TKK Structural Engineering and Building Technology Dissertations
Espoo 2009 TKK-R-DISS-2

CONCEPTS AND ATTRIBUTES OF CUSTOMER SATISFACTION IN CONSTRUCTION

Sami Kärnä

TEKNILLINEN KORKEAKOULU
TEKNISKA HÖGSKOLAN
HELSINKI UNIVERSITY OF TECHNOLOGY
TECHNISCHE UNIVERSITÄT HELSINKI
UNIVERSITE DE TECHNOLOGIE D'HELSINKI

TKK Structural Engineering and Building Technology Dissertations
Espoo 2009 TKK-R-DISS-2

Concepts and attributes of customer satisfaction in construction

Sami Kärnä

Dissertation for the degree of Doctor of Science in Technology to be presented with due permission of the Faculty of Engineering and Architecture for public examination and debate in auditorium R1 (Rakentajainaukio 4) at Helsinki University of Technology on the 13th of November, at 12 o´clock noon.

Helsinki University of Technology
Faculty of Engineering and Architecture
Department Structural Engineering and Building Technology

Publisher:
Helsinki University of Technology
Department of Structural Engineering and Building Technology
P.O. Box 2100
FI - 02015 TKK
FINLAND
URL: http://ltl.tkk.fi /
Tel. +358 (9) 451 1
Fax + 358 (9) 451 37858
E-mail:Elsa.Nissinen@tkk.fi

Cover picture: Sami Kärnä and Kari Lehkonen

ISBN 978-952-248-132-0
ISBN 978-952-248-133-7 (PDF)
ISSN 1797-4836
ISSN 1797-4844 (PDF)
URL: http://lib.tkk.fi/Diss/2009/isbn9789522481337/

1. Edition

Multiprint Oy
Espoo 2009

VÄITÖSKIRJAN TIIVISTELMÄ	TEKNILLINEN KORKEAKOULU PL 1000, 02015 TKK http://www.tkk.fi
Tekijä Sami Kärnä	
Väitöskirjan nimi Concepts and attributes of customer satisfaction in construction	
Käsikirjoituksen päivämäärä 21.5.2009	Korjatun käsikirjoituksen päivämäärä 15.10.2009
Väitöstilaisuuden ajankohta 13.11.2009	
☐ Monografia	☒ Yhdistelmäväitöskirja (yhteenveto + erillisartikkelit)

Tiedekunta	Insinööritieteiden ja arkkitehtuurin tiedekunta
Laitos	Rakenne- ja rakennustuotantotekniikka
Tutkimusala	Rakentamistalous
Vastaväittäjä(t)	Prof Pertti Lahdenperä, Valtion Teknillinen Tutkimuskeskus
Työn valvoja	Prof Jouko Kankainen, Teknillinen korkeakoulu
Työn ohjaaja	Prof Jouko Kankainen, Teknillinen korkeakoulu

Tiivistelmä

Asiakastyytyväisyyden merkitys on kasvanut kaikilla tuotannon aloilla. Tiukentuneen kilpailun ja entistä vaativampien asiakkaiden myötä asiakastyytyväisyyden merkitys korostuu myös rakentamisessa, joskin sen tutkimus on ollut vielä varsin vähäistä. Tutkimus tavoitteena on käsitteellistää rakentamisen asiakastyytyväisyyttä ja siihen vaikuttavia tekijöitä sekä pohtia asiakastiedon hyödyntämistä sekä mittaamista rakentamisen moniulotteisessa liiketoimintaympäristössä.

Tutkimus koostuu yhteenveto-osiosta ja kuudesta erillisartikkelista. Tutkimuksessa luodaan teoreettinen malli asiakastyytyväisyyden tekijöiden välisistä suhteista sekä tarkastellaan tyytyväisyyden attribuutteja. Tutkimusaineistona on käytetty Rakentamisen Laatu RALA ry:n laajaa aineistoa, jossa asiakas arvioi urakoitsijan toimintaa 22 muuttujan avulla. Lisäksi tutkimuksessa luodaan malli ja viitekehys rakentamisen palautesystematiikalle.

Asiakastyytyväisyyden osalta negatiiviset tekijät tulevat ilmi hankkeen loppuvaiheessa. Sen luonnetta kuvaa hyvin se, että heikommin menneissä projekteissa projektin kaikki osa-alueet koetaan heikoksi ja mikäli projekti onnistuu jossain osa-alueessa, se todennäköisesti onnistuu myös toisessa. Merkillepantavaa on myös se, että yhteistyö ja urakoitsijan toimittama palvelu, eivät ole itsenäisiä ulottuvuuksia, vaan ne niveltyvät rakentamisen keskeisiin prosesseihin. Asiakastyytyväisyyden tekijöiden välillä voidaan lisäksi havaita suoria ja epäsuoria suhteita.

Tutkimus tarjoaa uusia näkökulmia rakentamisen asiakaslähtöiseen kehittämiseen. Suurimmat käytännön kehittämiskohteet liittyvät rakennushankkeen viestinnän ja luovutusmenettelyiden kehittämiseen. Kehittämällä näihin liittyviä toimintatapoja urakoitsija voi poistaa tyytymättömyys-tekijöitä ja parantaa toimintansa laatua sekä asiakaslähtöisyyttä.

Asiasanat	Asiakastyytyväisyys, laatu, rakentaminen, projektijohtaminen, menestystekijät		
ISBN (painettu)	978-952-248-132-0	ISSN (painettu)	1797-4836
ISBN (pdf)	978-952-248-133-7	ISSN (pdf)	1797-4844
Kieli	Englanti	Sivumäärä	61 + liitteet
Julkaisija	TKK Rakenne- ja rakennustuotantotekniikka		
Painetun väitöskirjan jakelu	TKK Rakenne- ja rakennustuotantotekniikka		

☒ Luettavissa verkossa osoitteessa http://lib.tkk.fi/Diss/2009/isbn9789522481337/

ABSTRACT OF DOCTORAL DISSERTATION	HELSINKI UNIVERSITY OF TECHNOLOGY P.O. BOX 1000, FI-02015 TKK, http://www.tkk.fi
Author Sami Kärnä	
Name of the dissertation Concepts and attributes of customer satisfaction in construction	
Manuscript submitted 21.5.2009	Manuscript revised 15.10.2009
Date of the defence 13.11.2009	
☐ Monograph	☒ Article dissertation (summary + original articles)

Faculty	Faculty of Engineering and Architecture
Department	Department of Structural Engineering and Building Technology
Field of research	Construction Economics and Management
Opponent(s)	Professor Pertti Lahdenperä, VTT, Technical Research Centre of Finland
Supervisor	Professor Jouko Kankainen, Helsinki University of Technology
Instructor	Professor Jouko Kankainen, Helsinki University of Technology

Abstract

The significance of customer satisfaction has increased in all fields of production. Due to tightened competition and more demanding customers, the importance of customer satisfaction is emphasised in construction as well, although few studies has been made so far. The objective of this study is to produce new information widely as regards customer satisfaction in construction and the factors affecting it and to discuss utilising and measuring the customer data in the multi-dimensional business environment of construction.

The study consists of a summary and six independent articles. The study outlines a theoretical model of the relationships between the factors of customer satisfaction and examines the attributes of satisfaction. The study material was comprised of the extensive material of the Finnish Construction Quality Association (RALA) in which the customer evaluates the contractor's operations using 22 variables. Additionally, the study creates a model and framework for developing a feedback systematic for construction

Regarding the level of customer satisfaction, the negative factors appear towards the end of the project. It is well described by the fact that in less successful projects, all sectors of the project are seen as poor, and if a project succeeds in one sector, it is likely to succeed in another as well. What is noteworthy here is that co-operation and contractor's quality of services are not separate dimensions but intertwine with the central processes of construction. Moreover, direct and indirect relationships can be perceived between the factors of customer satisfaction.

The study offers new perspectives for customer-centred development of construction. The most significant targets for development in practice are related to communication and handover methods of a construction project. By developing these methods, the constructor can eliminate factors causing dissatisfaction and improve their operations and customer orientation.

Keywords	Customer satisfaction, construction, quality, success factors, project management		
ISBN (printed)	978-952-248-132-0	ISSN (printed)	1797-4836
ISBN (pdf)	978-952-248-133-7	ISSN (pdf)	1797-4844
Language	English	Number of pages	61+ appendixes
Publisher		TKK Structural Engineering and Building Technology	
Print distribution		TKK Structural Engineering and Building Technology	

☒ The dissertation can be read at http://lib.tkk.fi/Diss/2009/isbn9789522481337/

Life is expensive,
but includes one free journey
around the sun, once in the year.
- Norwegian proverb

ACKNOWLEDGEMENTS

Writing this Dissertation has been a long journey but fortunately I have had good companions. Several skilful and innovative people have directly and indirectly influenced this Dissertation. Some of those people have acted as travelling companions and friends to discuss matters with and their presence has facilitated the journey and made it more pleasant. Some others have acted as tour guides who make it possible to reach the destination. Both kinds of people are needed and I want to thank all of you!

Special thanks are due to the supervisor and tutor of this work, Jouko Kankainen. Thank you for bringing a "humanistic" student to the world of technical matters. I owe my warmest thanks also to Juha-Matti Junnonen who has led me to the world of construction. He is an example of a truly humane and altruistic man and an inspiring mentor. In addition, I want to thank the entire staff and ex-colleagues at CEM for creative, supportive, and pleasant atmosphere at work.

