply chain performance measures that are necessary components in any supply chain performance

measurement system, as follows: (i) resource: measuring the efficiency of resource management (eg cost), (ii) output: measuring the level of customer service (eg punctuality of delivery), and (iii) flexibility: measuring the ability to respond to demand changes. Although this framework is suitable for a traditional supply chain, it is not so for an organisational network.

The study of Leseure et al (2001) presents a framework for meta-performance to measure the performance of the total network, the capability of each network member in performing what is expected, and the contribution of each network member to the overall performance of the network. Meta-performance has two dimensions: aggregate performance and equity. It is important to stress that meta-performance can only be evaluated by measuring both aggregate performance and equity.

Notable imperfections in this framework have been perceived (Chenhall, 2003). The framework is too conceptual to be used as a tool by practitioners, and secondly, detailed implementation of a single measure to cover all members of a network in the spirit of the meta-performance framework has mostly been left unanalysed. Varamäki et al (2008) have developed a framework for a performance measurement system, composed of factors that enable the action and success of processes, as well as the success of the productivity and profitability of activities.

The issues enabling success are the values and culture of the network, resources and competences, as well as the models of action in the networks. The profitability of activities can be divided into the profitability of internal processes, customer satisfaction, and the financial key ratios of the network. In this framework, the values and culture of the network describe the mental state of the network through trust, commitment, partnership values and communication, such as the manner and openness of interaction within the network.

Resources and competences are connected in particular to the ability and capacity of the network to produce core output to the business effectively and to create new modes of action. The models of actions of the network describe the ability of the actors in the network to design and exploit different modes of action in the network. Even though there are some frameworks for network-level performance measurement, the existing frameworks are fairly theoretical and quite difficult to apply for practical solutions. However, every development and design process is different and unique, and thus these frameworks could not be used directly in the design and development process of the case network in the present study.

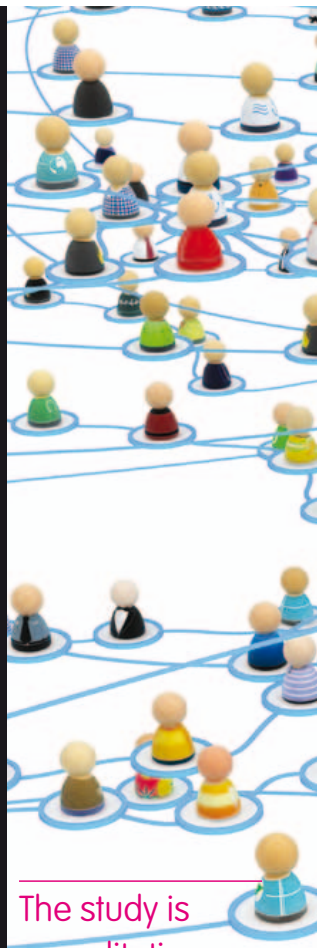
Design and implementation of a performance measurement system

Various frameworks have been presented in the literature for constructing a performance measurement system for a manufacturing or service organisation (see eg Kaplan and Norton; 1992, 1996; Olve et al 1998; Simons, 2000; De Toni and Tonchia, 2001; Gooderham, 2001; Tenhunen, 2001). The frameworks contain a different number of phases and use different methods. However, in most cases the design process is quite similar: the first phase clarifies the strategy and determines the critical success factors, and the next phase aims at defining the measures for these success factors.

Kaplan and Norton (1996) have described a typical and systematic implementation plan to build a balanced scorecard for an organisation. The process model, which consists of four main steps, aims to encourage commitment to the scorecard among senior and mid-level managers, which is considered as a prerequisite of successful implementation. The model of Kaplan and Norton was created to meet the needs of a large organisation.

There are also many other process models for designing and implementing a performance measurement system (eg Olve et al, 1998; Gooderham, 2001; Tenhunen, 2001), but their utilisation has not been widely studied. However, it can be summarised that, although different frameworks consist of different numbers of phases and methods, the designing process is often quite similar.

However, Kulmala and Lönnqvist (2006) have proposed the following approach to designing performance measurement for a network. Firstly, the success factors of the network from the end customer's point of view should be identified. The success factors can be defined in a similar fashion as is done when designing performance measures for an individual company. The success factors are likely to consist of both financial and non-financial factors. Secondly, network-level performance measures should be defined for these success factors. Thirdly, the PM should be extended to the level of the member companies of the network.



The study is a qualitative multiple case research, which examines a problem thoroughly in a specific organisation and increases understanding of phenomenon

Methodology

This study concentrates on the testing phase of network-level performance measurement, which is the last and very important phase of the implementation process (Eg, see Kaplan & Norton, 1996; 1999; Tenhunen, 2001). The aim of this study is to compare two different network-level performance measurement systems: how the use of the developed network-level performance measurement system is perceived in the networks, what the reasons behind the positive or negative perceptions are, and how the use of the measurement system differs in the case networks.

The study is a qualitative multiple case research, which examines a problem thoroughly in a specific organisation and increases understanding of phenomenon. According to Gummesson (2000), a case study increased in-depth understanding of the issue and helps to learn something new about the phenomenon.

Case study A was carried out in 2009 and case study B in the spring and autumn of 2010. Both these networks operate by the franchising concept, and they have the same main company (franchisor), which manufactures kitchen and bathroom fittings. The case environment can be described as follows:

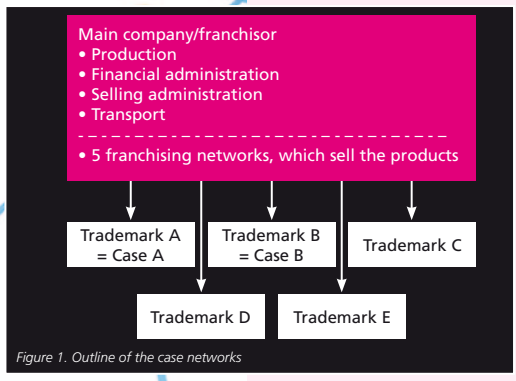


Figure 1. Outline of the case networks

The main company has five trademarks and brands under its operations. Every trademark has its own selling network, which operates by the franchising concept. Franchising refers to methods of practicing and using another person's business philosophy.

The franchisor grants an independent operator the right to distribute its products, techniques and trademarks for a percentage of gross monthly sales and a royalty fee. Various tangibles and intangibles, such as national or international advertising, training, and other support services are commonly made available by the franchisor. The agreements typically last from five to thirty years, with premature cancellations or terminations of most contracts bearing serious consequences for the franchisees (Sherman, 2004).

In this study, we concentrate on two selling networks: trademark A, which forms case A and trademark B, which forms case B. We compare the results of the two networks, which have the same main company and mainly same operational principles. There are some differences, for example company size and number of collections, between these networks. In addition, in both networks the reseller sells the product and the franchisor bills the customer and transports the products to the customer.

Trademark A – Case network A

- The resellers operate inside a hardware store
- A total of 22 resellers and 26 reseller units in this trademark
- A reseller unit consists of a shopkeeper and 1-3 seller(s) all the shopkeepers and most of the sellers are independent entrepreneurs
- The trademark has one collection

Trademark B – Case network B

- The resellers operate in stores of their own
- A total of 10 resellers in this trademark
- A store consists of a shopkeeper and 7-12 sellers, and almost all the sellers are hired employees
- Most of the shopkeepers are independent entrepreneurs
- The trademark has three collections

The study is an explorative case study, and the main line of research is the action-oriented approach. The empirical data has been gathered in four development sessions in both case networks. The results of this study are based on two researchers' personal observations, their presence and participation in the actual development process. The development sessions have been utilised as a practical development method in the design and implementation work.

In addition to the authors, five resellers from case network B and one person from the main company attended the sessions in case B, and eight resellers from case network A and three persons from the main company attended in case A. The experiences of the sessions were carefully documented for research purposes. In this study, we compare the results of the implementation process of the case networks. The design and implementation process of the network-level performance measurement system was carried out in the same way in both networks.

From the perspective of resellers, commitment is highly important in the design and

We believe that the network-level performance measurement framework performs in networks that sell products and services with the franchising concept

implementation process. If the resellers of case network B just adopted the PM system of case network A directly, commitment to and the use of the PM system could suffer. This is one reason why the design and implementation process was carried out twice.

The second reason is that from the perspective of the main company, it would be easier to just implement the same network-level performance measurement system developed by case network A to every selling network, but we could not be certain that the PM system would work in the other networks of the main company. For this reason, it was decided to develop a network-level performance measurement system also in case network B and to compare the results of the study. On the basis of the results, it can be seen whether it is possible to spread the PM system to the whole selling network of the main company.

In the beginning of the development and implementation process for the network-level performance measurement system, a project group was formed, which would have responsibility for the design, implementation and testing process before the network-level PM system would be applied in the whole network, and would participate in the development sessions. The design and implementation process consisted of four development sessions: in the first session, the participants ideated on the aspects that should be measured and followed, and after that they selected the measures.

In the second session, the measures were analysed in detail: how to get information for the measures, what would be the benefits of the measures etc. In the third session, based on the selected measures, the measurement tool was presented to the participants and they started to use the PM system. After the testing phase, there was a feedback session where it was analysed how the measurement system worked in practice, what were the positive and negative effects etc.

After that, the network-level performance measurement system was applied to the whole network. These development sessions were highly important from the perspective of commitment. This way, the participants could understand the importance of performance measurement and management. More detailed information on the design and implementation process of the network-level performance measurement system can be seen in Pekkola et al (2009).

Four perspectives of performance were selected in the beginning of the process for case network A. The selection of the perspectives was based on interviews carried out in case network A. The selected four perspectives were: financial, future, customer and employee perspectives. The participants of case network B also saw that these perspectives were the best for this context and they decided to use them. In the next chapter, the two performance measurement systems are presented perspective by perspective, the measures are presented and differences analysed from the point of view of both networks.

Findings

The results of the study are presented in the following chapter. Both network-level performance measurement systems are presented and analysed perspective by perspective, and differences and causes are reported on.

Performance measures

The financial measures are mainly the same measures in both networks (table 2). In case network A, the measurement information is mainly reported from the perspective of the whole organisation, and in case network B from the perspective of every seller. In addition, the measures, such as the real earnings of every seller, where the costs are taken into account and specific information on reclamation costs, where product reclamation,installation and other costs are taken into account, were increased in the measurement system of the case network B.

These choices are the result of the larger work community in case network B. There are more sellers and more selling, so the reclamation costs are also greater and need to be analysed in closer detail than in case network A. The resellers of case network B do not have an opportunity to check every order and correct mistakes, and that is why the sellers have bigger responsibility for their own work. In case network A, there are only a few sellers and it is easier to follow, for example, reclamation costs and see the mistakes of the sellers more clearly. These differences are natural because, when you have more employees, it is important that the results of

selling are analysed in closer detail. The development targets are easier to point out to the sellers when they are based on facts. The resellers of case B stated that commitment is one of the most important aspects from the perspective of management and leadership.

According to the franchising concept, the franchisor has responsibility for marketing, support services and training. Due to this, both networks have their own marketing plan, and the main company has responsibility for the marketing actions of the network. In addition, the reseller can use its own marketing if it considers this necessary. The resellers of case network B use marketing of their own quite rarely and that is why the marketing costs are not relevant for them. The resellers of case network A use their own marketing much more, compared to case network B.

In case network A, there are some selling units that spend perhaps too much on their own marketing, which affects their income. The resellers of case network A stated that, for this reason, it is important to follow the marketing costs and especially network-level averages. The resellers that have high marketing costs can compare their own costs to the averages of the network and to the averages of the number of new customers to their own numbers. Analysing the results of these measures reveals how much profit the marketing investments show, compared to the averages of the whole network.

In the future perspective (table 3), the measures are the same for both case networks, except that case network A calculates the volume of orders, offers and new customers at the level of the whole reseller unit, while case network B calculates it per seller. Both networks were already measuring the volume of offers and the number of new customers, but the volume of orders measure was new for both of them.

The number of new customers measure is more important in case network A than in case network B. There are also different opinions inside case network A on what is a new customer. New customers are easier to identify in case network B, because they operate in their own stores, while the resellers of case network A operate inside a hardware store. Is a new customer a person who just visits the selling point, or is a new customer a person who you talk with, or is a new

Table 2. Measures from the financial perspective

Financial perspective	
Case network A	**Case network B**
Contribution margin/seller	Contribution margin/seller
Total reclamation costs	Reclamation costs (product)/seller
Sale/Seller	Other reclamation costs/seller
Total staff expense	Sale/seller
Total marketing costs	Staff expense/seller
	Earnings/seller

customer a person who makes an appointment with you?

The definition of a new customer is clear in case network B – when a customer comes to the store, she/he is a new customer. Because case network A operates inside a hardware store, there are also passing customers in the selling unit of case A, who are just looking and do not have any intention to renew their kitchen. So, these customers are not real new customers.

That is why the definition of the new customer is an important question in case network A and the measure has a more important role in case network A than in case network B. This new customer-challenge is a good example of the fact that the definition of the measures is highly important when starting to measure, because the same measure can mean something else to someone else, even when people are working in the same workplace or organisation. In these cases, the participants decided that a new customer is a person whose name is in the customer relationship management system. The data was collected in the same way, and this makes comparison between the stores and selling units possible.

Both networks have the same customer satisfaction tool in use, which produces information on customer satisfaction, service quality and the service process. That is why it is obvious that both networks have the same measures (table 4). There is one exception, customer profiling, which is seen in network A as important to follow but, in case network B, it is considered more like nice-to-know information, and that is why it is not in the system. The resellers of case network A, who use their own marketing more, highlighted that customer profiling has an important role in marketing planning. They explained that this way it is easier to allocate the marketing actions.

The customer satisfaction measure consists of a group of submeasures, which are product satisfaction, service satisfaction and delivery satisfaction. These elements form customer satisfaction. The lost deals measure reveals how many offers have turned to an order, and this way they can see how many deals they lose to the competitor. This measure is especially important from the point of view of the resellers and the main company, because it reveals something about the service quality and activity of the selling unit.

Even though both networks have the same measures on the employee perspective, the welfare and wellbeing of the reseller and seller are emphasised much more in case network B than in case network A. As mentioned above, the work communities are larger in case network B than in A, and for this reason there are more conflicts between the sellers and more silent know-how, which are easier to verify in development discussions between the resellers and sellers and with a well-being questionnaire to the whole network, which gives a wide picture of the state of well-being in the whole network.

In case network A, where it is very common that the work unit consists of a reseller and one/two seller(s), it is easier to transfer tacit knowledge and discuss the development targets. The resellers of case network A were not committed to having development discussions with their seller earlier, but along with this project they have started to carry out these development discussions.

Table 3. Measures from the future perspective

Future perspective	
Case network A	**Case network B**
Volume of orders	Volume of offers/seller
Volume of offers	Volume of offers/seller
New customers	New customers

Table 4. Measures from the customer perspective

Customer perspective	
Case network A	**Case network B**
Satisfaction	Satisfaction
Lost deals	Lost deals
Profiling	

Table 5. Measures from the employee perspective

Employee perspective	
Case network A	**Case network B**
Satisfaction	Satisfaction
Well-being	Well-being
Know-how	Know-how

Table 6. Use of the network-level performance measurement system

Use of the network-level PM system	
Case network A	**Case network B**
Mainly resellers' tool	Human research management
Company level	Seller level
Easy to use	Takes time
Understanding the state of the operations	Understanding the state of the operations

They see that development discussions are very useful for both parties.

From the perspective of the whole network-level performance measurement system, the size of the work community should affect the importance of the employee dimension, because there is already need for human resource management. In working life, the importance of the well-being and welfare of the employees is often forgotten. Thus, regular development discussions and well-being questionnaires are a useful way of finding out how the employees manage in their work life.

Use of the network-level performance measurement system

After the testing phase, the participants of both networks were asked how they utilise the network-level performance measurement system, and the results reveal that the use of the PM system is emphasised differently in the networks (table 6). The resellers in case network A only use the PM system for controlling and following the state of the business operations from a wider perspective. The reason for this is that the sellers in case network A are mainly independent entrepreneurs and they have responsibility of their own business.

In case network B, where the sellers are hired employees, the resellers follow the information on the selling, costs, and reclamations of every seller closer. The resellers of case network B stated that they analysed the results of the every seller in closer detail – how they managed last month. Both case networks introduced the results of the measures to the sellers. This way, it is easier to discuss the state of the operations, because the results are based on numerical facts.

The resellers of case network A highlighted that the measurement system is easy to use and the results are easy to analyse, which makes it easier to find the development targets of the operations. The resellers of case network B, on the other hand, commented that the PM system takes time. Both PM systems are almost the same but, in case network B, there is more information to analyse than in case network A.

This can be the reason why the resellers of case network B saw the measurement system as more laborious. Both case networks highlighted that the understanding of the state of the operations is better with the use of performance measurement. The information is timelier and more reliable, and the resellers have a wider picture of the state of their business.