Propal and this Dissertation would not have been possible without the support and cooperation of various partners. The Construction Quality Association (Rakentamisen Laatu, RALA) and particularly Raimo Määttä provided the vast research material for which I am grateful. I am also grateful to the pre-examiners, Professor Eila Järvenpää (TKK) and Professor Alfred. P.C. Chan (The Hong Kong Polytechnic University), who have both provided me with valuable comments and suggestions for improvements.

Additionally, I want to thank the entire Propal follow-up group led by Juha Salminen for assisting me in the research. Further thanks are due to Veli-Matti Sorvala for the statistical analyses that play a significant role in this Dissertation. Moreover, I would like to express my gratitude to Tekes and other various companies and associations involved for their financial support and practical know-how. This has enabled long-term target-oriented research work.

The financial support of other institutes, Rakennusteollisuus RT, RIL-säätiö, Liikesivistysrahasto, SKOL stipendirahasto, Kiinteistöalan Koulutussäätiö and Rakennustietosäätiö are also great acknowledged.

Finally, I want to thank my big brother who has given me inspiration to explore and taught me a great deal of analytics in practice. I owe much to my mother and father whose encouragement enabled me to find my place in life - therefore, this Dissertation is dedicated to them.

On the surface of planet earth, October 2009

Sami Kärnä

LIST OF APPENDED PAPERS

This dissertation summarizes the following publications:

I. Kärnä, S. (2004) Analysing customer satisfaction and quality in construction – the case of public and private customers. Nordic Journal of Surveying and Real Estate Research. Special Series Vol. 2, pp. 67-80.

II. Kärnä, S. and Junnonen, J.M. (2006) Customer satisfaction comparisons with renovation and new construction. Proceedings of CIB W70 conference, Changing user demands on buildings. Needs for lifecycle planning and management. 12-14 June 2006, Trondheim International symposium. Pp. 105-114. ISBN 82-7551-031-7.

III. Kärnä, S., Sorvala, V.M. and Junnonen, J.M. (2009) Classifying and clustering construction projects. Facilities. Vol 27 Issue: 9/10, pp. 387-398.

IV. Kärnä, S., Junnonen, J.M. and Sorvala, V.M. (2009) Modelling structure of customer satisfaction with the construction. Journal of Facilities Management. Vol 7 Issue 2, pp. 111-127.

V. Kärnä, S. and Junnonen, J.M. (2005) Project feedback as a tool for learning. Proceedings of the 13th Annual Conference on Lean Construction, Sydney. Pp. 47-57.

VI. Kärnä, S., Junnonen, J.M. and Häkkinen, M. (2009) Mutual Feedback System for Construction – Features, Demands, and Content. Proceedings of EuropeIA 12 conference, Innovations for Building and Construction. 18-20.3 March, Paris. Pp. 313-331. ISBN 9782-909285-56-1.

Contribution of the author to papers from 1 to 6 is as follows:

I. The author of this paper is fully responsible for writing this paper.

II. The author was responsible for planning the survey, literature review, and gathering the data. Analysing and interpreting the data was carried out in co-operation with Mr Junnonen.

III. The author of this paper is fully responsible for writing this paper. Mr Junnonen provided comments on both the contents and the text of the paper. The computations were done by Mr Sorvala and the author.

IV. The author was responsible for planning the survey, literature review, and gathering the data. Analysing and interpreting the data was carried out in co-operation with authors. The computations were done by Mr Sorvala.

V. The author was responsible for planning the survey, literature review, and gathering the data. Analysing and interpreting the data was carried out in co-operation with authors.

VI. The author of this article is responsible for writing this paper. Mr Junnonen and Mr Hakkinen provided comments on both the contents and the text of the paper.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Background

Customer satisfaction and customer orientation have become an essential competitive advantage in all areas of production (Woodruff 1997; Kotler 2000). In general, the significance of customer satisfaction is emphasised in markets where competition is intense (Jones and Sasser 1995). Companies use customer satisfaction measurements in developing, monitoring, and evaluating product and service offerings as well as motivating and compensating employees (Anderson *et al.* 1994). Measuring customer satisfaction also has several benefits for organisations, for example, improvement in communication between parties, enabling of mutual agreement, evaluation of progress towards the goal, and monitoring accomplished results and changes (Burns and Bush 2006; Naumann 1995).

Also in the construction industry, the importance of customer satisfaction and orientation has grown due to the tightened competition and more demand from customers as a response to the industry's poor performance. Amongst other things, this development has been documented thoroughly in studies by Latham (1994) and Egan (1998), which has gained a lot of attention in the field of construction, both from practitioners and academics. In the construction business, the actors have adopted new practices in striving towards tighter co-operation with customers. Indeed, the entire field of construction is becoming a service business. This has been implied by various developments and change factors in the field. Companies have expanded their operations on the project's life cycle, on the one hand, towards project development by developing the project in co-operation with the customers and by offering the customers different financing options, and, on the other hand, by offering real estate and user services and various management services. These features are most clearly manifested in PPP projects (Public-Private Partnership). The internal practices in the field have also changed, and the potential manners of implementing a project have multiplied, thus offering the customers the possibility to select the manner according to their own goals and resources.

Traditionally, performance in the construction has been measured through costs, time, and quality, which highlights production orientation in the construction (Pinto and Rouhiainen 2001). According to the "triple constraint", a project is considered to be successful if the building is delivered at the right time, for the right price and quality (*e.g.* Atkinsson 1999). In this former way of thinking, building was in the dominating position, the crucial field of know-how was production, and the customer was seen as a passive receiver of the building in the end of the construction value chain. However, this production related assessment does not describe the present state of the construction. On the contrary, construction affiliates strongly with customer orientation where service delivered by the contractor is emphasised alongside with traditional success factors. It is also stated that traditional performance measurement tools are too simple for measuring a construction project

environment (Dainty *et al.* 2003). However, since Latham's and Egan's reports, soft measurement tools such as customer satisfaction have been introduced little by little in the measurements of project success (Chan and Chan 2004; CCI 2004).

Construction can be characterized as a specific type of project industry, with specific features concerning production, such as temporality, restricted location, and one-off products. Due to the complex nature of construction and the special characteristics of project production, construction has had several problems in producing quality in a customer-oriented manner. However, customer orientation has lagged behind and resulted in unsatisfied customers. This is merely due to the fact that the industry has lagged behind in implementing a service-oriented culture (Winch *et al.* 1998). Indications of genuine service business are apparent in the field but the use of "soft" measurement tools, such as customer satisfaction, is still at an early stage of development (Torbica and Stroh 2001; Homburg and Rudolph 2000). The customer also selects the contractor according to the contractor's capability to co-operation, which emphasises the contractor-customer relationship during the project. It will also have a positive impact to the contractor future work with that client (Maloney 2002).

In construction, customer satisfaction has been considered as a dimension of quality (Yasamis *et al*. 2002; Barrett 2000; Hellard 1993; Palaneeswaran *et al.* 2006) and as an important factor indicating a project's success (Chan and Chan 2004; Sanvido *et al.* 1992; Delgado-Hernandez and Aspinwall 2005). Customer satisfaction can also be observed as a tool for developing the construction process (Egan 1998; Liu and Walker 1998; Mbachu and Nkado 2006) and a tool for mutual learning (Love *et al.* 2000; Bertelsen 2004).

There has also been debate on the adoption of total quality management (TQM) and its potential in improving the construction process. TQM links customer satisfaction, continuous learning and quality improvements in a systematic manner (Arditi and Gunaydin 1997; Haupt and Whiteman 2004; Ahmed and Kangari 1995). Service quality and process quality have also gained attention when examining features of customer satisfaction in construction (Al-Momami 2000; Ozaki 2003; Holm 2004).

Recently, performance measurement has gained a lot of interest in the Finnish construction field as well. For example, Salminen (2005) has constructed a model measuring success factors of construction sites and Pekkanen (2005) has examined threats and opportunities with customer relationships in construction projects. Success factors have been drawn up in the facilities management services from the viewpoint of partnering relations (Lehtonen 2006; Salonen 2006). The rallying point of these researches is strong customer orientation and emphasis of relationship.

1.2 Research problem and objectives

In the multi-dimensional field of construction, the framework of customer satisfaction needs more structure and a great amount of research to unveil its central features. It is clear that in construction as well as in other fields of business, the significance of customer satisfaction and customer orientation is increasing. As stated in the earlier chapter, the use of "soft" measurement tools, such as customer satisfaction, is still at an early stage of development in the construction (Torbica and Stroh 2001). Soft measurement tools are focusing on perceptions and attitudes rather than on more concrete objective criteria.

Customer satisfaction as a research subject is based on service quality and marketing research which showed that the traditional quality indicators cannot be used in measuring the quality of services. More and more companies are interested in gaining more comprehensive understanding of their customers' perceptions (Hayes 1998). In various articles in the field of construction, this very important matter is taken as a given, and few articles have discussed it analytically and at length. This lack of proper information and need for research of this field has been recognized also by *e.g.* Beatham *et al.* (2004).

The main goal of the study is to achieve better understanding and knowledge of customer satisfaction and it examines widely the concept and of attributes of customer satisfaction in construction. Based on the goal of the study, the following research questions are formed:

1. What are the customer satisfaction factors and how they could be identified?
2. What are the interrelationships between factors?
3. How to utilize customer satisfaction in the organizations?
4. How the mutual performance in the construction supply chain should be assessed?

The network and connection of the research papers are presented in the Figure 1. Papers I-IV deal with identifying the customer satisfaction factors and studying the interrelationships with the factors. They contribute a theoretical frame and contribution in order to understand customer satisfaction in construction. The summary is mainly focusing on Papers III and IV, however Papers I and II brings valuable information in order to understand customer satisfaction in different perspectives.

Papers V and VI contain contributions on how customer satisfaction could be utilised in the organisations and explores the mutual evaluation and creating framework for feedback systematic in the construction. The unit of research in the Papers I-IV is a specific customer-main contractor relationship. Papers V and VI discusses wider main parties in construction and their mutual evaluation of the project's success.

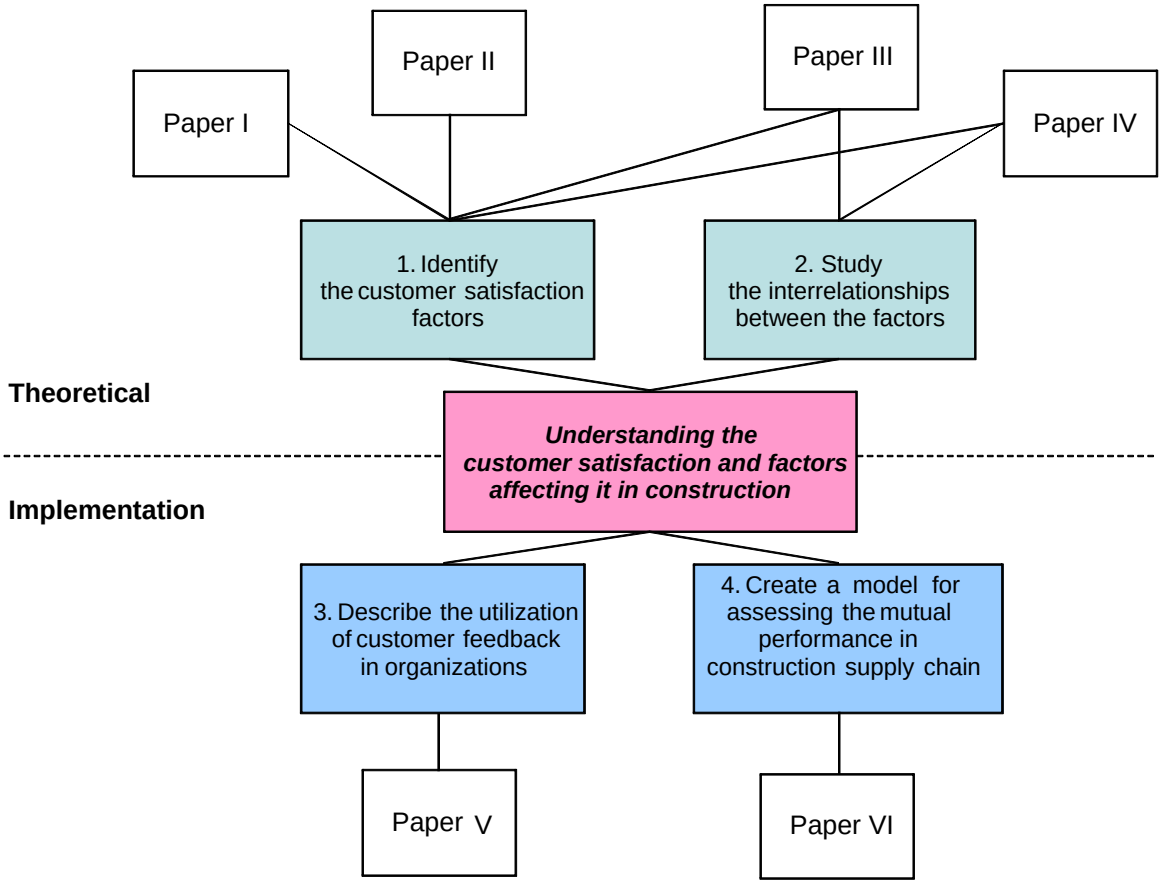

Figure 1. *The network and the connection between the research questions and the papers.*

1.2.1 Content of the study

First in the study, a wide literature review was conducted to understand the phenomenon and to create a systematic approach for the study. It is noted that a literature analysis was also carried out during the research process. Research goals discussed in the previous chapter were building up for determining objectives more precisely as well.

Data for this study were generated by the Finnish Construction Quality Association (RALA). Using RALA's extensive database, a versatile quantitative analysis were made. The results of the quantitative analysis form a theoretical model of the study. The theoretical model created captures the two main goals of the study: (1) identifying customer satisfaction factors and (2) studying the interrelationships between the factors. It is also noted that a theoretical model consists of a number of models which were developed in a quantitative analysis. Data analysis methods are described more briefly in the Chapter 2.

The theoretical model also brings contribution for focus group interviews. Through qualitative data analysis a generic model for a feedback systematic were created. Together with the theoretical

framework, it brings practical utility and recommended actions. Research process and content of the study is presented in the Figure 2.

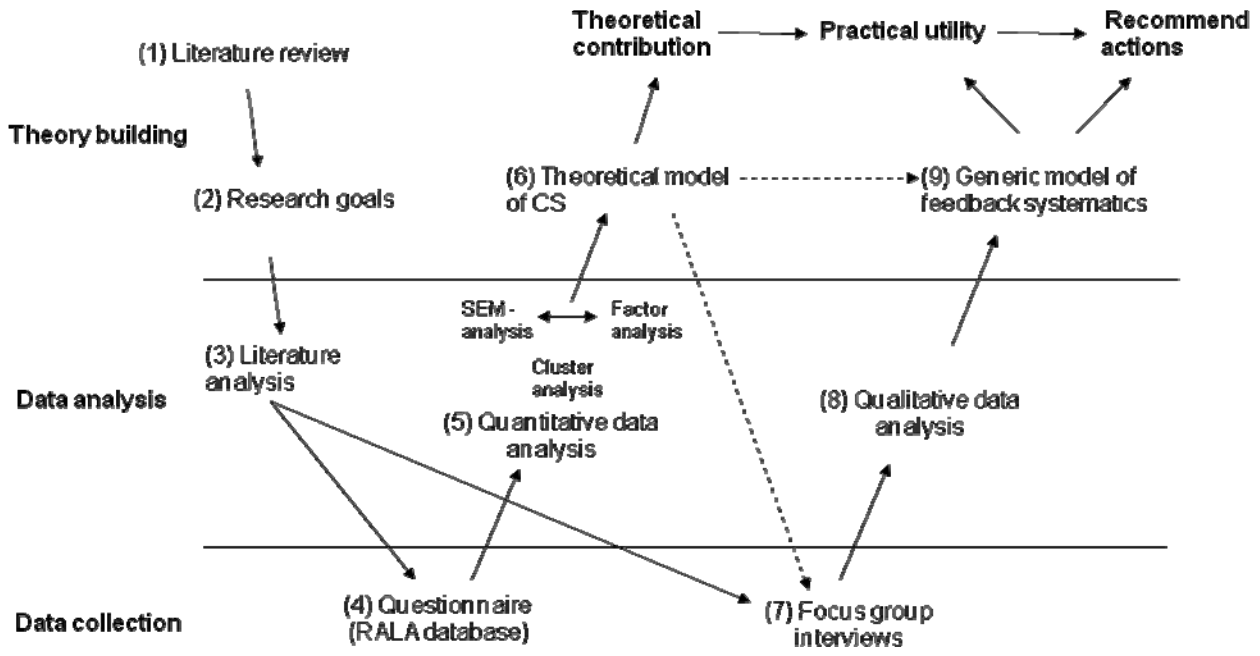

Figure 2. *The research process and the content of the study.*

1.3 Scope and concepts

1.3.1 Conceptualising the study

This chapter introduces the conceptual framework of the study. In order to understand and deepen the knowledge of the concept of customer satisfaction in construction, it is important to explore the basic concepts and management terms related to the subject.

The first important concept to determine for the purposes of the study is quality, which in construction has considered being both complex and pressing issue (*e.g.* Seymour and Low 1990). The contractor's quality is considered as vital for customer satisfaction (Palaneeswaran *et al.* 2006). In general, as regards the definitions for quality, according to Juran (1979) the most important concept in quality is "fitness for use" which he defines as the extent to which the product successfully serves the purposes of the user and it is applicable also for services. Fitness for use is also the result of several parameters, which are quality of design, quality of conformance, the "abilities", and field service. Quality can be also determined as a *totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs* (*e.g.* Hellard 1993).

The latter definition emphasises strongly customer orientation and constitutes a conceptual and functional framework for this study. From this viewpoint, quality is good when a product or service meets or exceeds customers' expectations. Following this, quality is determined by customers or in the Grönroos's (2000) words: *what counts is quality as it is perceived by customers*. In a service marketing field it has been recognized that the quality as it perceived by customers involves two distinct dimensions; a technical or outcome dimension and a functional or process related dimension. The technical quality refers to *what* customers receive in their interactions with a firm. It is the outcome of the service production process. Another dimension is called functional quality and it is related to *how* he receives the service (Grönroos 1984).

Many researchers agree that customer satisfaction is a function of perceived performance and expectations. If the performance falls short of expectations, the customer is dissatisfied. If the performance exceeds expectations, the customer is satisfied (Parasuraman *et al.* 1988; Kotler 2000).