These network-level performance measurement systems also make it possible to compare a unit's own results to the average of the whole network and enables benchmarking between the resellers. Hence, the resellers have a picture of how they succeed from the perspective of the whole network: whether their selling is average or good. This is important information for the development of the selling and operations in the selling unit.

In addition, on the basis of the results of the measures, the main company has a possibility to develop the actions and processes of their own business (eg marketing, process of the factory) and support the resellers' actions and decision-making.

A large part of the measurement information is produced by a new customer relationship management (CRM) tool. In case network A, the resellers and sellers have started to use the CRM-tool more actively than the resellers and sellers of network B. The active use of the CRM-tool

produces timely and reliable information on the operations. The resellers, who use the CRM-tool, emphasise that via the CRM-tool they get measurement information easily, and the sellers can see their own measurement information easily and online. As a whole, the network-level performance measurement systems were seen as an important tool to follow the stage of the business and to find the important development targets. After the testing phase, the participants stated that there is no reason to measure performance if you are not ready to do changes and development actions in your business.

Conclusions

The study concentrated on the testing phase of network-level performance measurement is a case environment. The paper is based on a multiple case study, where the network-level performance measurement systems of two case networks were compared. Both case networks are franchising networks, they have the same main company, and both sell kitchen fittings. Both networks operate in the same way, the greatest differences being that the organisations of case network B are larger and there are wider collections than in case network A. In addition, the selling units of case network B have their own selling stores.

The results of the study revealed that the same measures were highlighted in both cases, and thus the performance measurement system is mainly the same in both networks. Some of the measures, such as the welfare and wellbeing of the reseller and seller are emphasised more in case network B than in case network A, as well as some measures that were added to the PM system of case network B: the real earnings of every seller, where the costs are taken into account; specific and reclamation costs specified in detail in product reclamations; and installation and other costs.

These differences are a consequence of the larger work community in case network B. Case network A consists of a reseller and one to three sellers, and the sellers are mainly independent entrepreneurs. In case network B, there is a reseller and seven to 12 hired sellers. Thus, it is relevant that the resellers of case network B analysed the results of the study in closer detail. The purpose of the use of the network-level performance measurement system differs slightly in these networks. In case network B the PM system is more a tool for human resource management than in case network A.

Both networks use the PM system mainly to get an overall picture of the operations. The resellers of case network A analyse the results from the perspective of the whole unit, and in case B the resellers analyse the results by every seller. This is because there are more employees in case network B than in case A.

Regarding the generalisation of the results, it can be stated that the network-level performance measurement framework seems to be applicable in franchising networks. But according to

As a managerial implication, it seems that the constructed system can help the network partners to ensure and improve the efficiency of operations, satisfaction of customers, motivation of the employees etc, and thus the financial performance of the business in the future

the results of the study, the size of the company should be taken into account when the PM system is implemented in a franchising network.

Considering these things, we believe that the network-level performance measurement framework performs in networks that sell products and services with the franchising concept. In future, it could be interesting to test how the framework works in other networks: are there any unused measures or are some measures missing; how is the PM system used; do the measures affect the activities in practice?

As a managerial implication, it seems that the constructed system can help the network partners to ensure and improve the efficiency of operations, satisfaction of customers, motivation of the employees etc, and thus the financial performance of the business in the future.

In addition, with the performance measurement system, the shopkeepers can compare their own performance to other shopkeepers' performance. This way the resellers have a possibility to compare the success of their own businesses to other businesses. This benchmarking opportunity was seen as very important from the point of view of the resellers. The benchmarking information supported and helped the resellers to understand the real stage of their business.

On the other hand, when the resellers report the results of the measures to the main company, the sales managers of the main company can easily get an overall picture of the whole selling network. It is important that the main company has information on the state of their selling networks and their operations. The managers of the main company can support the operations of the resellers, when they have a clear picture of their operations and business.

References

Beamon, BM (1999). "Measuring supply chain performance", International Journal of Operations and Production Management, Vol 19, No 3, pp 275-292.

Brewer, PC and Speh, TW (2000). "Using the balanced scorecard to measure supply chain performance", Journal of Business Logistics, Vol 21, No 1, pp 75-93.

Brinker, BJ (1997). "Emerging practices in cost management: performance measurement", Emerging Practices in Cost Management, Vol 1997, WG&L/RIA Group, Boston.

Chenhall, RH (2003). "Management control system design within its organisational context: findings from contingency-based research and directions for the future", Accounting, Organisations and Society, Vol 28, pp 127-168.

Cohen, MA and Lee, HL (1988). "Strategic analysis of integrated production-distribution systems: models and methods", Operations Research, Vol 36, No 2, pp 216-228.

Dekker, H (2003). "Value chain analysis in interfirm relationship: a field study", Management Accounting Research, Vol 14, pp 1-23.

De Toni, A and Tonchia, S (2001). "Performance measurement systems. Models, characteristics and measures". International Journal of Operations & Production Management, Vol 21, No 4, pp 50-55.

Ellram, LM (1995). "A managerial guideline for the development and implementation of purchasing partnerships", International Journal of Purchasing and Materials Management, Vol 31, No 2, pp 9-16.

Gooderham, G (2001). "The top 10 lessons of implementing performance management systems", Journal of Cost Management, Vol 15, No 1, pp 29-33

Gummesson, E (2000). "Qualitative methods in management research", Sage publications, Inc, Thousand Oaks.

Gunasekaran, A, Patel, C and McGaughey, RE (2004). "A framework for supply chain performance measurement", International Journal of Production Economics, Vol 87, pp 333-347.

Håkansson, H and Lind, J (2004). "Accounting and network coordination", Accounting, Organisations and Society, Vol 29, pp 51-72.

Johnson, HT and Kaplan, RS (1987). "Relevance Lost: The Rise and Fall of Management Accounting", Harvard Business School Press, Boston.

Kald, M and Nilsson, F (2000). "Performance measurement at Nordic companies", European Management Journal, Vol 18, No 1, pp 113-127.

Kaplan, RS and Norton, DP (1992). "The Balanced Scorecard – Measures that Drive Performance", Harvard Business Review, Vol 70, January-February, pp 71-79.

Kaplan, RS and Norton, DP (1996). "The Balanced Scorecard: Translating Strategy into Action", Harvard Business School Press, Boston.

Kaplan, RS, Norton, DP and Rugelsjoen, B (2010). "Managing Alliances with the Balanced Scorecard", Harvard Business Review, January-February 2010.

Kulmala, HI (2003). "Cost management in firm networks", PhD Thesis, Publication 418, Tampere University of Technology, Tampere.

Kulmala, HI and Lönnqvist, A (2006). "Performance measurement of networks: towards a non-financial approach", International Journal of Networking and Virtual organisations, Vol 3, No 3, pp 299-316.

Kulmala, HI, Paranko, J and Uusi-Rauva, E (2002). "The role of cost management in network relationships", International Journal of Production Economics, Vol 79, pp 33-43.

Leseure, M, Shaw, N and Chapman, G (2001). "Performance measurement in organisational networks: an exploratory case study", International Journal of Business Performance Management, Vol 3, No 1, pp 30-46.

Morgan, C (2007). " Supply network performance measurement: future challenges", The International Journal of Logistics Management, Vol 18, No 2, pp 255-273.

Neely, A, Mills, J, Platts, K, Richards, H, Gregory, M and Bourne, M (2000). "Performance measurement system design: developing and testing a process-based approach", International Journal of Operations and Management, Vol 20, Iss 10, pp 1119-1145.

Olve, N-G, Roy, J, and Wetter, M (1998). "Balanced Scorecard – Yrityksen strateginen ohjausmenetelmä", Werner Söderström Osakeyhtiö, Helsinki.

Saiz, JJA, Bas, AO and Rodríguez, RR (2007). Performance measurement system for enterprise networks, International Journal of Productivity and Performance Management, Vol 56, No 4, pp 305-334.

Sherman, AJ (2004). "Franchising & licensing: two powerful ways to grow your business in any economy", American Management Association, USA.

Simons, R (2000). "Performance Measurement & Control Systems for Implementing Strategy", Prentice Hall, Upper Saddle River.

Tenhunen, J (2001). "Suorituskyvyn analysointijärjestelmän implementointi pkt-yrityksissä", LIITU-tutkimusraportti 1, Lappeenrannan teknillinen korkeakoulu, Lahden yksikkö, Lahti. (in Finnish)

Tenhunen, J (2006). "Johdon laskentatoimi kärkiyritysverkostossa: Soveltamismahdollisuudet ja yritysten tarpeet", Acta Universitatis Lappeenrantaensis 241, PhD Thesis, Lappeenrannan teknillinen yliopisto, Lappeenranta. (in Finnish)

Tomkins, C (2001). "Interdependencies, trust and information in relationships, alliances and networks", Accounting, Organisation and Society, Vol 26, pp 161-191.

Varamäki, E, Kohtamäki, M, Järvenpää, M, Vuorinen, T, Laitinen, EK, Sorama, K, Wingren, T, Vesalainen, J, Helo, P, Tuominen, T, Pihkala T and Tenhunen J (2008). "A framework for a network-level performance measurement system in SME networks". International Journal of Networking and Virtual Organisations, Vol 5, No 3/4 pp 415-435.

Although different frameworks consist of different numbers of phases and different methods, the designing process is often quite similar

ARTICLE III

Pekkola, Sanna (2013)
Managing a network by utilizing performance measurement information

Measuring Business Excellence, Vol. 17, Iss: 1, pp. 72-79.

Managing a network by utilizing performance measurement information

Sanna Pekkola

Sanna Pekkola is based at the Lahti School of Innovation, Lappeenranta University of Technology, Lahti, Finland.

Summary

Purpose – *The purpose of this paper is to examine how different network members utilize and use network-level performance measurement information. This is an important approach when discussing the management and development of a network by utilizing a performance measurement system.*

Design/methodology/approach – *The study is a single-case study, where a collaborative network forms the case. The data of the study have been gathered from an action research process of network performance measurement system design and its implementation phase in 2009, interviews in 2010, and discussions with the interviewees in 2012 to re-evaluate the results.*

Findings – *The results of the study reveal that the use of the network-level performance measurement system increased communication, trust, and commitment in the whole network, as well as in a single reselling unit. The performance measurement information also helped the companies create better alignment with their network partners.*

Practical implications – *The paper presents the main uses, utilizations and benefits of network-level performance measurement and management from the perspectives of the different network members.*

Originality/value – *The case study contributes to the literature of performance measurement and management in a network environment. It presents the main uses and utilization of network-level performance management and measurement.*

Keywords *Performance management, Performance measures, Performance measurement, Use, Network, Franchising*

Paper type *Case study*

1. Introduction

One of the main purposes of performance measurement (PM) is to deliver reliable information to support decision-making, and it is today utilized for both strategic and operative purposes. Strategic performance measurement usually refers to the monitoring of companies' long-range plans and success. However, companies apply PM quite often also on lower levels of the organization, such as teams and departments, but PM has been found to have a role in the network environment as well. The literature presents many frameworks, models and case studies for performance measurement system design and its implementation process, and several studies focus on the impacts and use of a PM system in a single organization (in private and public sectors) (Kaplan and Norton, 1996; Simons, 2000; De Toni and Tonchia, 2001; Gooderham, 2001).

In the network context, there is limited knowledge on how to promote successful performance development in a collaborative network. However, it can be seen that a network-level performance measurement system could also be used to manage the network business and to guide the actors in networks to pursue the joint targets of the network (Cohen and Lee, 1988; Beamon, 1999; Leseure *et al.*, 2001; Kulmala and Lönnqvist, 2006; Kaplan *et al.*, 2010; Yin *et al.*, 2011; Bititci *et al.*, 2012). There is hardly any research related to performance measurement and management in a network environment presented in the

The author wishes to thank Professor Juhani Ukko, for his comments on the earlier version of the paper; also Dr Jos Van Iwaarden (Editor) and two anonymous reviewers for their constructive suggestions for improvement.

literature (Papakiriakopoulos and Pramatari, 2010; Kaplan *et al.*, 2010; Yin *et al.*, 2011; Bititci *et al.*, 2012). Bititci *et al.* (2012) have identified research needs concerning a structured methodology of the PM system design and implementation process and its utilization and use in the network environment.

In the network environment and in a single organization, performance measurement has been seen as an important tool for managing the organization and its performance. The challenge is to make effective use of the results of performance measurement, and it must be possible to make the transition from measurement to management (Amaratunga and Baldry, 2002; Bourne *et al.*, 2005). It does not make sense to measure the performance if the measurement information cannot be utilized in the management or development of the single organization or the network. When an organization or a network implements a performance measurement system, it also has to be able to anticipate the changes needed in the strategic direction of the organization (Kulmala and Lönnqvist, 2006; Stivers *et al.*, 1998).

The objective of this study is to examine how the network utilizes and uses performance measurement information in network management. Previous literature presents a great variety of studies concerning the use of a PM system in a single company (Kaplan and Norton, 1996; Simons, 2000; Artz *et al.*, 2012), but not in the network context (Bititci *et al.*, 2012). This study is a single-case study where the case is a collaborative network. The data of the study has been gathered by utilizing an action research process in the design and implementation phase of a PM system in 2009, interviews a year after the implementation of the network-level PM system in 2010, and re-evaluating discussions in 2012.

Literature review

Performance measurement in network

In today's dynamic and rapidly changing business environment, companies have to concentrate on their core competencies and search for competitive advantages and innovations. To sustain such a competitive environment, companies have to collaborate with each other with the objective of the meeting their customers' needs more effectively and efficiently (see, e.g. Papakiriakopoulos and Pramatari, 2010; Kaplan *et al.*, 2010; Yin *et al.*, 2011; Bititci *et al.*, 2012) On the other hand, the main challenge in the networked way of doing business is that these alliances often fail. According to Kaplan *et al.* (2010), the main reason for this is the way they are traditionally organized and managed. Most of the alliances are defined by service-level agreements that identify what each side commits to delivering rather than what each hopes to gain from the partnership. These organizations emphasize operational performance metrics rather than strategic objectives, and all too often those metrics become outdated as the business environment changes. Kaplan *et al.* (2010) emphasize the role of performance measurement in helping companies create better alignment with their alliance partners. Performance measurement would promote consensus on and alignment with the goals of the alliance. A network-level PM system would also serve as a framework for a governance system to monitor the progress toward the goals and to create incentives for both parties to achieve them (Kaplan *et al.*, 2010).

Bititci *et al.* (2012) emphasize that the literature on performance measurement has recognized the trends towards inter-organizational working and regular calls for research into performance measurement in supply chains and collaborative organizations. According to Bititci *et al.* (2012), Yin *et al.* (2011) and Busi and Bititci (2006), there is still very little grounded empirical research exploring performance measurement and management-related issues in collaborative organizations. Bititci *et al.* (2012) state that it is not truly understood, from theoretical and practical perspectives, what the challenges of performance measurement are, what the appropriate measures are, and how to use the collaborative performance measurement information associated with a system of a collaborative organization. Yin *et al.* (2011) and Papakiriakopoulos and Pramatari (2010) also highlight that despite the increasing focus on collaboration, the existing literature in the area of performance management still narrowly look at a single enterprise and its internal processes. Yin *et al.* (2011) continue that there is little research that concentrates specifically on collaborative design, especially from

the design process perspective. Thus, there is a lack of research examining measurement system development and use in such a specific setting.

This research gap may contain several problems. Collaborative networks are very complex, which increases the challenge in the design and management of such business (Busi and Bititci, 2006). There are a lot of different pitfalls, such as lack of commitment and trust, unrealistic objectives, and problems to identify competitive advantage affecting the success of the collaboration and its performance development (see, e.g. Parung and Bititci, 2008; Camarinha-Matos *et al.*, 2009; Yin *et al.*, 2011). Despite of these challenges and the research gap, performance measurement and management has been seen beneficial in managing and developing collaborative networks (Camarinha-Matos *et al.*, 2009; Yin *et al.*, 2011; Bititci *et al.*, 2012). By sharing performance data with their partners, firms can identify the development targets and ''weak links'' in the network, and act accordingly to improve the overall performance. The measurement systems should be designed to make use of a balanced set of performance measures. Firstly, this would monitor both the external relations and the efficiency of the internal and extended processes, and secondly, it would support proactive management based on both feedback and feed-forward operations control (Kulmala and Lönnqvist, 2006).