Customer satisfaction surveys could be classified as one part of the marketing researches. Burns and Bush (2006) define marketing research as the process of designing, gathering, analyzing, and reporting information that may be used to solve a specific marketing problem. In this sense, marketing research is part of marketing which The American Marketing Association (AMA 2007) has defined as follows: *Marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large*. In addition, the concept of customer satisfaction is closely associated with customer relationship marketing (CRM), for example, buyer-seller relationships (Wilson 2000).

By and large, marketing research studies can be classified in four different groups (Burns and Bush 2006):

1) Identifying market opportunities and problems
2) Generating, refining, and evaluating potential marketing actions
3) Improving marketing as a process
4) Monitoring marketing performance

In the light of the classification, customer satisfaction studies belong to the fourth class the objective of which for measuring customer satisfaction is to monitor marketing performance. Marketing research firms have devised methods for measuring customer satisfaction that not only tell a client firm to what extent their customers are satisfied / dissatisfied (diagnostic information), but the research also gives clients information on what they should do to improve customer satisfaction. This prescriptive view point of monitoring marketing performance in sense of active learning is also examined in this study.

Similarly, Naumann and Kiel (1995) have investigated objectives for customer satisfaction measurements (CSM) which all have their own unique implications:

1) To get closer to the customer
2) To link CSM data to internal performance and reward system measures
3) To measure competitive strengths and weaknesses
4) To solicit customer input as the driver for product and/or process improvement
5) To measure continuous improvement from the customer's perspective

The need for continuous learning in order to improve companies' performance leads us to another important concept, which is total quality management (TQM). Total quality management is a philosophy, a set of tools, and a process the output of which yields customer satisfaction and continuous improvement (Hradesky 1995). The intent is to determine if the continuous improvement efforts with total quality management are resulting in improved perceptions by the customer. Therefore, strong customer orientation and ambition for learning are distinctive for TQM.

The construction industry has often been accused of poor quality and more and more also construction companies have adopted TQM in their quality improvement efforts (Fisher *et al.* 1995). Poor performance and quality of construction has several reasons that Kanji and Wong (1998) has summed up: the industry consists of numerous parties, products in the industry are one-offs, the production process in the construction industry is to some extent different in the each project, and changes to the design throughout the construction process. These fundamental factors pose challenges to companies' quality assurance which contains all activities concerned with the attainment of quality. Hellard (1993) states that quality assurance is a process designated to increase confidence in a product's or service's ability to achieve the stated objectives. Because of this, customer satisfaction survey could also be a tool for quality assurance.

It is important to note and understand that in his study, the objective of the data gathered from customer satisfaction is to develop the processes of construction. In this case, its basis is not so much in marketing, but in systematic development of operations.

The purpose of this chapter was to describe the background and general concepts related to customer satisfaction as well as the relationships between them in order to better depict the nature of customer satisfaction. In the third chapter of this study, customer satisfaction is examined theoretically on a general level and in the context of construction. The conceptualisation is illustrated in Figure 3.

***Figure 3**. Conceptualisation of the study.*

1.3.2 Focus of the study

According to Juran (1979), a customer is someone who buys something from another. In this study, a customer[1] is defined as the owner of the construction project or in some cases, the owners' representative (*e.g*. project consultant). For example, Kamara *et al.* (2000) describe the customer as a body that incorporates the interests of the buyer of construction services, prospective users, and other interest groups. Therefore, in this case, the buyer of a construction project is the client whereas the user of the facility can be seen as the client of the body buying or ordering the construction project. This definition was made for two reasons. First, in RALA's feedback system, the buyer of the project or his representative (construction consultant) evaluated the project's success. At that time, the main point of evaluation was the construction process assessed mainly by professional constructors. Second, the end user of the facility is an important party in construction whose evaluation of the various operations in construction may be inexact and moreover, users are a very heterogeneous groups demanding different ways of approach as regards the users' evaluation of the construction process, the handover and commissioning and the functionality during the life cycle of the building. Similar division has been used by, *e.g.* Pekkanen (2005).

The qualitative part of the study discusses customer relationships of the construction supply chain in a wider perspective. This refers to idea that every party in the construction is, to some extent, a customer or supplier and their operations are interdependent. This leads to an assumption that every major party in the construction should assess each other's operations. First Papers I-IV are examining the most important customer relation in the construction (customer-main contractor) and Papers V and VI examine the construction supply chain as a whole.

[1] In the light of terminology, the expression *customer* is used as a synonym for client

2. METHODOLOGICAL BASIS OF THE STUDY

2.1 Philosophical basic defaults

Ontology in philosophy is the study of the nature of being, existence or reality in general, as well as of the basic categories of being and their relations. Generally, the social sciences comprise four different ontological approaches (see e.g. Niiniluoto 1990). According to *empirism*, reality could be observed and assessments made in relation to the reality. *Positivism* concentrates on observations itself and explores primarily arguments dealing with reality. *Critical realism* refers to the idea that facts exist but are waiting to be found. Finally, *post-modernism* sees that facts are varying and cannot be reached; therefore, researchers have to concentrate only on claims based on observation.

In the ontological perspective, this study represents empirism. The main target of this study is the phenomenon called *customer satisfaction* which has been explored using systematic methods. From the empirical point of view, there are three different types of research design or meanings for the research which can be classified according to their main research problem: exploratory, descriptive, and causal. It is said that all empirical research could be classified using these three categories. Terminologically, the research design refers to the meaning of research or research strategy (*e.g.* Creswell 2003).

2.2 Methodological approach

The choice of a research strategy and methods are strongly related to the research problem. This research is based on a customer satisfaction survey in the field of construction: therefore, the main strategy is quantitative. Nevertheless, there are some qualitative research features concerning how and why the entire construction supply chain should assess their mutual performance. Also quantitative methods used here require some qualitative observation. This kind of approach, introduced by Creswell (2003), which uses both qualitative and quantitative methods, is called a mixed method approach. He argues that studies including only quantitative and qualitative methods fall short of the major approaches being used today in the social and human sciences. Similarly, Burns and Bush (2006) use pluralistic research as a means of research method which combines qualitative and quantitative in order to gain advantages of both.

In terms of methodology, there are two basic types of research: inductive and deductive. This describes the starting point of scientific reasoning. Inductive reasoning starts with individual observation (empirical data) and formulates generalization or theory based on that. Deductive research proceeds by moving from general law a specific case. Abductive reasoning was “invented” by Charles Peirce (2001) who states that induction means reducing many into one. He argues that inductive reasoning based on probabilities is the same as statistical reasoning. In contrast, deductive reasoning starts with the existing theories and formulates hypotheses that are afterwards tested.

According to Gummesson (2000), all types of research become iteration between deductive and inductive. The iteration between the types of reasoning is referred to as abductive research. Abductive reasoning is seen as extensive reasoning which Pierce together with induction defines as synthetic forms of reasoning: both lead to increasing knowledge and developing theory but in different ways. Abductive reasoning is qualitative in nature and it simplifies the complex nature of reality. According to Pierce, empirical data or data based on experiences is impossible without these two synthetic forms of reasoning. Abductive reasoning is an on-going process which could be compared to, *e.g.* the work of a detective looking for connections or rules that would explain what has happened. It is characterised by interactivity between theory and empirical data and emphasises the search for suitable theories to an empirical observation (Kovacs and Spens 2005).

In the light of the reasoning, this study is combination of inductive and abductive reasoning. In generally, statistical analysis in the study is considered to be inductive approach and model presented in the Chapter 5 presents abductive reasoning. In addition, *e.g.* some stages of structural equation modelling and factor analysis contains some features of abductive reasoning.

Burns and Bush (2006) emphasise that the choice of the most appropriate research design depends largely on the objectives of the research. For example, the less a researcher knows about a phenomenon, the more likely he is going to use exploratory research. Exploratory research objectives are usually used to clarify problems and hypotheses and to gain background information. In this study, exploratory research were used widely to examine the concept and of attributes of customer satisfaction in construction. Descriptive point of view has been used to describe and measure marketing phenomena and causalities to determine the relationships between two or more variables. Causal and descriptive researches were used to identify the customer satisfaction factors and to study the interrelationships between factors. Descriptive point of view was also used to assess the mutual performance in construction supply chain.

Customer satisfaction is a multi-dimensional concept and, *e.g.* Hayes (1998) suggests that it should be explored by using versatile methods. The nature of the research problem and methods used are presented in Table 1.

Table 1. *Nature of the research problem and methods used in the study.*

Nature of the research problem	Methods	Research paper
Exploratory	Literature analysis	I-VI
	Ordinal factor analysis	IV
	Interviews	VI
Descriptive	Cluster analysis	III
	Cross tabulation	I, II
	Focus groups	VI
Causal	Structural equation model	IV

Literature analysis was conducted in order to obtain information about customer satisfaction in a marketing context and in the project business environment. Ordinal factor analysis was used for data-reduction purposes and to identify different dimensions within the RALA data. Cluster analysis was used to identify customer satisfaction factors and the level of customer satisfaction. The level of customer satisfaction in the different project types and customer groups was studied by using cross tabulation. Cluster analysis and cross tabulation bring information about the level of customer satisfaction and classification information from the different projects assessed by the customer. Related focus group meetings and interviews were conducted to develop feedback systematic in the industry. The aim of the structural equation modelling (SEM) is to explore causal relationships between customer satisfaction factors. Structural equation modelling and factor analysis are used widely on the customer satisfaction context. Recently, SEM modelling has been used for supply chain quality management (Lin *et al.* 2005), b-to-b satisfaction (Molinari *et al.* 2008), and customer orientation (Macintosh 2007).