The use of performance measurement information

Traditionally, performance measurement has been seen as a management tool mainly utilized by managers. Later, performance measurement has come closer to the employees (Ukko *et al.*, 2007), and the benefits have been seen also in network environment (Busi and Bititci, 2006). Marr *et al.* (2003) present three general reasons why organizations use business performance measurement: to implement and validate a strategy, to influence employees' behavior, and to report externally on performance and corporate governance. Although Artz *et al.* (2012) state that the literature suggests that the use of performance measurement systems affects the influence of organizational actors, empirical evidence of this suggestion is limited to a few qualitative case studies. On the other hand, the literature presents a great variety of different purposes for using performance measurement. For instance, Simons (2000) categorizes the different uses into five broad categories: decision-making, control, signaling, education and learning, and external communication. The needs for measuring performance differ in different organizations, and the purposes of use can depend for example on the strategy, organizational culture and other characteristics of the organization. This may be one reason why the purposes of using performance measurement have not been studied very extensively (Neely *et al.*, 2000). It can be assumed that many of the earlier identified uses are also valid for the network environment. However, the purposes of using a network-level PM system depend on such elements as the strategy, tightness, and formality of the network. It can be assumed, however, that such purposes as communication, decision-making, and detection of problems are highlighted also in the network context. Also factors like commitment, trust and openness have a critical role in the use of PM information in network management and development.

Methodology

The objective of this study is to examine how a network utilizes and uses performance measurement information in management. The study is a single-case study where one collaborative network (cf. Camarinha-Matos *et al.*, 2009) forms the case. The case network consists of a main company that manufactures kitchen fitments and one reselling network which sells these products to the end customer. The study focuses on the uses and utilization that can be perceived in network-level operations and management in the main company and in a single reselling unit of the network. The resellers in this network are independent enterprises that have full responsibility for their own businesses. The case network operates by the franchising concept where all resellers have shared advertising, training and support services. This case differs from the traditional franchising concept in many ways – for example, the selling process requires strong expertise and know-how regarding the collection, design, installation etc. In addition, the end customer service

process is a jointly produced process with the main company, where the interfaces of these two partners are not necessarily visible to the end customer.

The network-level performance measurement system design and implementation process was conducted in the case network in 2009. The interviews for this study were carried out in the case network after one-year use of the developed network-level performance system, in autumn 2010. The uses of PM were discussed and evaluated again with the sales managers and two representatives of the reselling network in 2012. The discussions revealed that the results of the earlier interviews were still valid and the network-level performance measurement system had a significant role in management. For this study, eight of the total 26 resellers in the case network and two sales managers in the main company were interviewed. All the participants were also involved in the network-level performance measurement design and implementation process, where a part of the data of this study was gathered by the action research process. The participants represented the whole network very well, because some of them were smaller operators and some larger, and some were more successful and some less. The interviews were semi-structured interviews focusing on the interviewees' views concerning how they used the PM system and its information in their own organization or network, what were the main impacts (negative or positive) of the use, how they would develop the network-level PM system in the future etc. All the interviews were recorded. The same themes were repeated in the discussions in 2012.

Findings

The results of the study revealed that the network-level performance measurement system had various uses concerning management performance and operations from the perspective of the whole network and an individual reselling unit. The results are presented below from the point-of-view of two groups that exploit the information of the PM system, sales managers and resellers.

The network-level performance measurement system of the case network consists of four measurement perspectives: financial, future, customer, and employees. The financial perspective measures the financial aspects of the operations, such as profits (€), orders (€), and contribution margin (€). The future perspective produces future-oriented information of the network performance, i.e. offers (€) and market predictions. The customer perspective measures the customers' opinion of the service quality and availability, and the employees' perspective measures the welfare and well-being of the resellers and sellers of the network. The basic idea of the network-level performance measurement system is that all the operators have the same measures in use. Thus, the measurement information is commensurate between each group. The information makes it possible to calculate network-level averages and create network-level information, and to manage the network or a single reselling unit more effectively and timely than before. The starting point of the design of the network-level PM was to give a comprehensive picture of the state of the network-level performance. The sales management and resellers of the network can be seen as the main utilizers of this network-level information.

Sales managers

The results of the interviews showed that the information produced by the network-level performance measurement system is very important for the network management and development of operations. The interviewed sales managers stated that the network-level performance measurement information offers a comprehensive and reliable picture of the performance and operations, and makes decision-making concerning the network easier. Before the use of the network-level PM system, the management of the network was based only on the information of a few measures of the network, such as selling and orders. In addition, the sales managers stated that the network-level PM information is also a very useful tool for finding the development targets and needs of the network. On the basis of the information of the PM system and the wishes of the network members, the sales managers organize training and courses which support and develop the skills, know how, and performance of the resellers and sellers. From the perspective of the sales managers, the

network-level performance measurement information can be seen also as an assessment tool for marketing campaigns:

> During the campaign, we follow the number of new customers, the number of offers, and the number of sales at the network level. This way, we receive information on how effective the campaign is, and based on that information we can make changes in the campaign if the circumstances so demand (sales manager of the main company).

In addition, the sales managers emphasized the usefulness of the new concept of sales manager-reseller meetings. The new meeting concept was implemented in the network at same time as the network-level PM system. In these meetings, the sales manager and resellers go through the results of the measurement system from the perspective of a single reselling unit, and compare its results to the results of the whole network. This makes the discussions and decision making more structured and open between the network members. The sales managers stated that it is easier for them to support and help the resellers in their operations, when they have understanding of the current state of the operations of the reselling unit. The experiences of the sales managers show that the new meeting concept has increased the trust and openness between the sales manager and the resellers. The analysis of the study indicates that the sales managers use the network-level PM information for the following purposes:

- Constructing an overall and comprehensive picture of the network is clearer (e.g. the financial state).
- Following the state of the network is easier and updated (e.g. the total selling, offers, and deals of the network).
- Decision-making based on numerical information (e.g. campaigns, budgets, target setting).
- Developing the targets of the network in easier to identify (e.g. training and courses, development projects).

Resellers

The network-level performance measurement system has a different role for the resellers than the sales managers. The network-level performance measurement system produces both network-level information and single reseller unit-level information. The results of the interviews revealed that a single reselling unit and network-level information are analyzed in closer detail in the reselling units than in the main company. The reason for this is that the network-level PM information is commensurate between the network operators, and a single reselling unit can compare its own results to the results of the whole network. Even though the case network is a franchising network, the different operators are naturally competitors with each other, and the resellers are fully responsible for their own activities both functionally and economically. The comparative information is essential for increased understanding and knowledge of the state of their operations, and it helps to get amore realistic picture of the business. One example of this possibility is comparing the network-level information to the information of one reselling unit. An interviewed participant described the situation as follows:

> Now, when we have started to follow the costs that occur from customer complaints and reclamations and are based on measurement information, I have been able to reduce the reclamation costs to a half. This is also psychological. When something is started to be measured and followed, the focus of the operations concentrate on the development of measurement targets. The measurement information illustrates in a very realistic way how much money you lose by doing reclamations. It is very disconcerting to realize that without these unnecessary reclamation costs you could take your family off to a vacation (reseller 1).

Another interviewed reseller said that:

> You have many years' experience of this business and you thought that your reclamation costs are not so high. When I compare these to the costs of the others, I'm not so happy anymore (reseller 2).

The possibility to use the comparative PM information gives the result of the measurement system a totally new perspective. Even though some resellers had followed the reclamation costs every month, they had not had any comparative information available to compare these results to the results of network-level performance. That is why they did not have a realistic picture of their operations.

The network-level performance measurement system is also integrated to the customer relationship management (CRM) system. The network-level measurement information and the reselling unit-specific information are available mainly online in this system. The role of the IT systems emphasizes the network environment because it makes collaboration possible in practice (see, e.g. Busi and Bititci, 2006). In this system the resellers can see the offers, contribution margins and so on very easily:

> Just looking at the CRM-system, you can see the state of your business very easily and the information is visualized. You see the results per every seller, and you see also the total results (reseller 4).

The system integration makes the controlling and following of the results of the performance measurement system efficient to the users. Also, every seller in the reselling units can see their own results, and the reseller can see also the results of the whole selling unit. The measurement information is available faster and timely. According to a reseller:

> It is easier to manage the operations of the selling unit, when you have facts to show how our unit has succeeded compared to others (reseller 3).

The above quotation indicates that managing the operations is effective to the reseller, because he/she has facts in use. The resellers stated that it is straightforward to make decisions and explain these choices to the sellers of the network on the basis of this. Also, the PM information provides a good basis for development discussions between the reseller and the seller:

> By using the measurement information, you can easily explain to the seller how she/he has succeeded in her/his selling, and find development targets for the future (reseller 4).

On the other hand, the results of the interviews revealed that the network-level measurement system is not rooted in the operations of those network members who do not actively use the CRM-system and do not have network-level PM information always available. They have only a few measures in use and the information is not online.

The results of the interviews showed that the network-level PM system has brought several changes and impacts to the management of the reseller units:

- Because of the comparative information, the understanding of the state of the operations and success is more realistic (benchmarking).
- Finding the development targets is clearer (e.g. reducing the reclamation costs).
- Understanding and knowledge of performance has increased (learning).
- Decision-making is easier and straightforward.
- Human resource management is more comprehensive (motivating, leading and guiding).

Conclusions

The aim of this study was to examine the use and utilization of a network-level performance measurement system from the perspectives of the sales managers of the main company and resellers of the franchising network. From the perspective of the sales managers, the main use and benefit of the network-level performance measurement system is that they have a wider and more complete picture of the operations on the network level. The use of the network-level information makes it easier to follow the state and development of the network. In addition, the sales managers highlighted that the network-level information has an important role in decision-making in general. The results of the study also emphasized that

the use of network-level information has an important role in developing the network, i.e. it helps to make development plans and to evaluate for instance marketing campaigns.

The results from the resellers' perspective revealed that using the network-level PM information makes understanding the state of the operations more realistic than before. This comparative information makes it possible to find the development targets of the reseller's own business more easily. In addition, the results of the study showed that the decision-making concerning the operations of the reseller's own reselling unit is easier and faster, as the network-level PM information is in use timely and in the right form. It was also emphasized that the role of the network-level PM system is very important in the human resource management of the reselling unit. The network-level PM system information makes the reseller's role as the manager easier in motivating and leading the employees towards the targets.

Generally, the results of the study also revealed that the use and utilization of the network-level performance measurement system increased communication, trust, and commitment in the whole network, as well as in a single reselling unit. This result is well in line with the results of Kaplan *et al.* (2010) and Busi and Bititci (2006), which present several critical success factors and characteristics, such as commitment, trust, communication, participation, and coordination, that have a key role for the success of a network. Based on these success factors and the results of this study, it can be seen that the use of a network-level performance measurement system has a positive effect on the general success of the network. The results of the study also support the results of Kaplan *et al.* (2010), which highlight the role of a performance measurement system to help companies create better alignment with their alliance partners. Even though the results of the study are not widely generalizable, they are valuable for the identified research gap (Yin *et al.*, 2011; Bititci *et al.*, 2012).

References

Amaratunga, D. and Baldry, D. (2002), ''Moving from performance measurement to performance management'', *Facilities*, Vol. 20 Nos 5/6, pp. 217-27.

Artz, M., Homburg, C. and Rajab, T. (2012), ''Performance-measurement system design and functional strategic decision influence: the role of performance-measure properties'', *Accounting, Organizations and Society*, Vol. 37 No. 7, pp. 445-60.

Beamon, B.M. (1999), ''Measuring supply chain performance'', *International Journal of Operations & Production Management*, Vol. 19 No. 3, pp. 275-92.

Bititci, U., Garengo, P., Dörfler, V. and Nudurupati, S. (2012), ''Performance measurement: challenges for tomorrow'', *International Journal of Management Reviews*, Vol. 14 No. 3, pp. 305-27.

Bourne, M., Kennerley, M. and Franco-Santos, M. (2005), ''Managing through measures: a study of impact on performance'', *Journal of Manufacturing Technology Management*, Vol. 16 No. 4, pp. 373-95.

Busi, M. and Bititci, U.S. (2006), ''Collaborative performance management: present gaps and future research'', *International Journal of Productivity and Performance Management*, Vol. 55 No. 1, pp. 7-25.

Camarinha-Matos, L.M., Afsarmanesh, H., Galeano, N. and Molina, A. (2009), ''Collaborative networked organizations – concepts and practice in manufacturing enterprises'', *Computers & Industrial Engineering*, Vol. 57 No. 1, pp. 46-60.

Cohen, M.A. and Lee, H.L. (1988), ''Strategic analysis of integrated production-distribution systems: models and methods'', *Operations Research*, Vol. 36 No. 2, pp. 216-28.

De Toni, A. and Tonchia, S. (2001), ''Performance measurement systems: models, characteristics and measures'', *International Journal of Operations & Production Management*, Vol. 21 No. 4, pp. 50-5.

Gooderham, G. (2001), ''The top 10 lessons of implementing performance management systems'', *Journal of Cost Management*, Vol. 15 No. 1, pp. 29-33.

Kaplan, R.S. and Norton, D.P. (1996), *The Balanced Scorecard: Translating Strategy into Action*, Harvard Business School Press, Boston, MA.

Kaplan, R.S., Norton, D.P. and Rugelsjoen, B. (2010), ''Managing alliances with the balanced scorecard'', *Harvard Business Review*, Vol. 88 Nos 1/2, pp. 114-20.

Kulmala, H.I. and Lönnqvist, A. (2006), ''Performance measurement of networks: towards a non-financial approach'', *International Journal of Networking and Virtual organizations*, Vol. 3 No. 3, pp. 299-316.

Leseure, M., Shaw, N. and Chapman, G. (2001), ''Performance measurement in organizational networks: an exploratory case study'', *International Journal of Business Performance Management*, Vol. 3 No. 1, pp. 30-46.

Marr, B., Gray, D. and Neely, A. (2003), ''Why do firms measure their intellectual capital'', *Journal of Intellectual Capital*, Vol. 4 No. 4, pp. 441-64.

Neely, A., Mills, J., Platts, K., Richards, H., Gregory, M. and Bourne, M. (2000), ''Performance measurement system design: developing and testing a process-based approach'', *International Journal of Operations and Management*, Vol. 20 No. 10, pp. 1119-45.

Papakiriakopoulos, D. and Pramatari, K. (2010), ''Collaborative performance measurement in supply chain'', *Industrial Management & Data Systems*, Vol. 110 No. 9, pp. 1297-318.

Parung, J. and Bititci, U.S. (2008), ''A metric for collaborative networks'', *Business Process Management Journal*, Vol. 14 No. 5, pp. 654-74.

Simons, R. (2000), *Performance Measurement & Control Systems for Implementing Strategy*, Prentice Hall, Upper Saddle River, NJ.

Stivers, B.P., Covin, T.J., Hall, N.G. and Smalt, S.W. (1998), ''How nonfinancial performance measures are used'', *Management Accounting*, Vol. 79 No. 8, pp. 44-9.

Ukko, J., Tenhunen, J. and Rantanen, H. (2007), ''Performance measurement impacts on management and leadership: perspectives of management and employees'', *International Journal Production Economics*, Vol. 110, pp. 39-51.

Yin, Y., Qin, S. and Holland, R. (2011), ''Development of a design performance measurement matrix for improving collaborative design during a design process'', *International Journal of Productivity and Performance Management*, Vol. 60 No. 2, pp. 152-84.

Further reading

Kulmala, H.I. (2003), ''Cost management in firm networks'', PhD thesis, Publication no. 418, Tampere University of Technology, Tampere.

Tenhunen, J. (2006), ''Johdon laskentatoimi kärkiyritysverkostossa: Soveltamismahdollisuudet ja yritysten tarpeet'', Acta Universitatis Lappeenrantaensis 241, PhD thesis, Lappeenrannan teknillinen yliopisto, Lappeenranta (in Finnish).

About the author

Sanna Pekkola, MSc (Tech), is a Researcher at Lahti School of Innovation, Lappeenranta University of Technology, Finland. Her current research focuses on performance measurement systems and performance management, especially networks and service operations. Her post-graduate studies concentrate on network-level performance management and measurement. She has published in journals such as *International Journal of Business Excellence*, *International Journal of Business Performance Management* and *International Journal of Public Sector Management*. She has also participated in many development projects related to performance management in Finnish organizations.

ARTICLE IV

Pekkola, Sanna and Rantanen, Hannu

Utilisation of performance measurement information in management: top manager perspective

Accepted for International Journal of Business Performance Management

Utilisation of performance measurement information in management: top manager perspective

Sanna Pekkola* and Hannu Rantanen

Lappeenranta University of Technology,
Lahti School of Innovation,
Saimaankatu 11, FI-15140 Lahti, Finland
E-mail: sanna.pekkola@lut.fi
E-mail: hannu.rantanen@lut.fi
*Corresponding author

Abstract: The main purpose of the study is to analyse the role of performance measurement information in management, and what performance measurement information top managers use in their decision making. The study is a single case study of a company that manufactures kitchen fitments and operates in a turbulent environment. The company is part of a collaborative network. The research focus of the study is the top management of the main company. The results of the study are based on three semi-structured interviews and two action research processes. The study contributes to current understanding by analysing how performance measurement information has been utilised in the top-level management of the company, and goes a step further by studying the utilisation of performance measurement information in management. This can be regarded as an important theme because a lack of research focusing on this phase of performance measurement and management has been perceived.

Keywords: performance management; performance measurement; information; top management; knowledge; network.