3. THEORETICAL BASIS OF CUSTOMER SATISFACTION

3.1 Concept of customer satisfaction

In general, customer satisfaction is seen as an indicator of the future financial success of the company (Kotler 2000; Rust *et al*. 1994). Companies use customer satisfaction more and more as a criterion when assessing the quality of products and services. In addition, it is commonly used as a part of personnel bonus systems. Customer satisfaction also affects the future cash flows, enhances profitability and increases profits, thus also having strategic implications. Customer satisfaction has gained a vast amount of interest particularly in consumer marketing, and its scientific foundation is rather well documented, although there are varying opinions on, *e.g.* the role of expectations in customer satisfaction.

The benefits of customer satisfaction are often associated with high customer loyalty, future purchases, and positive verbal communication (Jones and Sasser 1995; Cronin and Taylor 1992; Molinari *et al.* 2008). The more loyal the customers are, the more often they use the company's services or make purchases from the same supplier. Establishing the circle of customers also creates a basis for steady cash flow. Along with strengthened co-operative relations, customer satisfaction leads to long-term customer relationships that have been found to be profitable for the company (Storbacka *et al.* 1994). Satisfied customers also tolerate the rise in service and product prices (Fornell 1992). Additionally, it has been observed that there is a significant difference between the customer loyalty of a "very satisfied" and "satisfied" customer (Jones and Sasser 1995).

Positive verbal communication has been found to affect the customer's expectations and increase the business profit (Grönroos 2000). For instance, in the United States, a large residential builder has estimated that 60% of the building sales of the company can be merited to positive verbal communication (Reicheld and Sasser 1990). High quality and high level of customer satisfaction can be observed to increase the profitability of the company due to increasing profit (Anderson *et al.* 1994; see also Rust *et al.* 1994).

The most commonly used model of customer satisfaction is the SERVQUAL model in which the service quality and thereby customer satisfaction is defined as differences between the customer's expectations and experiences (Parasuraman *et al.* 1985; 1988). In the model, the customer's expectations form a certain standard according to which the customer evaluates the experience on the services received. The customer is satisfied when the experience exceeds the standard (*positively disconfirmed*) and dissatisfied when his/her experiences of the service quality are below standard (*negatively disconfirmation*). The latter may also be described as the level in which the quality observed by the customer no longer corresponds with the customer's expectations. A negative outcome is more common in cases in which the quality can be easily assessed (Andersson and Sullivan 1993). However, the SERVQUAL model has met with criticism especially as regards

problems in measuring expectations since the subconcepts related to the concept of expectations are numerous. On the other hand, it has been seen to focus too much on interaction and failing to take account the other dimensions of service (Cronin and Taylor 1992).

Customer satisfaction can be approached from the viewpoint of a separate service event and customer encounter (micro level) or more extensively, from the viewpoint of the overall satisfaction based on all encounters of one customer (macro level). On the micro level, customer satisfaction refers to the satisfaction or dissatisfaction of an individual customer towards a certain service event, as regards which the customer evaluates his/her experiences on an individual, separate event. Overall satisfaction is based on all encounters and experiences a customer has in relation to a certain organisation. In that case, customer satisfaction is built during the co-operation (Bitner and Hubert 1994). The success of individual operations and the customer's positive experiences as regards the company lead in time to high customer satisfaction although the customer's evaluation of each separate encounter cannot be seen to directly influence the overall satisfaction. The customer may be dissatisfied with a certain service event but still happy with the operations of the organisation as a whole or vice versa.

In a wider sense, customer satisfaction can be described as the evaluation of a product or service taking place after a purchase considering the expectations the customer had before the purchase (Kotler 2000). Simply put, customer satisfaction is therefore *customer's satisfaction with the quality of a service or product which can also be defined as the correspondence of customer's experiences and expectations*. When the customer's experiences have corresponded with or exceeded the expectations, the customer is satisfied. The customer is not satisfied when his/her experiences on the service or product have fallen short of the expectations. As satisfaction is defined by the customer, the measures of improving customer satisfaction in a company should start by defining the customer's needs and demands towards the company.

Service quality and customer satisfaction are usually seen as very close concepts, even synonyms. Nevertheless, current research has stressed that they are separate, yet related concepts (Anderson *et al.* 1994). Firstly, the customer needs experiences on a product or service to assess his/her satisfaction but quality can be assessed without real consumer's experience. Secondly, customer satisfaction is dependent on the value created by the price or benefit and observed quality whereas quality is not usually dependent on the price of the product or service. Thirdly, quality is more related to the present moment whereas customer satisfaction is based on all prior but potentially also future experiences on the service or product. Furthermore, quality is seen as a precedent of customer satisfaction. Quality that falls short of the customer's expectations affects customer satisfaction and future purchases more than quality that exceeds the expectations. This can be reflected to, *e.g.* project production in construction in which negative matters (errors, poor quality, scheduling problems) appears to accumulate towards the end of the project (Anderson and Sullivan 1993).

Literature discussing service quality and customer satisfaction emphasises the significance of customer encounters and interaction when the customer assesses the service quality experienced. Interaction between the personnel and the customer takes place during service encounters, which refers to the time period when the customer and the company are interacting on a personal level, face to face, on the phone or using some other media (*e.g.* Normann 1991).

3.2 Features of customer satisfaction in construction

In construction, customer satisfaction could be determined by the extent to which a physical facility (product) and a construction process (service) meet and/or exceed a customer's expectations. This definition recognises the importance of understanding, evaluating, defining, and managing expectations so that the customers' requirements are met. According to Pmbok (1996), this requires a combination of conformance to specifications (the project must produce what is said it would produce) and fitness for use (the product or service produced must satisfy real needs). It also emphasises the management responsibility: success requires the participation of all members of the team, but it remains the responsibility of management to provide the resources needed to succeed, continuous improvement of the project's management and as well as the quality of the project's product. Common definitions of customer satisfaction and their usage in construction and real estate have been listed in Table 2.

In construction, the completed facility refers to the physical product left standing when the work has been completed and the contractor-customer interactions involved in it are over. Yasamis *et al.* (2002) refer to the transformation process from resources to the constructed facility as the contracting service. They suggest that quality in construction includes a mix of product and service quality dimensions (Maloney 2002). The customer's satisfaction with the constructed facility, the contracting facility and the contracting services define project-level quality in construction.

Customer relations in construction are non-recurrent and dynamic. Moreover, there is a small number of customers but the relationship is complex. In the contractor's customer relations, traditionally two dimensions have been distinguished. A contractor produces the physical product for the user of the facilities (end user) and various service processes to the party ordering the project. In addition to the fact that custom turns complex as the commissioner, user and owner of the facilities become differentiated, the supplier networks of a construction project grow more complex. More actors are needed than before to create the desired entities. Companies form networks through which they can increase their profitability by improving the management of the project process and supplying large product and service packages to the customer. The construction company having a direct relationship to the customer has to make sure that the service entity fulfils the customer's needs. Indeed, in construction, custom creates customer chains in which various parties act simultaneously. A customer chain is formed by the user, the commissioner, the designer(s), main contractor and subcontractor(s). Flows of information, money, goods, and

services move between the actors in the chain, The chains build networks in which the form of the network and the relationship between the actors is determined by the nature of the construction project, The construction project involves participants from the commissioner and contractor side from several organisational levels with different tasks. This makes the construction project a multilevel entity (see also Pekkanen 2005).

Table 2. *Definitions of customer satisfaction in general and in construction.*

Author	**Definition of customer satisfaction**
Parasuraman *et al.* (1985)	Customer satisfaction (CS) is a function of perceived quality and disconfirmation – the extent to which perceived quality fails to match repurchase expectations.
Kotler (2000)	CS is a person's feelings of pleasure or disappointment resulting from comparing a product's perceived performance (or outcome) to his/her expectations.
Fornell (1992)	Cumulative customer satisfaction is an overall evaluation based on the total purchase and consumption experience with goods or service over time.
Woodruff (1997)	CS is an overall positive or negative feeling about the net value of services received from a supplier.
Pinto and Rouhiainen (2001)	CS refers to the idea that a project is only successful if it satisfies the needs of its intended users.
Pmbok (1996)	CS – understanding, managing, and influencing needs so that customer's expectations are met or exceeded. This requires a combination of conformance to specifications and fitness for use.
Yasamis *et al.* (2002)	The customer's satisfaction with the constructed facility, the contracting facility and the contracting service define project level quality in the construction.