Reference to this paper should be made as follows: Pekkola, S. and Rantanen, H. (xxxx) 'Utilisation of performance measurement information in management: top manager perspective', *Int. J. Business Performance Management*, Vol. X, No. Y, pp.000–000.

Biographical notes: Sanna Pekkola is a Researcher at Lappeenranta University of Technology, Lahti School of Innovation, Finland. Her current research focuses on performance measurement systems and performance management, especially networks and service operations. Her post-graduate studies concentrate on network-level performance management and measurement. She has published in journals such as *International Journal of Business Excellence*, *International Journal of Business Performance Management* and *International Journal of Public Sector Management*. She has also participated in many development projects related to performance management in Finnish organisations.

Hannu Rantanen is a Professor of Industrial Management and the Vice Rector of Lappeenranta University of Technology. His current research concentrates on performance analysis in the private and public sector, and cost management in industrial enterprises. He was a Senior Researcher from 1989 to 1996 and has been a Professor since 1996.

1 Introduction

Companies are facing a lot of challenges to succeed in the global competitive market. Customers' demands are changing rapidly in terms of sophistication of the products and the services they require. Hence, companies need to become responsive to customers and market needs with more flexible processes, suppliers and resources coordinated through a number of organisations, while reducing the costs. Rapidly changing conditions outside the organisation and across multiple variables require management teams to interpret the changes more quickly and accurately, and to respond more decisively than in stable conditions (Nudurupati et al., 2011; Barrows and Neely, 2011; Bititci et al., 2012). In order to respond to these challenges proactively, the management requires accurate up-to-date information on its business at the company level as well as the collaborative network level. The performance information needs to be thus integrated, dynamic, accessible and visible to aid fast decision-making to promote a proactive management style leading to agility and responsiveness. Many companies use an information system to provide the required performance information online. However, managers suffer from data overload, even though they need up-to-date performance information on for example production, quality markets, through which they can proactively manage and control several processes to reach the overall performance targets (Sousa et al., 2006; Barrows and Neely, 2011; Rompho, 2011; Nudurupati et al., 2011).

The aim of performance management is to convert data from internal and external performance measurement information sources and to communicate it to managers at all levels of organisations, to enable timely and effective decisions and continuous improvements. The existing literature presents a number of different purposes for performance measurement, such as following the performance, identifying the development targets, enhancing motivation, improving communication, and strengthening accountability (Kaplan and Norton, 1996; Simons, 2000). However, if measures are not used or they are used in a wrong way, performance measurement fails to deliver any of the promised benefits (Busi and Bititci, 2006). Organisations have to make use of their measures to receive the benefits of performance measurement (Amaratunga and Attaran, 2002; Bourne et al., 2005). Performance measurement is not an end in itself, but a tool for more effective general management. The results of performance measurement indicate what happened, not why it happened, or what to do about it. In order for an organisation to make effective use of their performance measurement outcomes, they must be able to make the transition from measurement to management (Kaplan and Norton, 1996).

When a company operates in a dynamic, turbulent operating environment or as a part of a network or/and larger consolidated corporation, it receives internal and external performance measurement information on different levels. This can lead to information overload and inefficient use of performance measurement information on management. Nudurupati et al. (2011) present a research need for how performance measurement information is used to manage the performance of organisations which operate in a dynamic, changing operating environment. The present study is a single case study where the case company is a part of larger consolidated company, and operates as a part of a collaborative network in a turbulent environment. The study focuses on the performance measurement information that the top management team of the company utilises. The aim of the study is to examine:

1 what performance measurement information the top management uses in management

2 what is the role of network-level performance measurement information in management.

The study contributes to the current understanding of the use of performance measurement information in management when a company operates in a turbulent operating environment, and as a part of a collaborative network and a consolidated company. The results of the study are analysed by utilising the information management process cycle model presented by Choo (2002). The model helps to identify the utilised measurement information, its sources, information flows and the people who are responsible for the analysis of the performance measurement information.

The paper is divided into four sections. The next section is a literature review that summarises previous research on performance management and measurement and information management. The following section explains the methodology used in the data collection. Then the findings are outlined. Finally, the paper offers conclusions and recommendations for practice and further research.

2 Literature review

2.1 Use of performance measurement information

Performance management has various applications, depending on its purpose and the organisational level. According to a definition by Hannula and Lönnqvist (2002), performance management is management based on the information provided by performance measurement. In their view, performance management includes systematic use of measurement for managing and developing the performance of different organisational activities, which means that it covers most of the employees at different levels of the organisation. The managerial use of performance measurement also differs on the strategic and operative levels. On the strategic level, performance measurement is focused on the key issues from the perspective of the organisation's mission and strategic objectives. When the measures are derived from the strategy, the initial use is that they measure the success of the implementation of the strategy. On the other hand, the information and feedback from the measures should be used to challenge the assumptions and test the validity of the strategy (Kaplan and Norton, 1996; Bourne et al., 2000). On the operative level, the measures are used to provide detailed information to support daily management activities. In addition, to survive in a turbulent operating environment, organisations collaborate with other organisations increasingly. As a part of a network, organisations are required to share and use information dynamically. So, together with internal performance information, external performance information has to be taken into account in management.

Performance measurement information has a lot of different uses, and a lot of positive impacts have been identified. For example, Stivers et al. (1998) and Nudurupati et al. (2011) indicate that managers do not utilise measurement information in their organisations as effectively as possible. Stivers et al. (1998) have identified a so-called measurement-use gap in the use of performance measurement information, especially non-financial performance measurement information. Nudurupati et al. (2011) have

collected a list of problems that may cause inefficient use of performance measurement information:

- performance measurement systems are historical and static and they take account of dynamic and sensitive changes in the internal and external environment (Marchand and Raymond, 2008)
- lack of support from a management information system results in complex and time-consuming data collection, sorting of maintenance and reporting (Nudurupati and Bititci, 2005)
- people do not understand the objectives and potential benefits, or the management tends to use the performance measurement system as a command and control mechanism, disengaging people (Davenport et al., 2010; Wisniewsky and Olofsson, 2004)
- lack of effective communication of the right information to the right people at the right time
- information is not shared or communicated throughout the organisation
- many information systems report only financial performance and do not provide adequate, up-to-date information on non-financial performance.

The real success lies in people's behaviour in using performance measurement information (Prahalad and Krishnan, 2002). Many studies indicate that the main reason why performance measurement is short-lived is because of people's behaviour with the information (Bititci et al., 2002). Meekings (1995) points out that making people use measures properly not only delivers performance improvement but also becomes a vehicle for a cultural change, which helps in liberating the power of the organisation. For the future, Marchand and Raymond (2008) present some research questions that are important from the perspective of efficient use of performance measurement information: How can we ensure that the information system matches the firm's environment, strategy, structure and culture? How is information systems actually used in organisations? What are the advantages of using information systems?

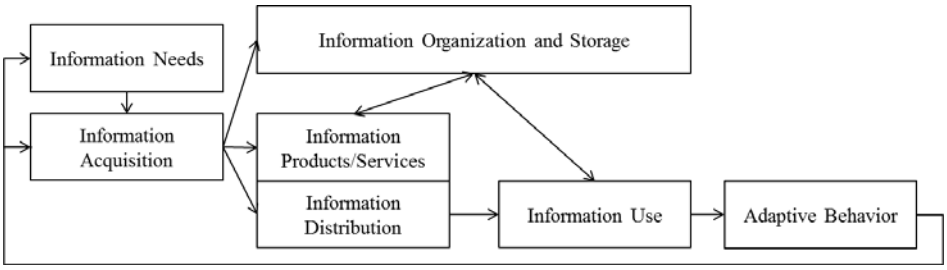
2.2 Information management process

The efficient use of a performance measurement system often involves computer programming to trap the data already used in the system and to present them in a meaningful form (Bourne et al., 2000). There is some evidence that a performance measurement system without information technology does not support the management practices as efficiently and effectively as possible (Kennerley and Neely, 2003; Bititci et al., 2012). The information systems of many companies and especially networks play a vital role in the upward flow of information, i.e., every-day operations are communicated to the decision makers and strategies and goals are passed downwards to the lower levels. Information systems also ensure that information flows horizontally across the various departments within the organisation and other network members outside the organisation (Nudurupati et al., 2011).

Choo (2002) presents an information management process cycle model that consists of six closely related activities, as presented in Figure 1. The basic goal of information

management is to harness the information resources and information capabilities so that the organisation learns and adapts to its changing environment. The main assumption of the model is that the information should not be confined to subject-related concerns but should also address the situation demands of the information-use environment in which the users are immersed. A process cycle can be seen as a tool to analyse the information flows and processes of the company and to find the key bottlenecks and development targets. The information management cycle model consists of the following stages:

Figure 1 Information management cycle



Source: Choo (2002)

The first stage is identification of the need of information, where the members of the organisation have to identify the necessary information needs concerning decision making and problem solving. The information needs are defined by subject-matter requirements and situation-determined contingencies. The second phase is information acquisition, which is driven by the information needs and must address these needs adequately. The objective of the third phase, information organisation and storage, is to create organisational memory and to ensure that the significant information concerning the organisation's past and present are preserved and made available for organisational learning. The fourth phase is information products and services. This phase has to add value by enhancing the quality of the information and by improving the fit between the information and the needs or preferences of the users. The target of information distribution is to increase the sharing of the information. The end users should be given the best available information to perform their work, and the information should be delivered through channels that match the users' work patterns. The last phase is information use, which is the creation and application of knowledge through interpretive and decision-making processes. The use of information for interpretation involves social construction of reality, and the information presentation and delivery should support multilevel interaction in social discourse.

The use of information for decision making involves a selection of alternatives, and the information provision and content should accommodate the kinetic and non-linear nature of the decision process (Choo, 2002; McKenzie et al., 2011). Decision making is an intrinsic aspect of business activities, and ill-informed decisions can have far-reaching consequences. Decision making requires the right knowledge at the right place and right time to be efficient and effective (McKenzie et al., 2011). Knowledge management practices are well placed for improving decision making. Decision making is a knowledge-intensive activity. Content knowledge keeps the decisions relevant for the circumstances and rooted in expertise; process knowledge, such as skills and

organisational structures to support better decision making, is equally valuable in developing a capability to make significant decisions well.

3 Research design

The main purpose of the study is to examine what performance measurement information the top management uses in management and what is the role of network-level performance measurement information in management. The empirical data has been gathered in a company that manufactures kitchen fitments. The company does not have selling activity of its own, five reselling networks sell the products to the end customers. The resellers of the reselling network are independent entrepreneurs. Together the case company and reselling network form a collaborative network that employ 470 people. The company is also a part of a larger consolidated corporation. The company operates in a highly turbulent environment. If companies or private customers do not build houses, for example because of a global economic recession or credit crises, it influences the sales of the case company directly.

The focus of the study is on the top management team of the main company, consisting of four managers – the CEO, the financial manager, the marketing manager, and the production manager. This group of managers is responsible for the success of the company. The team focuses on specifying the mission, vision and objectives of the main company and the networks, developing policies and plans, often in terms of projects and programmes, which are designed to achieve these objectives, and then allocating resources to implement the policies and plans, projects and programmes.

The interviews were conducted as a group interview, carried out in March 2012. All other participants of the top management team participated in the group interview except the production manager. The interview took two hours and it was audio recorded. In addition, the first author participated as a facilitator in two action research processes in 2009 and 2010, in which a network-level performance measurement system was developed for two reselling networks. A great part of the empirical evidence of the present study is based on the data of these two processes.

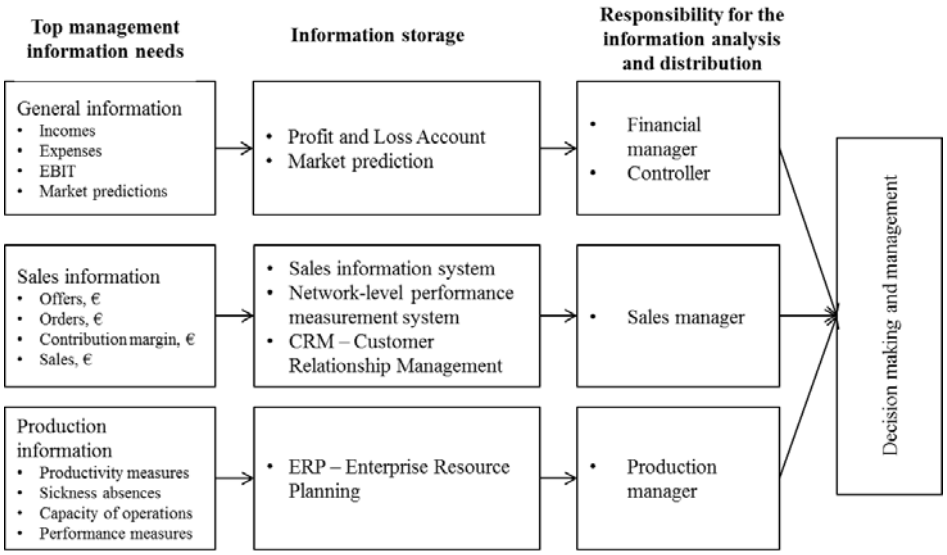
The interviews focused on the interviewees' perceptions concerning general information needs, information processes, use of performance measurement information, as well as the development needs of performance measurement information. To achieve a broad view of these themes, open-ended questions were used, and discussed quite informally during the interviews. When applying open-ended questions, multiple answers are often reported. The respondents may give one or more answers, and the combination of the answers may vary across the respondents (Ghauri and Grønhaug, 2002). The analysis was conducted with the method of content analysis by coding the themes from each interviewed participant separately, reflecting on the information management cycle of Choo (2002). In addition, the results, documents, and coded observations of the two action research processes were analysed from the same perspectives as the interviews. The empirical data from these two action research processes included a lot of data concerning network-level performance measurement practices, the use of network-level performance measurement information, management practices, information sources, target values etc. The results of the interviews and action research process were then cross-analysed to find a common view of the themes. Finally, based on the results of the analysis, the findings of the study were revealed.

4 Results

4.1 Information processes of the case company

The empirical data of the study was analysed by utilising the information process model of Choo (2002). The process model helps to examine and analyse the performance information processes and information that the manager uses. By utilising this model, the information processes can be identified (internal and external processes), developed (bottlenecks, information needs) and managed (ensuring upward and downward processes). By utilising the information management process cycle and empirical data from the interviews, three separate performance measurement information processes were identified in the case company (Figure 2).

Figure 2 Information management processes of the case company



The first information process focuses on the general financial information of the company by giving a general view of the financial performance. These measures are partly delivered from the strategy of the consolidated company. The general information consists of the information from the Profit and Loss Account, where such measures as revenues, expenses, fixed costs, and earnings before interest and taxes (EBIT) are highlighted. The controller of the company produces the Profit and Loss Account report, and the financial manager analyses the results and reports them to the top management team. The main weakness of the profit and loss account is that the information is historical and the role of this information is descriptive, giving a general view of the state of the company for the consolidated company.

To manage the impacts of turbulence, the interviewees emphasised that market prediction information concerning the house construction industry and private house builders has a highly important role, together with the general information measures. In this business branch, the managers can predict the future state of the company by using market prediction information. In this information process, the managers emphasised the

role of tacit knowledge in interpreting the information. The managers defined tacit knowledge as experience that has accumulated during the years they have worked in the company. Most of the top management team members had over ten years of experience in this business and markets. The interviews indicated that tacit knowledge helps the managers to interpret, analyse, and use the explicit information more effectively.

The second identified performance information process was related to external, network-level information. The company is part of a collaborative network that has network-level performance measurement system in use. This information can be divided into two areas: sales to construction firms and sales to private customers. The key measures on the network level are offers (€), orders (€), contribution margin (%), and sales (€) of the reselling network. This external network-level information has a role in management, and the information is used effectively on every level of the company. Network-level sales information has a directional role when the management team decides the level of capacity and controls the capacity utilisation rate.

The third information process focuses on the company's internal information. This process includes such measures as productivity of the factory, sickness absences, capacity of the factory, efficiency, and the resellers' satisfaction with the company's operations and products. In the management team, the production manager is responsible for analysing and reporting of the information that concerns the factory and its operations, such as transportation. The production manager has an enterprise resource planning (ERP)-system in use to produce the performance information of the factory. The most important measures from the perspective of the management are the productivity measures (e.g., the volume of operations), sickness absences of employees, capacity of operations, and efficiency measures (e.g., produced units). By identifying this in the information process, the interviewees pointed out that the productivity measures contain some challenges. There are too many aspects that influence this measure, and the cause-effect-relationship is difficult to perceive. For this reason, the information is not totally reliable and there is a need to develop this measure in the future.

4.2 Findings from the information process

The case company operates in a turbulent environment which is vulnerable to global changes. In order to survive, the managers must detect and interpret information much more rapidly. They have to make faster decisions, and they also have to make decisions more quickly with a narrower margin for error (Barrows and Neely, 2011). For that reason, the performance measurement system has to be very flexible, rapidly changeable and maintainable (Hudson et al., 2001; Cocca and Alberti, 2010). The results of the analyses showed that the case company tries to manage turbulence by utilising market-prediction information to prepare for possible changes. This information helps in anticipating potential changes in the operating environment and making more sustainable and dynamic decisions. Without this information, the measurement information would be historical and static, even though the information is available online in the information system. However, the interviewees highlighted the tacit knowledge of when to use the information in management. Earlier experience and knowledge of the operating environment promote interpretation of the information and support the decision making.

The case company is also a part of a collaborative network that has a performance measurement system in use. This measurement system has been launched for network management purposes in order to manage and develop the joint operations. This external

networked information has a surprisingly significant role in the management of the case company. The networked information guides decisions related to the capacity of the factory, and especially the closed orders (€) and offers (€) are important when predicting the results of the company. Networked information also directs the development and marketing actions that would increase the financial results of the case company, as well as the entire network. This corroborates the results of Aedo et al. (2010) that companies have become more dependent on sharing and using performance information dynamically. Further, this result also highlights the benefits of performance measurement in networks, because its benefits can be extended also to the single network partner level, not only the network.

The results of the interviews showed that the top management team uses mainly financial measurement information in management, and non-financial measures have a minor role. This result is well in line with the results of Stivers et al. (1998) and Nudurupati et al. (2011). The case company has non-financial measures in use concerning the wellbeing, welfare and know-how of the employees, as well as the culture of the company, but these measures have a fairly minor role in the management. The company evaluates the non-financial measures at least once a year, but the role of these measures is not highlighted in monthly decision making and management. The reason for this may be that the company is a traditional manufacturing company, and financial and efficiency aspects are usually emphasised in this kind of a business environment. On the other hand, the management information systems support only financial measures, hence up-to-date information on non-financial performance is not available.

The role of tacit knowledge is also strongly highlighted in the results of the study. Even though explicit performance measurement information has an important role in decision making and turning strategy into action, tacit knowledge has also a major and supportive role in the final decision making. The literature concerning the effective use of a performance measurement system in performance management should take also the role of tacit knowledge into account more clearly.

In many companies, the managers suffer from data overload (Nudurupati et al., 2011). Also the interviewed managers highlighted that they had too much general information in use, and they would have to focus their attention in the future. The top management team had a development idea where they would select a few most important general measures and follow these measures actively. These measures should also be visualised, so that the information would be easy to analyse and interpret. In addition, the financial manager stated that there is a lot of unused data in the different information systems. There are a lot of opportunities to produce information in these systems, but different organisational levels do not utilise that information well enough. Bititci et al. (2002) found that information is not shared or communicated throughout the organisation, even though it is important for the managers to ensure that information flows downwards, upwards from everyday operations, and horizontally across the various departments. Hence, there is a need to clarify the different information needs around the company and utilise these systems more effectively on every organisational level of the company.

5 Conclusions

This study contributes to the current understanding by analysing how performance measurement information is utilised in management and how it could be made more

efficient. Promoting effective performance management and the use of performance measurement information should guide and support the decision making and management processes. More research is needed to capture the role of performance measurement information in management because companies operate today in a turbulent operating environment and are increasingly part of collaboration networks.

The information management process cycle model of Choo (2002) was exploited to analyse performance information and its processes that the top management of the case company utilised. The results of the study showed that the top management analysed and used performance measurement information widely. Significant results were that the network-level information and the market-prediction information from the operating environment had and emphasised role in the management of the company. These results highlight that companies are becoming more dependent on external information, and on the other hand they have to be willing to share measurement information in the collaborative network. Thus, the information processes are no longer just internal, and the role of information systems in delivering information to the partners is emphasised. Also, the results of the study also emphasised the role of tacit knowledge in strategic management. This should be paid attention to in the literature that focuses on the use of performance measurement systems.

Companies have performance information in use, sometimes an overload of it, but there are challenges in using this measurement information effectively. The reason for this can be that the information processes are not linked properly, some data is hidden, or information is not available timely (e.g., Prahalad and Krishnan, 2002; Nudurupati et al., 2011). The results of the present study support using the information management process cycle model of Choo (2002) as a practical tool in analysing and improving the information processes, and using performance measurement information in performance management. As a managerial implication, the model helps managers to map and evaluate the performance measurement information processes and the available information, and to identify possible information gaps. On the basis of the results, the managers can identify the development needs of the performance measurement system and performance management. The results come only from a single case study and that is why it would be interesting to study wider what kind of information companies utilise, how the turbulent operating environment affects performance management and measurement, and how the performance measurement system and information management process could be further developed on the basis of the process cycle model of Choo (2002).

References

Aedo, I., Diaz, P., Carroll, J.M., Convertino, G. and Rosson, M.B. (2010) 'End-user oriented strategies to facilitate multi-organizational adoption of emergency management information systems', *Information Processing and Management*, Vol. 46, No. 1, pp.11–21.

Amaratunga, D. and Attaran, S. (2002) 'Moving performance measurement to performance management', *Facilities*, Vol. 20, Nos. 5/6, pp.217–223.

Barrows, E. and Neely, A. (2011) *Managing Performance in Turbulent Times Analytics and Insight*, John Wiley & Sons Inc., New Jersey, 240pp.

Bititci, U., Garengo, P., Dörfler, V. and Nudurupati, S. (2012) 'Performance measurement: challenges for tomorrow', *International Journal of Management Reviews*, Vol. 14, No. 3, pp.305–327.

Bititci, U.S., Nudurupati, S.S., Turner, T.J. and Creighton, S. (2002) 'Web enabled performance measurement systems: management implications', *International Journal of Operations & Production Management*, Vol. 22, No. 11, pp.1273–1287.

Bourne, M., Franco-Santos, M., Kennerly, M. and Martinez, V. (2005) 'Reflections on the role, use and benefits of corporate performance measurement in the UK', *Measuring Business Excellence*, Vol. 9, No. 3, pp.36–41.

Bourne, M., Mills, J., Wilcox, M., Neely, A. and Platts, K. (2000) 'Designing, implementing and updating performance measurement systems', *International Journal of Operations & Production Management*, Vol. 20, No. 7, pp.754–771.

Busi, M. and Bititci, U.S. (2006) 'Collaborative performance measurement: present gaps and future research', *International Journal of Productivity and Performance Management*, Vol. 55, No. 1, pp.7–25.

Choo, C.W. (2002) *Information Management for the Intelligent Organization*, Art of Scanning the Environment, Information Today, USA, 325pp.

Cocca, P. and Alberti, M. (2010) 'A framework to assess performance measurement systems in SMEs', *International Journal of Productivity and Performance Management*, Vol. 59, No. 2, pp.186–200.

Davenport, T.H., Harris, J.G. and Morison, R. (2010) *Analytics at Work: Smarter Decisions, Better Results*, Harvard Business School Press, Boston, MA.

Ghauri, P. and Grønhaug, K. (2002) *Research Methods in Business Studies: A Practical Guide*, 2nd ed., Prentice Hall Europe, Essex.

Hannula, M. and Lönnqvist, A. (2002) *Suorituskyvyn mittauksen käsitteet*, Metalliteollisuuden Kustannus, Helsinki (in Finnish).

Hudson, M., Smart, A. and Bourne, M. (2001) 'Theory and practice in SME performance measurement systems', *International Journal of Operations & Production Planning*, Vol. 21, No. 8, pp.1096–3577.

Kaplan, R.S. and Norton, D.P. (1996) *The Balanced Scorecard. Translating Strategy into Action*, Harvard Business School Press, Boston.

Kennerley, M. and Neely, A., (2003) 'Measuring performance in a changing business environment', *International Journal of Operations & Production Management*, Vol. 23, Nos. 2, pp.213–229.

Marchand, M. and Raymond, L. (2008) 'Researching performance measurement systems – an information systems perspective', *International Journal of Operations and Production Management*, Vol. 28, No. 7, pp.663–686.

McKenzie, J., Van Winkelen, C. and Grewal, S. (2011) 'Developing organisational decision-making capability: a knowledge manager's guide', *Journal of Knowledge Management*, Vol. 15, Nos. 3, pp.403–421.

Meekings, A. (1995) 'Unlocking the potential of performance measurement: a practical implementation guide', *Public Money & Management*, Vol. 15, No. 4, pp.5–12.

Nudurupati, S.S. and Bititci, U.S. (2005) 'Implementation and impact of IT enabled performance measurement', *Production Planning and Control*, Vol. 16, No. 2, pp.152–162.

Nudurupati, S.S., Bititci, U.S., Kumar, V. and Chan, F.T.D. (2011) 'State of the art literature review on performance measurement', *Computers & Industrial Engineering*, Vol. 60, No. 2, pp.279–290.

Prahalad, C.K. and Krishnan, M.S. (2002) 'The dynamic synchronisation of strategy and information technology', *MIT Sloan Management Review*, Vol. 43, No. 4, pp.24–33.

Rompho, N. (2011) 'Why the balanced scorecard fails on SMEs: a case study', *International Journal of Business and Management*, Vol. 6, No. 11, pp.39–46.

Simons, R. (2000) *Performance Measurement & Control Systems for Implementing Strategy*, Prentice Hall, Upper Saddle River.

Sousa, S.D., Aspinwall, E.M. and Guimarães Rodrigues, A. (2006) 'Performance measures in English small and medium enterprises: survey results', *Benchmarking: An International Journal*, Vol. 13, Nos. 1/2, pp.120–134.

Stivers, B.P., Covin, T.J., Hall, N.G. and Smalt, S.W. (1998) 'How non-financial performance measures are used', *Management Accounting*, Vol. 79, No. 8, pp.44–19.

Wisniewsky, M. and Olofsson, S. (2004) 'Performance measurement for stakeholders – the case of Scottish local authorities', *International Journal of Public Sector Management*, Vol. 17, No. 3, pp.222–233.

ARTICLE V

Pekkola, Sanna; Niemi, Petri and Ukko, Juhani (2013)
Building understanding of the development of performance management for collaborative networks with a knowledge maturity model

International Journal of Networking and Virtual Organisations, Vol. 12, No. 3, pp. 179-200.

Building understanding of the development of performance management for collaborative networks with a knowledge maturity model

Sanna Pekkola*

Lappeenranta University of Technology,
Lahti School of Innovation,
Saimaankatu 11, FI-15140 Lahti, Finland
E-mail: sanna.pekkola@lut.fi
*Corresponding author

Petri Niemi

Department of Industrial Management,
Lappeenranta University of Technology,
P.O. Box 20, FI-53851 Lappeenranta, Finland
E-mail: petri.niemi@lut.fi

Juhani Ukko

Lahti School of Innovation,
Lappeenranta University of Technology,
Saimaankatu 11, FI-15140 Lahti, Finland
E-mail: juhani.ukko@lut.fi

Abstract: The objective of the study is to analyse how the stage of the performance management of a network can be evaluated with a knowledge maturity model. The purpose is to examine how the knowledge maturity model OSSIC works in the context of network-level performance management. In addition, the study generates contents for management attributes from the network perspective. The study concerns a single case consisting of a collaborative network. The empirical data has been gathered with interviews and an action research process. According to the results of the study, the OSSIC maturity model is a suitable approach for the adoption of a network-level performance measurement system, for several reasons. The use of the OSSIC model helps to observe the development issues concerning performance management in a wider scope. The results of the study indicate that the most essential attributes for the successful adoption of a network-level performance measurement system are the network culture and the skills and knowledge of the participants.

Keywords: network; performance management; knowledge maturity model.

Reference to this paper should be made as follows: Pekkola, S., Niemi, P. and Ukko, J. (xxxx) 'Building understanding of the development of performance management for collaborative networks with a knowledge maturity model', *Int. J. Networking and Virtual Organisations*, Vol. X, No. Y, pp.000–000.

Biographical notes: Sanna Pekkola is a Researcher at Lappeenranta University of Technology, Lahti School of Innovation, Finland. Her current research focuses on performance measurement systems and performance management, especially networks and service operations. Her post-graduate studies concentrate on network-level performance management and measurement. She has published in journals such as *International Journal of Business Excellence International*, *Journal of Business Performance Management* and *International Journal of Public Sector Management*. She has also participated in many development projects related to performance management in Finnish organisations.

Petri Niemi works as an Associate Professor at Lappeenranta University of Technology, Department of Industrial Management. He has worked earlier as management consultant and studied expert roles and expertise development in supply chain environment. His current research focuses on the on development processes in organisations and networks, the utilisation of the knowledge management techniques in them and especially further development of the OSSIC model.

Juhani Ukko works as a Professor at Lappeenranta University of Technology, Lahti School of Innovation. He holds a degree of Doctor of Science in Technology from Lappeenranta University of Technology, Department of Industrial Management. His dissertation focused on performance measurement at the operative level of an organisation. His current research interests are related to different areas of performance management and measurement, covering the assessment and measurement of innovation capability, innovativeness of organisations, and service operations.

1 Introduction

Participation in networks has nowadays become very important for many organisations to increase competitive advantage in markets. In general, the aims of companies in networks are to share resources, to share and exchange information, to reduce risks, costs and delivery-time, and to increase skills and knowledge. When inter-organisational relationships become tighter and more structured, there will emerge a need to manage and control the relationship in some way. Network-level performance measurement information is needed for decision-making and management, for example, in order to avoid organisation-level suboptimisation (Varamäki et al., 2008). Kaplan et al. (2010) emphasise that the role of performance measurement is to help companies create better alignment with their collaborative partners. Performance measurement would promote consensus on and alignment with the goals of the collaboration. The network-level performance measurement system would also serve as a framework for a governance system to monitor the progress toward the goals and to create incentives for all parties to achieve those (Kaplan et al., 2010). On the other hand, the current literature (see e.g., Camarinha-Matos and Abreu, 2007; Varamäki et al., 2008; Bititci et al., 2012) contains little empirical research and solutions on a comprehensive performance measurement for a network environment, but some research focusing on single measures, for example, buyer-seller relationships, buyer-supplier alliances and distributor-manufacturer partnerships have been presented (Brewer and Speh, 2000; Gunasekaran et al., 2004; Saiz et al., 2007). However, it is important for networks to monitor and understand their own

performance constantly to achieve the goals faster and more efficiently than the competitors. However, just monitoring the performance and even understanding are not enough by themselves. A network needs the right tools to plan, execute and refine its performance management in response to the changing and turbulent business environment in which it operates.

However, the empirical research on comprehensive performance measurement systems in networks reveals many potential obstacles and pitfalls when implementing them in practice (see e.g., Busi and Bititci, 2006; Kulmala and Lönnqvist, 2006; Cocca and Alberti, 2010). Because of the multiplicity of pitfalls, it is obvious that effective implementation may require more comprehensive approaches than trying to identify potential obstacles and pitfalls and to avoid them. The studies of Pascale and Athos (1981), Paulzen and Perc (2002) and Niemi et al. (2009, 2010) present knowledge maturity models that have been applied to help in organisational and managerial practices to accumulate and utilise knowledge in the organisation. These researchers have discovered that it is possible to improve the ability of organisations and networks themselves to adopt and refine techniques and tools, such as a performance measurement system, faster. The basic idea of the knowledge maturity approaches can be traced back to the contingency theory. The organisation should seek not only a fit with its environment but also internally, the elements of the organisation, called hereafter management attributes, should fit together to achieve high performance and the best utilisation of the allocated resources (Niemi et al., 2009, 2010).

The objective of the study is to analyse how the stage of the performance management of a network can be evaluated with a knowledge maturity model. The aim is to examine how the knowledge maturity model OSSIC (Niemi et al., 2009, 2010) works in the situation where a network-level performance measurement system has been designed and implemented in a collaborative network. The key contents for the maturity stages from the point of view of the collaborative network have been developed on the basis of the empirical findings. The existing literature (e.g., Pascale and Athos, 1981; Paulzen and Perc, 2002; Niemi et al., 2009, 2010) contains different maturity models, but the OSSIC model was selected for the reason that it is simple by structure, and the results of the study of Niemi et al. (2009) show that sustainable results have been achieved with this model. The knowledge maturity model OSSIC consists of five management attributes: organisation, systems, skills, incentives and performance measurement, and culture and leadership. The case study of Niemi et al. (ibid.) presents a path for how companies can gradually adopt sophisticated inventory management techniques by utilising the maturity model and management attributes to help see the development problem in a wider scope. The major presumption of Niemi et al. is that the process development state can be described with management attributes. In addition, to achieve sustainable results, the development related to these management attributes should proceed more or less parallel from stage to stage. The knowledge maturity model helps to assess the development and the current situation and point out the development areas.

The present research is a longitudinal case study where a collaborative network forms the case. The data collection was carried out in November 2008, May 2010, and May 2012 with semi-structured interviews and an action research process in 2009. The results of the study indicate that the OSSIC framework is useful also when adopting performance measurement techniques in collaborative networks by prioritising and analysing the development and goals for other issues that are important for performance

management, for example, the skills and culture regarding the utilisation of performance information.