At the project level, the customer assesses the contractors' performance in relation to three comparisons, all of which impact customer satisfaction (Figure 4):

- First comparison – between the quality of the building, the customer's expectations and the adjusted goals for the building
- Second comparison – between the quality of the construction process and the experiences that have emerged during the process
- Third comparison – between the customer's expectations and experiences

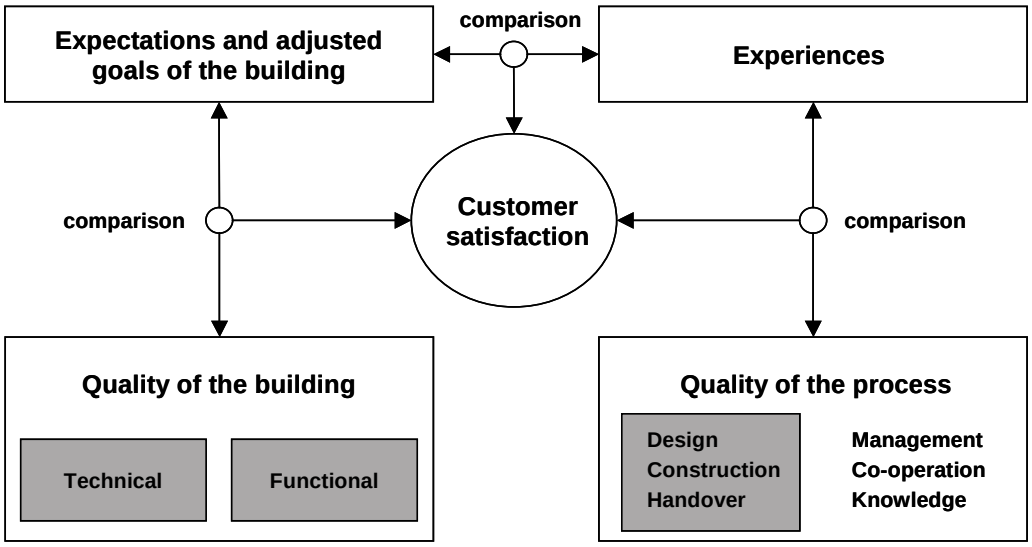

Figure 4. *Interrelationships between customer satisfaction and quality at project level.*

The customer's expectations of construction are a function of several factors: the customer's past or direct experiences with the contractor and similar contractors, word-of-mouth information about the contractor, and the customer's personal needs. In addition, a customer's expectations are affected by a contractor's marketing activities and image, the customer's own investment in the project and the relationship between the two parties.

There has been a shift from traditional triple constraints towards customer focus. Traditionally, project success is measured by the degree of achievement of project objectives, expressed in terms of time, cost, and quality. For example, Chan and Chan (2004) have set key performance indicators (KPI) for measuring construction success. Their study combines traditional, "hard" measures and softer subjective measures. They determine quality, functionality, the end-user's satisfaction, the client's satisfaction, the design team's satisfaction, and the construction team's satisfaction as subjective measures in contrast to objective measures such as construction time, unit costs, and net present value. Key performance indicators give a wide perspective on achieving project success.

According to Barret (2000), quality of construction projects can be regarded as the fulfilment of expectations (*i.e.* the satisfaction) of those participants involved. He highlights the importance of harmonious working relationships between the participants to achieve quality. Additionally, the customer's input has considerable implications on the outcome of the construction project. The customer has a tremendous responsibility to ensure that his/her project is successfully realized. Also Pocock *et al.* (1996) have examined the relationship between project interaction and performance indicators. They found that projects with a low degree of interaction have a wide range of cost and schedule growth as well as a large number of modifications, while projects with high degree of interaction tend to have better and more consistent performance indicators.

Burati *et al.* (1992) emphasise that strong customer orientation is achievable in construction by using the "market-in" concept which recognizes that each work process consist of stages. Customer feedback is obtained to improve the contractor's performance during each stage of the process. They also examined the roles of the parties in construction by using Juran's "triple role" concept. According to the concept, every party in the construction process has three roles: supplier, processor, and customer. The architect is the customer of the owner. The architect translates the owners' requirements into specifications and plans and processes them for the contractor who is his/her customer. Owner and construction management consultant are customers of a general contractor and subcontractors. The owner receives the constructed facility from the contractor. The owner is also a customer of the construction management consultant who guards the owners' benefits in construction management.

Pinto and Rouhiainen (2001) define a shift in customer focus from striving to maximize the company's profits in a project by optimizing the utilisation of the company's resources in order to attain a goal of superior service to the customer towards maximising the value of the customer's project by meeting the goals mutually agreed upon. In other words, this refers to the tendency that the customer focus is shifting from sub-optimizing the short-term profit in one project towards optimizing the total value of the customer's project, thus ensuring a relationship that maximises the developer's profit in the long run.

One of the central features of service is that the customer participates in the service's production process at least to some extent (Grönroos 2000). Also in construction, the customer takes part in the different factors of construction, depending on the form of implementation. If the customer is strongly involved in the construction process, the contractor's service and its significance in construction are emphasised. (Yasamis *et al.* 2002; Torbica and Stroh 2001).

3.3 Utilisation of the CS information in construction

In the construction sector, inter-organization systems characterised by steady relations of contractors are more and more frequent. In these systems, partner reliability and efficiency is particularly crucial. As a consequence, for the owner, the decisions process concerning the evaluation and the choice of contractors, architect and engineers to carry out specific project activities is of considerable importance.

There are two main strengths of project feedback. Initially, it can focus on an organization's core areas of business to help in achieving the greatest added value for any improvement strategy. Secondly, having identified how the production processes stands when compared to others, it can focus on investigating rather than assuming how those performing better achieve their performance rates.

In a construction project, feedback is usually collected and the customer's overall satisfaction is measured after the completion of the project. Customer listening tools can be used at the strategic level, for example, in developing strategic initiatives such as customer relationship management, benchmarking and Won/Lost and Why? -analyses. On the tactical level, customer feedback data can be used, for instance, in solving customer complaints and analysing critical incidents. Transaction studies and overall satisfaction analysis are not distinct constructs. Furthermore, they can be seen as complementary in developing a company's customer feedback processes. Finally, companies should pay attention to linking customer satisfaction programs with actionability. According to Barnes (2003), many customer feedback systems are doomed to fail before they begin. He argues that customer feedback systems can be successful only when that vital information is linked, aligned, and deployed within the organisation.

Feedback is one important basis for learning. Simply stated, feedback is a prerequisite for learning in construction both at the project level and on the company level. With well-timed feedback it is possible to prevent problems from developing or at least enable quick problem solving. Through effective feedback systems, the organisation can foresee changes in the business environment and could also adapt to these changes beforehand. In addition, functional communication channels at the company and communication skills at the individual level are needed. This is challenging in construction due to its nature. It is difficult to give feedback and also allocate it to the right party. This also hinders the fulfilling of the continuous learning objective.

A feedback system is part of company's communication system and no organisation can perform without communication. Every company makes mistakes and in all likelihood mistakes recur without an effective feedback system. An organisation could receive feedback sporadically inside the organisation (organisation's initial feedback) and from customers, but it is important and warranted to organise a way to collect feedback.

A learning organization and organizational learning are complicated and multifaceted phenomena which are difficult to define unambiguously (Table 3). If they are defined too broadly, there is a danger that they will be used as a substitute for other forms of behaviour. If defined too narrowly, they will encompass only the content of everyday discourse. According to Senge (1990), learning organizations place emphasis on "generative learning". "Generative learning" emphasises continuous experimentation and feedback in ongoing examination of the very way organizations go about defining and solving problems. To achieve this learning, Senge suggested the use of five "component technologies": systems thinking, personal mastery, mental models, shared vision, and team learning. According to Garvin (1993), learning organizations are skilled at five main activities: systematic problem solving, experimentation with new approaches, learning from their own experience and past history, learning from the experiences and best practices of others, and transferring knowledge quickly and efficiently throughout the organization. Each is accompanied by

a distinctive tool kit and pattern of behaviour. By creating feedback systems and processes that support these activities, companies can manage their learning more effectively.

Table 3. *Summary of some researcher's views on organisational learning.*

Authors	**Definition of organizational learning**
Stata 1989	Organisational learning occurs through shared insights, knowledge and mental models… [and] builds on past knowledge and experience – that is, on memory.
Argyris 1977	Organisational learning is a process of detecting and correcting error.
Foil and Lyles 1985	Organisational learning means the process of improving actions through beret knowledge and understanding.
Garvin 1993	A learning organisation is an organisation skilled at creating, acquiring, and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights.
Leonard-Barton 1992	A learning laboratory is an organisation dedicated to knowledge creating, collection and control.
Senge 1990	Learning organisations are places where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together.

Organisational learning occurs when an organisation learns about its environment and processes and improving them. The central purpose of organisational learning is the creation of a comprehensive continuous improvement mechanism to create knowledge, values, and processes to deal with uncertainties. The majority of continuous improvement programs fail because most companies fail to see the basic truth: continuous improvement requires a commitment to learning. Without learning, companies and managers simply repeat the old practices under a new name.

Incremental process innovations in a stable organization can be created through "adaptive" learning. But a continuously learning organisation uses generative learning to create new processes in a concerted way, remaining also efficient in day-to-day operations. The challenge for the management is to create the necessary conditions for continuous organisational learning through incremental process innovations. In addition, constant improvement requires a commitment to learning (Garvin 1993).

For sound continuous learning from experience, unambiguous feedback about the change actions is essential. If new innovations are developed before feedback from the previous action has been gained and comprehended, the innovations are likely to lead to random drift rather than improvement (Levitt and March 1995). There is the risk that the "detail complexity" of the system is being solved by adding to the complexity, rather than by simplifying the systemic pattern and

interrelationships of the problem, *i.e.* solving its "dynamic complexity" (Senge, 1990, also Drucker, 1990). In addition, Senge (1990) recommends the use of the principle of "economy of means": the best results (in change) come not from large scale efforts but from small, systemically correct, well focused actions. This supports the idea of a continuously learning organization.

The greatest need is for a developed learning cycle, where the use of project experiences is maximised into the learning of all of the partner organisations. Reflecting on the process of work will become a second nature to the learning managers of the future, and communicating the outputs of such reflections will be central. Projects have a restricted learning content because they exist for a single purpose and the project teams are dissolved when the goal has been reached. However, organisational learning literature stresses a continuous process of improvement. The way in which project organizations capture their learning is therefore a central issue, which requires greater attention. Continuous improvement coupled with organisational learning is a powerful way to improve business results. However, learning organisations cannot be built overnight.