The paper is divided into four sections. The next section is a literature review that summarises previous research on performance management and measurement in the network environment, as well as the theory concerning knowledge maturity models. The following section explains the methodology used in the data collection. Then the findings are outlined. Finally, conclusions are made and recommendations for practice and further research are offered.

2 Literature review

2.1 Network-level performance measurement system

If companies wish to create and sustain competitive advantage through collaboration, the structures of the network need to understood and managed, otherwise the objectives will not be achieved and the network will fail (Verdecho et al., 2009). Kaplan et al. (2010) state that networks are usually traditionally organised and managed as single organisations, which is not an appropriate way in the network context. In order to develop and manage a successful business network, continuous performance measurement in a single network member as well as the entire network is needed to organise the collaboration successfully (see, e.g., Yin et al., 2011). Verdecho et al. (2009) and Bititci et al. (2012) highlight that performance measurement can be seen also as a tool that produces the necessary network-level information, promotes network management effectively, and enhances the success of collaborative processes, i.e., by decreasing organisation-level sub-optimisation. A study of Busi and Bititci (2006) presents the factors that have an impact on collaborative performance management: enterprise collaboration, organisational behaviour and knowledge management, information and communication management, operations management and business process management, and performance measurement/management and decision support. According to Busi and Bititci, all these elements should be analysed in order to develop and enhance collaborative performance management. Successful development of these factors can also be seen behind the success of the network. The OSSIC model, utilised in the current study, tackles the factors presented by Busi and Bititci (ibid.), by taking also the knowledge maturity stages and people's skills and competences under investigation.

The current literature reveals that there is a lack of empirical research focusing on comprehensive performance measurement systems and their design and implementation processes, i.e., what should be measured, what are the appropriate measures, etc. (Busi and Bititci, 2006; Kaplan et al., 2010; Yin et al., 2011; Bititci et al., 2012), but some frameworks (Beamon, 1999; Leseure et al., 2001; Varamäki et al., 2008), perspectives of measurement, and single measures for a network have been presented (Beamon, 1999; Ellram, 1995). The literature suggests various reasons why comprehensive performance measurement systems are not carried out in practice, even if measurement would seem to be beneficial from the viewpoint of managing the performance of the network (Zineldin and Bredenlow, 2003; Parung and Bititci, 2008). For example, networks are complex environments where there are different level structures, processes and dynamics (see, e.g., Busi and Bititci, 2006), lack of trust, commitment and openness between the network members (Kulmala, 2003; Tenhunen, 2006), and poor accounting and

management practices, especially in small network members (Cocca and Alberti, 2010). In addition, the network partners easily expect that the target of network-level performance measurement is to identify the 'guilty' member of bad performance.

To improve and develop performance measurement of single measures towards more comprehensive measurement, the networks need models and tools for analysing the current stage of performance management. The literature contains different knowledge maturity models (see, e.g., Paulzen and Perc, 2002; Niemi et al., 2009, 2010; Aho, 2012) for analysing the ability of an organisation to adopt a new tool or refine old ones faster and to identify the key development targets. These existing models have been developed from the perspective of a single organisation and focus on the software development process (e.g., Harter et al., 2000), project management process (e.g., Ibbs and Kwak, 2000), inventory management techniques (Niemi et al., 2009, 2010), and performance management from the point of view of information and knowledge management (Aho, 2012). Taking account of the relevancy of performance management in networks, the challenges related to performance management, and the need of more comprehensive performance measurement systems, it can be stated that there is a need for a knowledge maturity model for network-level performance management.

2.2 Gradual development – knowledge maturity framework

Fast adoption of new techniques, tools and practices is commonly considered as a key element for companies and networks to survive and succeed in a more and more competitive and turbulent environment. "In our strategy we define what we need to develop and implement. In strategy execution we implement them" is a common conception of how companies respond to challenges. Accordingly, problems in implementation are seen to be caused by lack of leadership, change management and other issues related to the capabilities and skills of individual managers (e.g., Kotter, 1996; Riis et al., 2001). This is an obvious reason, but it also raises the question of whether it is possible to improve the ability organisations themselves have to adopt new techniques and tools faster, for example, with organisational and managerial practices helping to accumulate and utilise the knowledge in the organisation.

There are various models describing the organisational adoption of innovations which can be used to study the adoption of for instance various tools and techniques (and roughly speaking, also new related knowledge), such as the well-known and widely cited adoption model of Rogers (1995). As the model of Rogers (1995) describes the various factors that affect the organisational adoption of new innovations such as organisational practices and tools, it is commonly used in the prediction and comparison of the organisational adoption of various practices. However, in the case of the development of organisational processes, such as performance management processes, the organisational adoption of new knowledge takes place gradually, as does the adoption of various related techniques and practices. Rogers' model is not particularly well suited for analysing and facilitating the gradual development of processes and related practices. The underlying aim of the present study is to identify practices and norms to facilitate and potentially accelerate the development of performance management processes and systematic tools to support this facilitation. Therefore, a more practice-oriented model than e.g., Rogers' model is called for.

The accumulation of knowledge and knowledge maturity can be described at the employee, process or organisational level. At the employee level, the approaches generally concentrate on the attitudes of employees towards knowledge management or their resistance to necessary changes (e.g., De Gooijer, 2000; Paulzen and Perc, 2002). The organisation-level knowledge maturity models assess the overall knowledge of performance management of a whole company or a business unit, including for instance the estimation of the knowledge capital of the company. However, neither of these approaches is very helpful in the determination of the activities suitable for adding value directly into a company's business processes. This is because the level of detail in organisation-level analysis is too low for the evaluation of business processes, and the one of the employee level is too high, considering the usefulness of resulting information for further development of performance management. Therefore, process-level maturity models designed and applied directly for the assessment and development of specific business processes, such as performance management processes, are needed.

Continuous process improvement is based on many small evolutionary rather than revolutionary steps (Lockamy and McCormack, 2004). This continuous stepwise improvement is reflected in the maturity stages of process-level maturity models, such as our process-level knowledge maturity framework applied to the topic of performance management. The process maturity concept is analogous to that of a lifecycle, which occurs in various developmental stages. Concerning the process level maturity models, the concept of process maturity proposes that a process has a lifecycle (i.e., a sequence of maturity levels) that is evaluated by the extent to which the process is explicitly defined, managed, measured and controlled. The concept of process maturity also implies growth in process capability, richness and consistency across the entire organisation (Lockamy and McCormack, 2004). In addition, when processes mature, they move from an internally focused perspective to an externally focused one, a more holistic system perspective (Dorfman and Thayer, 1997). As organisations increase their process maturity, institutionalisation takes place via e.g., policies, standards, and organisational structures (Hammer, 1996).

According to various studies concerning knowledge accumulation in companies and especially in their business processes (e.g., Niazi et al., 2005; Marshall and Mitchell, 2004; Housel et al., 2001; Moore, 1999; Bohn, 1994), knowledge development and accumulation can be categorised and described in distinct phases or stages. These maturity models can be seen as roadmaps for implementing practices in an organisation and they aim at helping to improve the capabilities of an organisation in certain application or management areas, such as software development (Niazi et al., 2005), R&D (Berg et al., 2004), process development (Moore, 1999), or processes related to knowledge management (Paulzen and Perc, 2002). Their basic idea is that because an organisation cannot implement all the best practices in one phase, maturity models are used to help to introduce them in stages. Maturity models also seem to offer systematic guidelines and norms for continuous learning and improvement in organisations.

In knowledge maturity models (Paulzen and Perc, 2002; de Gooijer, 2000; Bohn, 1994), knowledge is seen to develop gradually through stages, starting from initial 'darkness', evolving from awareness via more systematic approaches to a quantitatively managed, and finally to the optimised level. A maturity level or stage is an evolutionary plateau at which one or more domains of the organisation's processes have been transformed to reach a new level of organisational capability. Typically, various types of capability maturity models identify five or six maturity – or capability – levels, from low

to high (Jokela et al., 2006; see also Paulzen and Perc, 2002). Table 1 presents a concluding example of the maturity models of Paulzen and Perc (2002), Langen (2000), de Gooijer (2000) and Bohn (1994). It is illustrated with performance management task adoption stages as an example.

Table 1 Illustration of knowledge maturity stages of performance measurement

Stage	*Nature of knowledge*	*Illustration*
5 Optimisation	Causalities understood thoroughly	The quantitative data and models make it possible to optimise the performance. PM is rolled out to organisational hierarchy and network. Long- and short-term decision-making is based on PM.
4 Quantitative management	Basic causalities can be expressed quantitatively	The control variables and trade-offs between them can be expressed quantitatively at aggregate and detailed levels. The key staff utilises sophisticated PM mainly in longer-term decision making.
3 Establishment	Knowledge on basic causalities	The key staff understands the basic concepts, control variables and trade-offs between them at the aggregate level: there is a basic PM to collect and utilise the data on a regular basis.
2 Awareness	Tacit knowledge and assumptions on basic causalities	The key staff is aware of the basic concepts like margins, productivity and quality, and the relationships between them, and collects the data.
1 Initial	No knowledge	Performance is not considered an issue.

There are many ways to categorise and describe the management environment in the context of knowledge and process maturity models. Some process-oriented knowledge maturity models, like the model of Bohn (1994, 1995), do not include separate management attributes in the maturity stages, contending merely with a general-level description of the separate maturity stages. Some maturity models, such as CMMI (e.g., Niazi et al., 2005) and SPICE (see e.g., Marshall and Mitchell, 2004) utilise a process dimension, because the software development process that the model is concerned with is connected to many other company processes that need to be managed. However, to be able to operationalise the maturity stages into manageable tasks, norms and clear maturity descriptions, it is practical to divide the organisational environment to sub-areas. These viewpoints, through which the organisations are examined, are hereafter called management attributes. In the literature of maturity models, the number of management attributes varies from one to over 20 (Jokela et al., 2006). On the other hand, Paulzen and Perc (2002) divide the maturity stages of their knowledge process maturity model (the knowledge process quality model, KPQM) into three broad management areas: organisation, people and technology.

Table 2 The management attributes of OSSIC compared to the 7-S (Pascale and Athos, 1981) and Paulzen and Perc's (2002) models

7-S	*OSSIC*	*Paulzen and Perc*
Strategy Positioning and actions taken by a company to achieve competitive advantage		
Structure The way in which tasks and people are specialised and divided	*Organisation, roles and responsibilities* The division of roles and responsibilities to manage and develop the area	Organisation
Systems The procedures to manage the organisation, control systems, performance management and rewarding, information systems	*Systems and processes, operative and planning* The state-of-the-art of operative ICT systems, planning and control systems in the area *Incentives and performance measurement* The state-of-the-art of goal setting and performance measurement systems, their utilisation especially in the context of rewarding individuals and groups	Technology
Staff People and their competencies *Skills* The distinctive competencies of the organisation	*Skills and knowledge* People and their skills and competencies to manage and develop the area	People
Style/culture The leadership style of the managers *Shared values* Shared guiding principles of the organisation	*Culture and leadership* A manifestation of general attitudes and values in the area	

Taking another viewpoint to the management attributes, a holistic approach, for example, the well-known 7S-framework of McKinsey (see e.g., Pascale and Athos, 1981; Kaplan, 2005) determines seven interacting management attributes: skills, systems, staff, structure, strategy, style, and shared values. The focus of the present study is on the development of performance management processes as a focal management attribute in developing the company as a whole. From the viewpoint of developing and managing at the process level, the perspective of some attributes is certainly too broad. The strategy and shared values are obviously to a great extent beyond the scope of the process level. They rather set the environment for development in the area in question and define the importance of the area for the whole company. The structure is also quite broadly defined for the process level, and this study refers to the division of responsibilities to manage and develop the performance management process with the attribute organisation, roles and responsibilities. In order to depict the development of a process on the 7-S systems

area, it has been found useful to divide it to systems, operative and planning, referring mainly to information processing and incentives, and performance management (Niemi et al., 2009, 2010). Naturally, in this study, this helps also to relate the development of performance management to other management attributes. Considering process-level development, it has been found unnecessary to make a distinction between 7-S staff and (core) skills.

Compared to the management attribute division of Paulzen and Perc's (2002) generic quality improvement-oriented process-level knowledge maturity model, this study uses the division of Niemi et al. (2009, 2010). Technology has been divided into 'systems', 'incentives' and 'performance management'. In this study, Paulzen and Perc's 'organisation' refers partly to 'organisation' but also to 'skills'. Also, their attribute 'people' refers in this study to a great extent to 'incentives' and 'performance management'. The management attributes are described in Table 2, abbreviated as OSSIC and compared to the attributes of the 7-S (Pascale and Athos, 1981) and Paulzen and Perc's (2002) models.

To summarise, the general approach to development work within a management task, like inventory management in Niemi et al. (2009, 2010), or performance management in this study, has two key presumptions. Firstly, the adoption of new techniques and the related knowledge takes and also should intentionally take place gradually. The second key presumption in this study is that the development state can be described with management attributes following the knowledge stages and, to achieve sustainable results, the development related to these management attributes should proceed more or less parallel from stage to stage. Using these presumptions as concepts for the planning process gives a simple matrix structure for the approach. The process should identify the stages, evolutionary plateaus, at which one of more domains of the organisation's processes have been transformed to achieve a new level of organisational capability. On the other side of the matrix are the management attributes acting as issues that need to be discussed and defined for each stage.

3 Research methodology

This study is a longitudinal case study, in which a collaborative network forms the case. The collaborative network consists of the main company and its reselling network, which operates by utilising the franchising concept. Franchising is a method where an independent operator practices and uses another person's business philosophy (Sherman, 2004). The franchisor grants the independent operator the right to distribute its products, techniques and trademarks for a percentage of gross monthly sales and a royalty fee, and advertising, training and other support services are commonly made available by the franchisor. The case network is a franchising network, but it differs from the traditional franchising concept in many ways. The franchisees sell kitchen fitments, which are very challenging to sell, because the sales action is unique in each case. Buying a kitchen is an expensive investment, and there are plenty of different variations, as well as tastes, that affect the selling process. For the above reasons, the members of the network have a strong and shared identity, and they collaborate around many issues. The reseller is in a more equal role with the main company compared to the traditional franchising concept. The challenging products and selling processes offer many opportunities to learn from the other members of the network. The network has many plans in common, regarding, for

example, the action plan and marketing, and they share the risk around these issues. They also have a joint information system, where they are able to participate in the design process. The network has also a common target to maximise the turnover in the entire network. On the basis of the above facts, it can be stated that the case network covers very well the different criteria of a collaborative network (see more Camarinha-Matos et al., 2009).

The results of the study are based on three separate interviews in November 2008, May 2010 and May 2012, and an action research process in 2009. Seven resellers and two sales managers participated in the interviews in 2008 and 2012, and in the action research process. In 2012, sales managers and a financial director were interviewed. The aim of this study was to examine how the knowledge maturity model OSSIC (Niemi et al., 2009, 2010) works in the situation where a network-level PM system has been designed and implemented in a collaborative network, and to create contents for the maturity stages from the point of view of the network. The study analyses how the management attributes have changed after implementing the network-level PM system, and whether these changes are in line with a more sophisticated use of a PM system. Also, the content of the management attributes from the network perspective was generated by using the results of the case study.

The first interviews were carried out before the PM system design and implementation project started. In these interviews, the state of the operations and the management attributes were examined. It was studied what kind of skills and knowledge the resellers had, what was the state of the technical tools, what were the roles and responsibilities between the resellers and sales managers, and what kind of culture there was in the network. After these interviews, the PM system design and implementation process was carried out between January and September 2009. This process was accomplished by utilising the action research process where the researchers had access to this process as a facilitator. The key benefit was that action research offers in-depth information of the process and the development of the management attributes (Gummesson, 2000). The researchers just facilitated the design process by asking questions and organising the sessions and their structures. After each session, the researchers discussed and analysed the observations and the results of the sessions, and formed the research data. Feedback from the participants was also collected, documented, and analysed after each development session. All captured data was analysed by using content analysis focusing on the management attributes. The researchers analysed the data separately, after which a common view was formed and the results of the study formulated.

After the PM design and implementation process, the resellers started to use the network-level PM system as a tool to manage and develop their daily operations and businesses. After eight months of use, the interviewees were interviewed again to clarify how the skills and knowledge, technical tools, roles and responsibilities, and culture had developed and changed after the PM system implementation and use. In addition, future needs and wishes regarding these management attributes were also recorded. In 2012, the management attributes were also analysed to confirm the earlier results of the interviews and the action research process.

To achieve a broad view of the management attributes, open-ended questions were used, and the themes were discussed quite informally during the interviews (for more see Ghauri and Grønhaug, 2002). The analyses of all interview rounds were conducted by two researchers independently, after which a common view was discussed. The reliability

of coding is important in the evaluation of the reliability of the research. To ensure reliability, two (or more) individuals should do the coding independently (Ghauri and Grønhaug, ibid.). The analysis was conducted by analysing the content by coding the management attributes from each interview separately. Next, the results of the interviews were cross-analysed to find a common view of the change of the management attributes. Finally, the findings of the study were assembled on the basis of the results of the interviews and the action research process.

Table 3 Results of the study

	Past	*Present*	*Future*
Organisation, roles and responsibilities	The roles are not clear enough and operations and responsibilities are isolated.	The roles are clearer and responsibilities are divided. Still, more a top-down approach.	The role of the sales managers could be more consultative and the resellers could also have a more active role.
Systems and processes	No extensive tools to analyse the financial performance of the reseller units. A customer satisfaction tool in use.	A customer relationship management tool, a customer satisfaction tool and a financial measurement tool are in use.	A more advanced financial measurement tool and a renewed customer satisfaction tool are needed.
Skills and knowledge	Moderate skills to understand the financial state of the operations (resellers). Focus on own operations.	A better understanding and ability to analyse the state of own business operations and compare them to network-level information.	More formalised and comprehensive knowledge on network-level performance is needed.
Incentives and measurement	No use of overall performance measurement, only a few informal measures in use. A workable incentive system is in use.	An overall network-level performance measurement system is in use. The incentive system has been updated.	A more comprehensive network-level performance measurement system and an incentive system are needed in the future.
Culture and leadership	The network culture is quite open and the partners trust each other, except for the financial state of their business. The focus is on own business.	Trust and openness have increased. The partners share the information of their operations and benchmark and learn from each other.	The culture should be more open in the future. There are still some participants who are not willing to talk about the state of their business.

4 Findings

4.1 The results of the case study

This chapter describes the findings of the case study. The findings of the study are analysed by using the management attributes of the OSSIC model and presented from three time perspectives in Table 3: the past, which is the state when the PM system was not in use; the present, which is the current situation, when the PM system is already in

use; and the future, which reveals the needs for development in the future. The results also indicate that the perceptions of the resellers and sales managers related to the development of management attributes were well line with each other.

4.1.1 Organisation, roles and responsibilities

The results of the interviews revealed that at the beginning of the performance management project, the roles of the resellers and sales managers of the main company were not clear enough. Discussion about the overall state of the reseller unit or the whole network was quite superficial and without any point of comparison – there was no idea what the real state of the business performance was. In addition, the relationships between the resellers and sales managers were not very close. Along with the PM system, the roles and responsibilities between the network members were clarified. In their regular meetings, the participants have their own responsibilities, e.g., the reseller introduces the results of the measurements from the last period and the sales manager presents the averages of the whole network. The interviewees highlighted that these roles and responsibilities are very workable when discussing the state of the reseller's own business and the state of the whole network. However, the resellers suggested that the role of the sales manager could be even more consultative in the future. The interviewees proposed the following:

> "I think that the role of the sales manager should be even more consultative, because we are not so economy-oriented people, we just love to sell and design kitchen fitments. We need support to make us understand the state of our business." (Reseller)

This point was shared by the sales managers, but they highlighted that the resellers should also take a more active role in the meetings. Given that the resellers are private entrepreneurs, who have the responsibility of the success of their own businesses, they cannot delegate too much responsibility of their business to the sales managers of the main company. The responsibility of the operations should be balanced between the sales manager and the reseller, but in the end the responsibility is on the reseller.

4.1.2 Systems and processes

In the beginning of the development process, the resellers had a few technical tools in use, such as planning software, the intranet, and a customer satisfaction tool, which was not utilised and used regularly. The reason for this was that the information of the tool was not updated as often as would have been appropriate, and the information of this system was outdated. The resellers did not have any technical tools for analysing their financial and business operations. They had a few informal measures, which were partly presented on the intranet of the network. Because of the lack of technical tools, the resellers did not have online information on their operations.

In the current stage, there is a customer relationship management (CRM) tool in use, which produces more sophisticated information to support performance management and measurement. The CRM tool produces information based on customer profiles, volumes of orders and volumes of offers, etc. In addition, they have an Excel tool that produces information on the financial performance (income, costs, reclamations, etc.) by giving an overall view of the state of the operations. These technical tools make it easier to get more updated information of one's own business and to compare it to the average of the

network. The state of the customer satisfaction tool is still same as before, but development work for that has started. The results of the interviews indicated a need for a more advanced version of the financial measurement tool in the future. The interviewees also highlighted that the financial measurement tool should function more automatically and be available online to enable an easier reporting of PM results for management purposes.

4.1.3 Skills and knowledge

Before the launching of the network-level PM system, the interviewees described their skills and understanding concerning performance management and measurement as follows:

> "I follow instructions very rarely." (Reseller)
>
> "I follow anything too rarely nowadays." (Reseller)
>
> "I control the bank account of my firm." (Reseller)

These quotations describe the skills of the resellers regarding performance management to some extent. The interviewees stated that they had a lack of workable tools to follow their operations. The resellers described their skills and understanding regarding performance management and measurement to be at a moderate level, because they did not have enough detailed information and understanding of the state of their business. They just had a hunch, which was based on experiential and tacit information of the business. As the newer resellers did not have this experience to support their actions, their need for workable tools of performance measurement was emphasised.

After using the network-level performance measurement system, the interviewees noted that the resellers' skills and understanding regarding performance management and measurement had improved. The interviewees stated that they had better knowledge on the state of their business and the cause-effect relationship between operations, costs and financial income. This knowledge makes it easier to analyse the state of the business and find the most essential development targets of the operations at the single selling point and network level.

From the future perspective, the interviewees could not specify any special skills that they would need in the future. They stated that understanding and knowledge will increase by using the network-level PM system and analysing the results of the PM system from the perspectives of their own business and the entire network. The sales managers highlighted that the resellers will have to learn to analyse the results of the network-level performance measurement system more deeply and to find the reasons behind the poor or successful performance of their own business.

4.1.4 Incentives and measurement

At the starting point, the network did not have an overall performance measurement system. They only had few informal measures in use, which hindered an overall understanding of the state of their business. However, the network had a workable incentive system, where the annual incentive was based on the number of sales. The incentives were delivered twice a year. At present, the resellers have an overall network-level performance measurement system, which consists of four perspectives: financial, future, customer and employee. The PM system gives a wide and balanced

view of the operations. The PM system does not only cover financial elements, but also takes the future aspect, customers' wishes and feedback, and employees' (resellers and sellers) welfare and wellbeing into account. After the launching of the PM system, the incentive system was also updated. The incentives were started to be delivered four times a year. This way the financial feedback is more rapid and timely than before. All interviewees highlighted that it is highly important in the future to update the performance measurement and incentive systems continuously to ensure up-to-date information from all the four aspects.

4.1.5 Culture and leadership

The culture of the case network was already quite open and conversational. There were a few resellers who did not want to talk or show information about the state of their business, but as a whole, the culture was quite open and confidential. The reason for the exceptions was the insecurity of some resellers regarding the state and autonomy of their business. One of the most important results of the implementation process of network-level performance measurement was that the culture became more open than before. Today, the resellers are willing to share information with each other, because this way they have access to benchmarking information of the whole network, which enables the comparison of the state of their own business to the average of the network. In the future, the resellers hoped that the network could be even more open to enable benchmarking information also from non-financial aspects. The leadership attribute was left out of this analysis because the resellers and sales managers did not have a manager-subordinate relationship and they both considered themselves to be in an equal position in the network.

As regards the knowledge maturity stages, the skills and knowledge of the resellers and the culture were at a lower stage than those of the others. From the perspective of skills, the resellers had some quantitative information in use, but this information was only numerical and the resellers did not understand the cause-effect relationship behind the numbers. After the network-level PM system design and implementation process, the resellers have a better understanding of the overall performance of their operations and the causes behind successful or bad performance. The increased understanding was outstandingly realised through the possibility for benchmarking. As a future challenge, the resellers should learn to optimise and develop their performance more actively and independently, to reach a higher knowledge maturity stage. The organisational culture has an important role in performance management and measurement, especially in the network context, which consists of many different intangible aspects, such as relationships, trust and openness between the operators. In the case network, the culture of openness and trust was considered to be just on a tolerable level regarding successful launching of the network-level PM system. The paternalistic atmosphere, together with the clear target of benchmarking during the implementation process, was also a key element in the successful launching of the PM system.

Table 4 Knowledge maturity stages and attributes of network-level performance management

		Organisation, roles and responsibilities	*Systems and processes*	*Skills and knowledge*	*Incentives and measurement*	*Culture*
5	Optimisation	Customer-driven flexible roles	Advanced performance reporting tool, automatic link to network-level information	Overall knowledge of network-level performance and comprehensive use in decision making	Complete, open, causal model-based PM and incentive system of the whole network	Acting as one company
4	Quantitative management	Bottom-up/ reseller-driven	Advanced performance reporting tool, no link to network-level information	Formalised knowledge on network-level performance	Network-level PM system, open for the network, and comprehensive incentive system	Learning from others' businesses
3	Establishment	Top-down/main company	Systematic local reporting tool	Tacit knowledge on network-level performance	Formal PM and incentive system, partially shared	Interested in others' businesses
2	Awareness	Negotiational, a more open relationship	Local reporting system	Understanding own business	Some informal measures	Interested in one's own business
1	Initial	Negotiational, isolated relationship	No reporting system	Tacit understanding of own business	No PM and incentive system	Minding one's own business

4.2 Identifying the content of the maturity levels for the network environment

The OSSIC model is meant to split performance management into understandable and manageable sub-areas (management attributes) and to trace the relevant interrelated development stages of the management attributes in order to map the path to achieve the state-of-the-art of the issue. The aim of the model is to ensure that one or several areas do not hinder or slow down the overall development, which also focuses on the effort of critical attributes to achieve higher stages of development. Before continuing to higher maturity stages, the lower stages have to be reached completely. In practice, there is usually an imbalance between different attributes of maturity levels, so it essential to start balancing all these aspects and move on next level and thus increase the effectiveness and efficiency of the performance. In order to depict a more general path to state-of-the-art network-level performance management, the results and learning of the study were used to generate the key characteristics of the development stages (Table 4). Obviously, the OSSIC model of network-level performance management can be considered tentative because of the single case nature of the data.

Organisation, roles and responsibilities in the network context refer to the roles and relationships between the different network members and how isolated or flexible the roles and responsibilities are. Because all the network members are individual entrepreneurs, the organisational structures, roles and responsibilities cannot be regarded as a truism. *Systems and processes* mean operative ICT systems, planning and control systems related to performance measurement and management. There is some evidence that a performance measurement system without information technology does not support the management practices as efficiently and effectively as possible (see, e.g., Bititci et al., 2012). In the network context, the role of the ICT systems is highlighted to support information sharing and communication between all the network members. *Skills and knowledge* are related to the knowledge and understanding of the performance of the network and individual network members, and the use of performance measurement information on management, development of the operations, and decision-making. *Incentives and measurement* evaluate the maturity of the network-level performance measurement system and incentive plan of the network members. *Culture and leadership* focus on the network culture and how close collaboration the network members have with each other. Openness and trustfulness have been highlighted as very important factors in the organisational culture of a network (e.g., Tenhunen, 2006). The leadership attribute was left out of this content because network members do not usually have a manager-subordinate relationship. When utilising the management attributes, it is easier for the network members to see the development problem in a wider scope. Based on the stage of the management attributes, the development issues and targets should proceed more or less parallel from stage to stage.

5 Discussion

The importance of network-level performance management and its benefits in enhancing the success of network operations has been widely recognised, i.e., increasing the trust, commitment, and quality of the communication of the network (Kaplan et al., 2010; Busi and Bititci, 2006; Camarinha-Matos and Abreu, 2007). However, failures in these issues usually hinder the successful adoption of a network-level PM system. For example,

Kulmala and Lönnqvist (2006) and Kulmala (2003) present that lack of trust between the network members, poor accounting practices, and limited experience in managing a network instead of individual firms may be the reasons why network measurement has not succeeded or been carried out in practice. As a whole, networks are usually complex environments, in which different organisations operate with different cultures, skills, management systems, etc. (Busi and Bititci, 2006; Lambert and Pohlan, 2001; Lönnqvist and Laihonen, 2012), which can be seenas an extra challenge for network-level performance management and measurement in comparison to single organisations.

Some researchers have focused on this challenge by taking a wider perspective on collaborative performance management (Busi and Bititci, 2006; Niemi et al., 2009, 2010). Busi and Bititci (2006) present five factors that have an impact on collaborative performance management: enterprise collaboration, organisational behaviour and knowledge management, information and communication management, operations management and business process management, and performance measurement/ management and decision support. They highlight the need for analysing all these elements in order to develop and improve collaborative performance management. In the studies of Niemi et al. (2009, 2010), the OSSIC-model was designed for and utilised in the adoption of inventory management techniques in a supply chain. In their model, the adoption of new management techniques was analysed through five management attributes. The approach has some similarities with the approach of Busi and Bititci (2006), including some parallel attributes. However, the OSSIC-model includes also knowledge maturity stages related to management attributes, with the idea that parallel and gradual development of management attributes is needed for the sustainable and successful adoption of new management techniques. Based on the results of the empirical findings, a revised version of the maturity stages of the OSSIC model was elaborated for the network environment to help improve and develop the performance management of the network.

The aim of this study was to analyse the management attributes which support the development of network-level performance management, by using the OSSIC-model (Niemi et al., 2009, 2010). Based on the results of the study, the OSSIC-model was a suitable approach for the adoption of a network-level PM system, for several reasons. The results showed that the use of the OSSIC-model improved and enhanced the state of the management attributes by allowing the analysis of the time perspectives of the past, present and future, and also the analysis of knowledge maturity. The results indicated that the most essential attributes for successful adoption of a network-level PM system are the network culture and the skills of the participants. In the network culture, paternalism and openness were emphasised in order to commit all the network members to the common target. The result is in line with the findings of Bourne et al. (2002) and Franco and Bourne (2003), which highlight that a paternalistic culture that encourages actions and improvement and does not punish for errors will lead to a successful implementation and use of a performance measurement system. As the network members come from different cultures, the issue is even more important than in single organisations. Based on the results of the current study, it can be stated that the network culture needs to be at least at the awareness level to be able to adopt a new network-level management technique. The situation is quite similar with the skills concerning the understanding of the purpose and benefits of the system and the utilisation of PM information. If the skills of utilising the PM information among different network members are at a different stage, the benefits of the system will not be spread equally.

The use of the OSSIC-model helps to observe the development issues in a wider scope. By utilising the OSSIC-model in the case network, all the five attributes will develop at least into the establishment stage of a knowledge maturity model. On the other hand, the results indicated that if the knowledge stages of the different management attributes are at an initial level, the development should focus on the management attributes before launching new management techniques. The use of the OSSIC-model reduces uncertainty when the organisation makes decisions about development investments and targets. From the viewpoint of performance management in collaborative networks, the OSSIC-model offers one method to analyse and enhance the factors that are essential for successful network performance management and measurement. As a practical tool, the case study pointed out that the maturity model approach can help to prioritise the development actions, focusing, for example, on when to train people, invest in tools, and reorganise and improve performance measurement and incentive systems (c.f., Niemi et al., 2009, 2010).

6 Conclusions

The study focused on utilising gradual development of different kinds of knowledge related to the situation where a network-level PM system has been implemented in a collaborative network. The presumption was that the development state can be described with management attributes following the knowledge stages, and to achieve sustainable results, the development related to these management attributes should proceed more or less parallel from stage to stage. The studied five management attributes were organisation, systems, skills and knowledge, incentives and performance measurement, and culture and leadership. The study indicated that gradual development of all the five attributes is essential for the successful implementation of a collaborative network-level PM system. In the network context, the skills of different participants and culture of the network are the key attributes, when adopting a performance measuring system. If these attributes are not on a satisfactory level at the starting point, the risk of failure in the implementation process is probable. The results revealed that an open and paternalistic culture is needed and should be emphasised even more in the adoption of new management techniques in a network than in a single organisation. The skills of the participants regarding the understanding of the purpose of new management techniques, together with the skills of utilising the PM information in the development of business operations are also highlighted in networks. It is useful to focus on gradual development of knowledge related to different management attributes, and especially to seek a balance between these knowledge stages when adopting new management techniques.

As regards managerial implications, the study suggested that when adopting new management techniques, especially PM systems in networks, it is important to focus not only on the design and implementation process of the new system, but also on the state of the other management attributes and their gradual development. The management attributes and the related knowledge maturity stages can be utilised in the evaluation of the state of performance management and measurement systems in the networks, and further in the definition of the targets for future development projects and activities.