To conclude this section, a theoretical framework is presented to show how feedback information can improve project participants learning in the construction project at different facets. It also presents a way for linking vital information, aligned and deployed within the project organizations. In using project feedback as a method for learning in the construction industry, it is useful to divide learning into four dimensions; individual learning, construction team learning, organisational learning, and relationship learning, which is illustrated in Figure 5 by vertical arrows. Horizontal arrows depict main the patterns by which feedback is collected on the project level.

It is important to note that the usage of the feedback information and the learning aspects differs in all four dimensions. For example, at the individual level, the main objective of learning is increasing professional competence, at the construction team level, it is improving the teams' internal co-operation, at the company level, it is the development of organisational competence and at relationship level, it is the enhancement of co-operation and customer satisfaction.

Different benchmarks enable organisations to monitor customer perceptions of their performance and to improve their performance in various areas. They also enable to position organisation's performance in comparison to the competitors and help to perceive black spots in the process on the project level. Reference groups for benchmarks could develop, for example, according to the type of building, contractual relationship, line of business, or nature of the project. This can only be achieved if the project feedback system is generally accepted in the industry and the terms are agreed upon within the industry. The framework will be used during the further development of existing project feedback system in the Finnish construction industry.

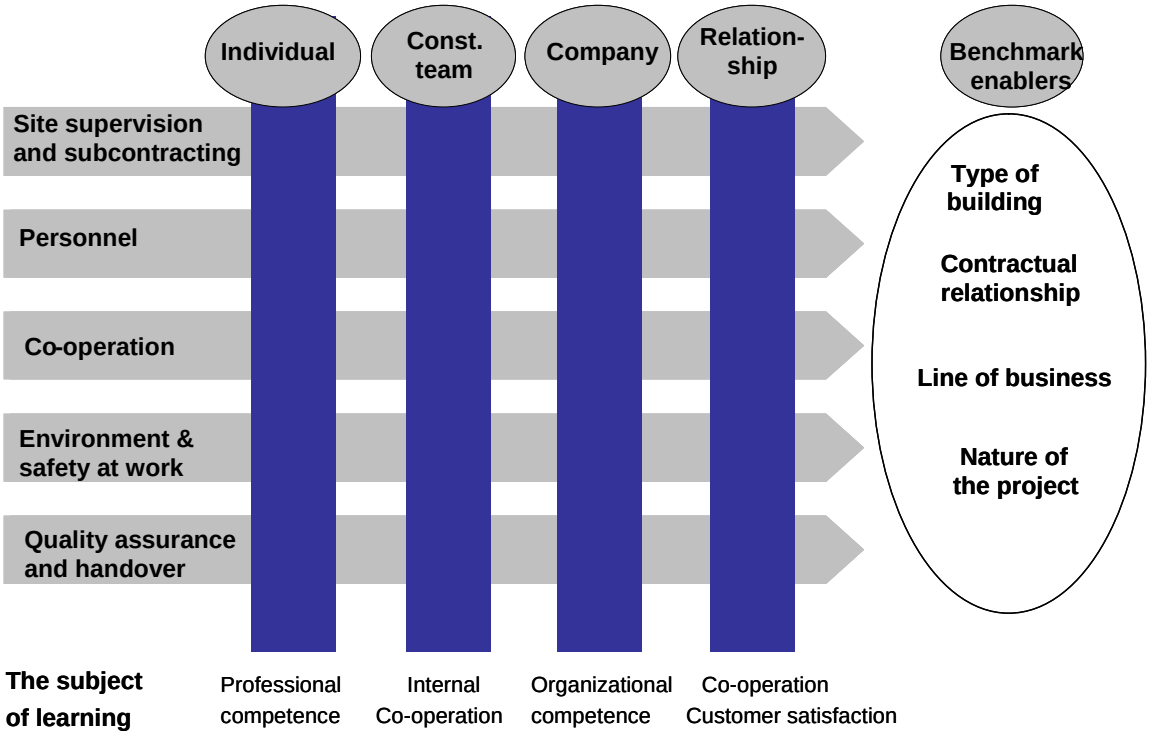

***Figure 5**. The relationship between learning and customer feedback.*

4. CREATING A THEORETICAL MODEL OF CUSTOMER SATISFACTION IN CONSTRUCTION

4.1 Data of the study

The data for this study were generated as a function of the Construction Quality Association (RALA). RALA is an independent joint association offering audited information for the Finnish construction and real estate sector. In practice, the customer (the owner of the project) fills in a form at the time of conclusion of a project and delivers it to RALA immediately following the completion of the project. Respondents were professional builders in the construction industry and technically one project was evaluated by one individual. Feedback from the projects was collected using a 22-item questionnaire. The total number of respondents was 831[2].

The data used here is called secondary data in the marketing research field, which means that it has been gathered by someone other than the researcher and/or for some other purposes other than the research project at hand. To be more exact, the data used here is an *external secondary database* (Burns and Bush 2006) but it primarily comprises the data in this research.

In the RALA database, the respondents gave their responses regarding their level of satisfaction on a five-point ordinal scale from 1 (indicating very high dissatisfaction) to 5 (indicating very high satisfaction) for all the items. This kind of a scaled response form is usually called a Likert scale. The original survey is presented in the Appendix I. The questionnaire used was developed in expert meetings with a wide range of representatives of associations in the construction and real estate management industry in Finland. The participants of the task group are presented in the Appendix 2.

The questionnaire contained several factors that the customer saw important regarding the successfulness of a construction project. However, no separate variable measuring the customer satisfaction was included in the questionnaire as the experts felt that satisfaction towards the success of the entire project is formed as a result of the other variables. In the survey there are traditional project success factors e.g. *adherence to schedule in accordance with common agreements* and *contractual work quality* along side with process related factors e.g. *supplier's personnel's capacity for co-operation* and *access of supplier's employees.*Variables and their codes used later to identify variables are presented in Table 4.

[2] Exceptionaly, in the Paper I survey data was gathered from 354 respondents.

***Table 4**. Variables of the study and their codes.*

Variables	Code
Contractual work quality	*contqual*
Management and implementation of agreed quality assurance procedures	*qaproced*
Functionality of handover material and maintenance manual	*handover*
Quality of assignment material and maintenance manual	*quassima*
Degree of completion at handover inspection	*compdegr*
Repair of defects and deficiencies noticed during handover inspection	*repadefe*
Adherence to schedule in accordance with common agreements	*schedule*
Cleanliness and order on site	*cleanord*
Management of work safety on site	*safety*
Management of environmental issues and related know-how on site	*environ*
Tending to official obligations	*official*
Supplier's personnel's capacity for co-operation	*co-opera*
Access of supplier's employees	*access*
Quality of overall service level	*servqual*
Information flow on site	*infoflow*
Agreeing on changes	*changeag*
Skill of supplier's work supervisors	*supskill*
Tending to notices of defect	*reclamat*
Tending to site supervision duties	*sitesupe*
Skill of supplier's workers	*workskill*
Commitment of supplier's employees to set goals	*empcommi*
Conformity of supplier's subcontracting to contract	*subcontr*

4.2 Factor analysis

The objective of a factor analysis is to classify and search hidden factors behind the variables of the RALA material. The factor is latent, not a construction that can be directly perceived. Since it is often impossible to measure concepts with one variable, several variables describing the same phenomenon are needed. Generally, factor analysis can be used when there are a large number of variables in the data and there is a need to reduce the number of the variables to a manageable size (Hayes, 1998). In a factor analysis, there is no assumption about a dependent-independent variable relationship and the data are "allowed to speak for themselves:" the establishment of the model is based on the specific data under scrutiny (Schmidt and Hollensen 2006).

Ordinal factor analysis can help in explaining correlations between variables (see *e.g.* Nummenmaa *et al.* 1993). If the variables correlate strongly with each other, and it cannot be assumed that correlations are zero, there might be common factors in the background. Thus, the variables may share a mutual concept, which is examined in this study. Our own views on the various dimensions of customer satisfaction in construction were tested with the RALA material using ordinal factor analysis. One of its benefits is that it allows the use of ordinal indicator variables (Jöreskog 2006).

In the study, factor analyses were performed with several numbers of factors. The final conclusion was that a solution with ten factors would be ideal. This was due to the fact that over-simplification as a result of decreasing the number of factors was to be avoided as then essential matters could be omitted from examination. On the other hand, the number of factors should be significantly lower than the original 22 variables. A further important matter in selecting the factors was examining them on the level of concepts and contents, *i.e.*, how well they describe the various factors of construction.

With the help of factor analysis, the study showed the kinds of hidden, latent factors described by the variables. As a result of the factor analysis, the original 22 variables formed ten structurally meaningful factors which were then interpreted. Then, the interdependencies between these factors were examined using the structural equation model. During testing, it appeared that the factors could not be combined to create one variable covering customer satisfaction as all of them describe customer satisfaction to some extent. On the other hand, the research question justified studying the interdependencies of various factors. The leading idea was that all factors measured were important for customer satisfaction in construction. Indeed, the added value created by the study for the quality research in the entire field is that it describes the connections between components significant for customer orientation.