The utilisation of management attributes and knowledge maturity stages are applicable in situations where a collaborative network is building a path to develop PM together with other managerial areas. The empirical evidence of the present study was

based on data from one network only, where the knowledge stages of different management attributes were at a satisfactory level. Thus, for further research, it could be interesting to study networks where the different knowledge stages are more unbalanced, or where the starting level of the knowledge stages of different management attributes are at a poor level. The knowledge maturity approach could also be utilised in an empirical study in which the framework of Busi and Bititci (2006) would be under investigation. A major limitation of the results presented above is that the OSSIC model itself has not been validated as a normative framework. This study can be considered as one test for the hypothesis "the OSSIC model adds value in defining the development path for a certain focal development issue". It is important to understand that the model is primarily an analysis and planning tool aiming to help the issue stakeholders to find the path or potential paths to state-of-the-art-level performance. The aim is not to include and analyse all the variables to be considered in planning, but to pinpoint the key issues in the development. However, it can be stated that in this study the model added value in understanding the development process of network-level performance management. This calls for further testing in different environments, like virtual networks.

References

Aho, M. (2012) 'What is your PMI? A model for assessing the maturity of performance management in organisations', *Proceedings of the International Conference on Performance Management: From Strategy to Delivery, PMA 2012*, Cambridge, UK, 11–13 July.

Beamon, B.M. (1999) 'Measuring supply chain performance', *International Journal of Operations and Production Management*, Vol. 19, No. 3, pp.275–292.

Berg, P., Pihlajamaa, J., Nummi, J., Leinonen, M. and Leppo, V. (2004) 'Measurement of the quality and maturity of the innovation process, methodology and case of a medium sized Finnish company', *International Journal of Entrepreneurship and Innovation Management*, Vol. 4, No. 4, pp.373–382.

Bititci, U., Garengo, P., Dörfler, V. and Nudurupati, S. (2012) 'Performance measurement: challenges for tomorrow', *International Journal of Management Reviews*, Vol. 14, No. 3, pp.305–327.

Bohn, R. (1994) 'Measuring and managing technological knowledge', *Sloan Management Review*, Vol. 36, No. 1, pp.61–73.

Bohn, R. (1995) 'Noise and learning in semiconductor manufacturing', *Management Science*, Vol. 41, No. 1, pp.31–42.

Bourne, M., Neely, A., Platts, K. and Mills, J. (2002) 'The success and failure of performance measurement initiatives: perceptions of participating managers', *International Journal of Operations & Production Management*, Vol. 22, No. 11, pp.1288–1310.

Brewer, P.C. and Speh, T.W. (2000) 'Using the balanced scorecard to measure supply chain performance', *Journal of Business Logistics*, Vol. 21, No. 1, pp.75–93.

Busi, M. and Bititci, U.S. (2006) 'Collaborative performance management: present gaps and future research', *International Journal of Productivity and Performance Management*, Vol. 55, No. 1, pp.7–25.

Camarinha-Matos, L.M. and Abreu, A. (2007) 'Performance indicators for collaborative networks based on collaboration benefits', *Production Planning & Control*, Vol. 18, No. 7, pp.592–609.

Camarinha-Matos, L.M., Afsarmanesh, H., Galeano, N. and Molina, A. (2009) 'Collaborative networked organizations – concepts and practice in manufacturing enterprises', *Computers & Industrial Engineering*, Vol. 57, No. 1, pp.46–60.

Cocca, P. and Alberti, M. (2010) 'A framework to assess performance measurement systems in SMEs', *International Journal of Productivity and Performance Management*, Vol. 59, No. 2, pp.186–200.

De Gooijer, J. (2000) 'Designing a knowledge management performance framework', *Journal of Knowledge Management*, Vol. 4, No. 4, pp.303–310.

Dorfman, M. and Thayer, R.H. (1997) 'The capability maturity model for software', in Dorfman, M. and Thayer, R.H. (Eds.): *Software Engineering*, pp.427–438, IEEE Computer Society Press, Los Alamitos, CA.

Ellram, L.M. (1995) 'A managerial guideline for the development and implementation of purchasing partnerships', *International Journal of Purchasing and Materials Management*, Vol. 31, No. 2, pp.9–16.

Franco, M. and Bourne, M. (2003) 'Factors that play a role in managing through measures', *Management Decision*, Vol. 41, No. 8, pp.698–710.

Ghauri, P. and Grønhaug, K. (2002) *Research Methods in Business Studies: A Practical Guide*, 2nd ed., Prentice Hall Europe, Essex.

Gummesson, E. (2000) *Qualitative Methods in Management Research*, Sage Publications Inc., Thousand Oaks.

Gunasekaran, A., Patel, C. and McGaughey, R.E. (2004) 'A framework for supply chain performance measurement', *International Journal of Production Economics*, Vol. 87, No. 3, pp.333–347.

Hammer, M. (1996) *Beyond Reengineering: How the Process-Centered Organization is Changing Our Lives*, HarperBusiness, New York, NY.

Harter, D.E., Krishnan, M.S. and Slaughter, S.A. (2000) 'Effects of process maturity on quality, cycle time and effort in software product development', *Management Science*, Vol. 46, No. 4, pp.451–466.

Housel, T., El Sawy, O., Zhong, J. and Rodgers, W. (2001) 'Measuring the return on knowledge embedded in information technology', *Proceedings of the International Conference on Information Systems, ICIS 2001*, New Orleans, Louisiana, USA, 16–19 December, pp.97–106.

Ibbs, C.W. and Kwak, Y.H. (2000) 'Assessing project management maturity', *Project Management Journal*, Vol. 31, No. 1, pp.32–43.

Jokela, T., Siponen, M., Hirasawa, N. and Earthy, J. (2006) 'A survey of usability capability maturity models: implications for practice and research', *Behaviour & Information Technology*, May–June, Vol. 25, No. 3, pp.263–282.

Kaplan, R. (2005) 'How the balanced scorecard complements the McKinsey 7-S model', *Strategy & Leadership*, Vol. 33, No. 3, pp.41–46.

Kaplan, R.S., Norton, D.P. and Rugelsjoen, B. (2010) 'Managing alliances with the balanced scorecard', *Harvard Business Review*, January–February, pp.114–121.

Kotter, J. (1996) *Leading Change*, Harvard Business School Press, USA.

Kulmala, H.I. (2003) *Cost Management in Firm Networks*, PhD thesis, Publication 418, Tampere University of Technology, Tampere.

Kulmala, H.I. and Lönnqvist, A. (2006) 'Performance measurement of networks: towards a non-financial approach', *International Journal of Networking and Virtual organizations*, Vol. 3, No. 3, pp.299–316.

Lambert, D.M. and Pohlen, T.L. (2001) 'Supply chain metrics', *International Journal of Logistics Management*, Vol. 12, No. 1, pp.1–19.

Langen, R. (2000) 'Knowledge management maturity model – holistic development of KM with the KM maturity model', *APQC Conference*, Las Vegas, USA.

Leseure, M., Shaw, N. and Chapman, G. (2001) 'Performance measurement in organizational networks: an exploratory case study', *International Journal of Business Performance Management*, Vol. 3, No. 1, pp.30–46.

Lockamy, A. and McCormack, K. (2004) 'The development of a supply chain management process maturity model using the concepts of business process orientation', *Supply Chain Management: An International Journal*, Vol. 9, No. 4, pp.272–278.

Lönnqvist, A. and Laihonen, H. (2012) 'Welfare service system productivity: the concept and its application', *International Journal of Productivity and Performance Management*, Vol. 61, No. 2, pp.128–141.

Marshall, S. and Mitchell, G. (2004) 'Applying SPICE to e-learning: an e-learning maturity model?' in Lister, R. and Young, A. (Eds.): *The Sixth Australasian Computing Education Conference (ACE2004), Dunedin, Conferences in Research and Practice in Information Technology*, Vol. 30.

Moore, C. (1999) 'Performance measures for knowledge management', in Liebovitz, J. (Ed.): *Knowledge Management Handbook*, Boca Raton et al., pp.6-1–6-29, (originally cited in Paulzen, O. and Perc, P. (2002) 'A maturity model for quality improvement in knowledge management', in Wenn, A., McGrath, M. and Burstein, F. (Eds.): *Enabling Organizations and Society Through Information Systems, Proceedings of the 13th Australasian Conference on Information Systems (ACIS 2002)*, Melbourne, pp.243–253.

Niazi, M., Wilson, D. and Zowghi, D. (2005) 'A maturity model for the implementation of software process improvement: an empirical study', *The Journal of Systems and Software*, Vol. 74, No. 2, pp.155–172.

Niemi, P., Huiskonen, J. and Kärkkäinen, H. (2009) 'Understanding the knowledge accumulation process – implications for the adoption of inventory management techniques', *International Journal of Production Economics*, Vol. 118, No. 1, pp.160–167.

Niemi, P., Huiskonen, J. and Kärkkäinen, H. (2010) 'Supply chain development as a knowledge development task', *International Journal of Networking & Virtual Organisations*, Vol. 7, Nos. 2/3, pp.132–149.

Parung, J. and Bititci, U.S. (2008) 'A metric for collaborative networks', *Business Process Management Journal*, Vol. 5, No. 14, pp.654–674.

Pascale, R. and Athos, A. (1981) *The Art of Japanese Management*, Penguin Books, London.

Paulzen, O. and Perc, P. (2002) 'A maturity model for quality improvement in knowledge management', in Wenn, A., McGrath, M. and Burstein, F. (Eds.): *Enabling Organizations and Society Through Information Systems, Proceedings of the 13th Australasian Conference on Information Systems (ACIS 2002)*, Melbourne, pp.243–253.

Riis, J., Hildebrandt, S., Andreasen, M. and Johansen, J. (2001) 'Implementing change: lessons from five development projects', *International Journal of Technology Management*, Vol. 22, Nos. 1–3, pp.13–27.

Rogers, E.M. (1995) *Diffusion of Innovations*, 4th ed., The Free Press, New York.

Saiz, J.J.A., Bas, A.O. and Rodríguez, R.R. (2007) 'Performance measurement system for enterprise networks', *International Journal of Productivity and Performance Management*, Vol. 56, No. 4, pp.305–334.

Sherman, A.J. (2004) *Franchising & Licensing: Two Powerful Ways to Grow Your Business in Any Economy*, 448pp, American Management Association, USA.

Tenhunen, J. (2006) *Johdon laskentatoimi kärkiyritysverkostossa: Soveltamismahdollisuudet ja yritysten tarpeet*, Acta Universitatis Lappeenranta ensis 241, PhD thesis, Lappeenrannan teknillinen yliopisto, Lappeenranta, 270pp, (in Finnish).

Varamäki, E., Kohtamäki, M., Järvenpää, M., Vuorinen, T., Laitinen, E.K., Sorama, K., Wingren, T., Vesalainen, J., Helo, P., Tuominen, T., Pihkala T. and Tenhunen J. (2008) 'A framework for a network-level performance measurement system in SME networks', *International Journal of Networking and Virtual Organisations*, Vol. 5, Nos. 3/4, pp.415–435.

Verdecho, M.J., Alfaro, J.J. and Rodriguez-Rodriguez, R. (2009) 'Foundations for collaborative performance measurement', *Production Planning and Control*, Vol. 20, No. 3, pp.193–205.

Yin, Y., Qin, S. and Holland, R. (2011) 'Development of a design performance measurement matrix for improving collaborative design during a design process', *International Journal of Productivity and Performance Management*, Vol. 60, No. 2, pp.152–184.

Zineldin, M. and Bredenlow, T. (2003) 'Strategic alliance: synergies and challenges – a case of strategic outsourcing relationship 'sour'', *International Journal of Physical Distribution and Logistics Management*, Vol. 33, No. 5, pp.449–464.

ACTA UNIVERSITATIS LAPPEENRANTAENSIS

492. PÄSSILÄ, ANNE. A reflexive model of research-based theatre Processing innovation of the cross-road of theatre, reflection and practice-based innovation activities. 2012. Diss.

493. RIIPINEN, TOMI. Modeling and control of the power conversion unit in a solid oxide fuel cell environment. 2012. Diss.

494. RANTALAINEN, TUOMAS. Simulation of structural stress history based on dynamic analysis. 2012. Diss.

495. SALMIMIES, RIINA. Acidic dissolution of iron oxides and regeneration of a ceramic filter medium. 2012. Diss.

496. VAUTERIN, JOHANNA JULIA. The demand for global student talent: Capitalizing on the value of university-industry collaboration. 2012. Diss.

497. RILLA, MARKO. Design of salient pole PM synchronous machines for a vehicle traction application. 2012. Diss.

498. FEDOROVA, ELENA. Interdependence of emerging Eastern European stock markets. 2012. Diss.

499. SHAH, SRUJAL. Analysis and validation of space averaged drag model for numerical simulations of gas-solid flows in fluidized beds. 2012. Diss.

500. WANG, YONGBO. Novel methods for error modeling and parameter identification of redundant hybrid serial-parallel robot. 2012. Diss.

501. MAXIMOV, ALEXANDER. Theoretical analysis and numerical simulation of spectral radiative properties of combustion gases in oxy/air-fired combustion systems. 2012. Diss.

502. KUTVONEN, ANTERO. Strategic external deployment of intellectual assets. 2012. Diss.

503. VÄISÄNEN, VESA. Performance and scalability of isolated DC-DC converter topologies in low voltage, high current applications. 2012. Diss.

504. IKONEN, MIKA. Power cycling lifetime estimation of IGBT power modules based on chip temperature modeling. 2012. Diss.

505. LEIVO, TIMO. Pricing anomalies in the Finnish stock market. 2012. Diss.

506. NISKANEN, ANTTI. Landfill gas management as engineered landfills – Estimation and mitigation of environmental aspects. 2012. Diss.

507. QIU, FENG. Surface transformation hardening of carbon steel with high power fiber laser. 2012. Diss.

508. SMIRNOV, ALEXANDER. AMB system for high-speed motors using automatic commissioning. 2012. Diss.

509. ESKELINEN, HARRI, ed. Advanced approaches to analytical and systematic DFMA analysis. 2013.

510. RYYNÄNEN, HARRI. From network pictures to network insight in solution business – the role of internal communication. 2013. Diss.

511. JÄRVI, KATI. Ecosystem architecture design: endogenous and exogenous structural properties. 2013. Diss.

512. PIILI, HEIDI. Characterisation of laser beam and paper material interaction. 2013. Diss.

513. MONTO, SARI. Towards inter-organizational working capital management. 2013. Diss.

514. PIRINEN, MARKKU. The effects of welding heat input usability of high strength steels in welded structures. 2013. Diss.

515. SARKKINEN, MINNA. Strategic innovation management based on three dimensions diagnosing innovation development needs in a peripheral region. 2013. Diss.

516. MAGLYAS, ANDREY. Overcoming the complexity of software product management. 2013. Diss.

517. MOISIO, SAMI. A soft contact collision method for real-time simulation of triangularized geometries in multibody dynamics. 2013. Diss.

518. IMMONEN, PAULA. Energy efficiency of a diesel-electric mobile working machine. 2013. Diss.

519. ELORANTA, LEENA. Innovation in a non-formal adult education organisation – multi-case study in four education centres. 2013. Diss.

520. ZAKHARCHUK, IVAN. Manifestation of the pairing symmetry in the vortex core structure in iron-based superconductors. 2013. Diss.

521. KÄÄRIÄINEN, MARJA-LEENA. Atomic layer deposited titanium and zinc oxides; structure and doping effects on their photoactivity, photocatalytic activity and bioactivity. 2013. Diss.

522. KURONEN, JUHANI. Jatkuvan äänitehojakautuman algoritmi pitkien käytävien äänikenttien mallintamiseen. 2013. Diss.

523. HÄMÄLÄINEN, HENRY. Identification of some additional loss components in high-power low-voltage permanent magnet generators. 2013. Diss.

524. SÄRKKÄ, HEIKKI. Electro-oxidation treatment of pulp and paper mill circulating waters and wastewaters. 2013. Diss.

525. HEIKKINEN, JANI. Virtual technology and haptic interface solutions for design and control of mobile working machines. 2013. Diss.

526. SOININEN, JUHA. Entrepreneurial orientation in small and medium-sized enterprises during economic crisis. 2013. Diss.

527. JÄPPINEN, EERO. The effects of location, feedstock availability, and supply-chain logistics on the greenhouse gas emissions of forest-biomass energy utilization in Finland. 2013. Diss.

528. SÖDERHOLM, KRISTIINA. Licensing model development for small modular reactors (SMRs) – focusing on the Finnish regulatory framework. 2013. Diss.

529. LAISI, MILLA. Deregulation's impact on the railway freight transport sector's future in the Baltic Sea region. 2013. Diss.

530. VORONIN, SERGEY. Price spike forecasting in a competitive day-ahead energy market. 2013. Diss.

531. PONOMAREV, PAVEL. Tooth-coil permanent magnet synchronous machine design for special applications. 2013. Diss.

532. HIETANEN, TOMI. Magnesium hydroxide-based peroxide bleaching of high-brightness mechanical pulps. 2013. Diss.

533. TYKKÄLÄ, TOMMI M. Real-time image-based RGB-D camera motion tracking and environment mapping. 2013. Diss.