A rotated factor matrix and correlations between factors are presented in Tables 5 and 6. When examining and interpreting the factor matrix, it is essential to note that each variable describes all of the factors to a certain extent. However, the greater the influence a variable has in each factor the better it describes the factor in question. In Table 5, the most significant loadings have been marked in bold. The size of a loading cannot be explicitly defined but generally, values between 0.3 and 0.5 are considered significant (de Vaus 1994).

The purpose of the factor rotation is to achieve simple structure, which can improve the interpretation of the model. A promax rotation method was chosen because their common use in statistical software sans because it allows factors to correlate with each other. This is also suggested by Jennrich (2004).

Table 5 depicts the load models of ten factors (promax rotation) and model measurement error. The greatest loads on each factor are bolded in the Table. Measurement errors refer to the part of factor variance which the model does not explain. For example, a measurement error may be related to whether the questions have been understood correctly or whether the questions measure the right matters. Most significant measurement errors are involved with the variables of the conformity of supplier’s subcontracting to contract and tending to official obligations. This might be partly explained by the fact that some customers may have difficulties in answering these questions. However, some variables loaded slightly under 0.3 but according to our interpretation, they describe best the factors within which they are bolded.

The four first factors have factors describing the end result and the end-phase operations of the project loaded onto them, such as the contractual work quality, management and implementation of quality assurance procedures agreed upon, the functionality of the handover control, and the status of the control material and maintenance manual. The other six factors loaded highly on various variables. Some variables, such as adherence to schedule in accordance with common agreements, the supplier's personnel's capacity for co-operation, and the quality of overall service level loaded on two factors. This implies that, *e.g.* the services provided by the contractor are connected to several of the central processes of construction.

The fifth factor was loaded by variables compdegr (0.77), repadefe (0.67), and schedule (0.56). The greatest loads on the sixth factor were caused by variables safety (0.81), environ (0.83), cleanord (0.63), and official (0.27). The seventh factor was mostly loaded by changeag (0.61) but also reclamat (0.37) and coopera had a great impact. The greatest loads on the eighth factor were caused by access (0.87) and infoflow (0.67). On the ninth factor, the variables workskill (0.79) and empcommi (0.73) load most highly. The last factor was loaded, for instance, by variables sitesupe (0.38), schedule (0.31), and official (0.31).

***Table 5**. Results of factor analysis and error variance (promax rotation).*

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Contractual work quality **- contqual**	**0.960**	0.013	0.005	0.012	0.099	0.067	0.027	0.055	0.040	-0.022
Management and implementation of agreed quality assurance procedures – **qaproced**	0.014	**0.900**	0.019	0.004	0.072	0.051	0.019	0.088	0.030	0.004
Functionality of handover material and maintenance manual **– handover**	0.004	0.013	**0.885**	0.034	0.136	0.047	0.011	0.043	0.033	-0.009
Quality of assignment material and maintenance manual **– quassima**	0.002	-0.014	0.022	**0.703**	0.098	0.022	0.029	0.041	0.000	0.058
Degree of completion at handover inspection **- compdegr**	0.043	0.021	0.070	0.037	**0.771**	0.017	-0.069	0.062	-0.017	0.068
Repair of defects and deficiencies noticed during handover inspection **– repadefe**	-0.001	0.040	-0.031	0.150	**0.665**	0.064	0.063	0.060	0.119	-0.147
Cleanliness and order on site **– cleanord**	0.031	0.004	0.020	-0.031	**0.234**	**0.629**	-0.036	0.050	0.018	0.056
Management of work safety on site - **safety**	0.050	0.022	0.017	-0.023	-0.015	**0.814**	0.006	0.054	0.034	0.032
Management of environmental issues and related know-how on site **– environ**	-0.048	-0.020	-0.021	0.027	0.009	**0.831**	0.061	0.099	0.078	-0.042
Adherence to schedule in accordance with common agreements **– schedule**	-0.037	-0.028	0.017	-0.075	**0.560**	0.098	0.103	0.098	-0.035	**0.308**
Supplier's personnel's capacity for co-operation – **coopera**	0.027	-0.014	-0.047	-0.075	0.166	-0.003	**0.298**	**0.549**	0.070	0.075
Agreeing on changes **– changeag**	0.014	0.008	0.001	0.013	0.035	0.062	**0.610**	0.336	-0.020	-0.028
Tending to notices of defect – **reclamat**	0.001	0.008	0.038	0.185	0.044	0.083	**0.373**	0.229	0.120	0.003
Access of supplier's employees **– access**	-0.013	-0.002	0.028	0.034	-0.026	0.091	-0.008	**0.866**	-0.009	-0.092
Information flow on site **- infoflow**	-0.008	0.043	0.028	0.012	0.010	0.109	0.029	**0.669**	-0.007	0.097
Quality of overall service level – **servqual**	0.046	0.000	0.020	-0.055	**0.244**	0.003	0.210	**0.458**	0.123	0.086
Tending to official obligations – **official**	0.029	0.021	0.004	0.232	-0.005	**0.270**	0.005	0.187	-0.047	**0.311**
Skill of supplier's work supervisors - **supskill**	0.044	0.002	-0.033	0.077	0.159	0.025	-0.118	**0.414**	0.195	**0.275**
Skill of supplier's workers – **workskill**	0.049	0.014	0.005	0.021	0.005	0.114	-0.022	0.067	**0.792**	-0.023
Commitment of supplier's employees to set goals – **empcommi**	-0.041	-0.007	0.024	-0.029	0.095	0.114	0.034	0.107	**0.734**	0.033
Conformity of supplier's subcontracting to contract **– subcontr**	0.026	0.048	0.020	0.107	-0.034	0.160	0.265	0.025	0.179	**0.240**
Tending to site supervision duties - **sitesupe**	-0.035	0.021	0.000	0.103	0.068	0.113	0.040	0.313	0.083	**0.380**

Table 6*. Correlation Matrix of Factors.*

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
(F1) CONTQUAL	1.00									
(F2) QAPROCED	0.81	1.00								
(F3) HANDOVER	0.73	0.78	1.00							
(F4) QUASSIMA	0.64	0.66	0.69	1.00						
(F5) TIMECOMP	0.74	0.72	0.66	0.63	1.00					
(F6) OFFICIAL	0.83	0.81	0.76	0.71	0.82	1.00				
(F7) CHANGEMG	0.76	0.76	0.70	0.67	0.77	0.89	1.00			
(F8) COMMUNIC	0.82	0.78	0.82	0.70	0.75	0.88	0.80	1.00		
(F9) PROF	0.76	0.74	0.70	0.65	0.81	0.87	0.79	0.81	1.00	
(F10) MANAGEMENT	0.83	0.84	0.76	0.74	0.85	0.95	0.90	0.87	0.87	1.00

4.2.1 Description of factors

The first factor (CONTQUAL) depicts the contractor's assessment on the contractual quality of the work. The contractual quality of the work is illustrated in how well the contractor has performed their work, and it may be seen as a sort of a summarizing variable which has to do with the assessment conducted in the final stages of the project as regards the qualitative success of the entire project.

The second factor (QAPROCED) describes the implementation of the quality assurance procedures the parties have agreed upon. Taking care of quality assurance methods is associated with the contractor's internal methods of ascertaining and maintaining the level of quality.

The third factor (HANDOVER) refers to the level of functionality of the contractor's handover controls. A handover control is a part of the building's examination procedure for approval and contractor's internal quality assurance. Handover control is used in making sure that the work can be handed over to the customer without flaws. Thus, the handover process precedes the building's actual examination procedure for approval. The key role in the functionality of handover control is played by the management of the contractor as in the handover stage: they inspect the various premises and fix the flaws, damages, and defects. Flaws and defects perceived in the handover control may be systematic, appear in almost all of the premises or incidental faulty performances that occurred during work. Prior to fixing the flaws and defects, it must be investigated who is responsible for that particular flaw, and each party must correct their own flaws.

The fourth factor (QUASSIMA) describes the quality of the building's handover material and maintenance manual. A building's handover covers the operations with which the ownership of and responsibility for the building is transferred from the contractor to the contractee or users. Temporally, it is located between the construction phase and the building's use but the handover process should start during construction and continue all the way to the approval of

warranty work. The handover process may be perceived as the core process of a building as it is directly linked to the customer, that is, the contractee of the project. Since handover takes place in the end phases of the project, it influences the customer's last experiences on the construction project and the contractor company.

Factor 5 (TIMECOMP) depicts the temporal management of the construction process. It consists of the following variables: repair of defects and deficiencies noticed during handover inspection, cleanliness and order on site, adherence to schedule in accordance with common agreements, degree of completion at handover inspection and quality of the supplier's overall service level. Attaining goals related to schedule together with quality and costs are included in almost every set of parameters measuring performance in construction (Chan and Chan 2004).

Factor 6 (OFFICIAL) describes the operational surroundings guided by legislation. This includes the variables cleanliness and order on site, management of work safety on site, management of environmental issues and related know-how on site, and tending to official obligations in practice (Hill and Bowen 1997; Kometa *et al.* 1995).

Factor 7 describes management of and agreement on changes (CHANGEMG). It involves the supplier's personnel's capacity for co-operation, agreeing on changes, and tending to notices of defect. It has been observed that these factors have a great impact on the successfulness of a project (Eden *et al.* 2000; Karim and Adeli 1999).

Factor 8 (COMMUNIC) portrays the matters having to do with communication in project management. These matters are also very significant as regards customer satisfaction in construction and customer-oriented operations (Ahmed and Kangari 1995; Pocock *et al.* 1996). Communication plays a key role in passing the project-related information to all internal and external interest groups. This factor contains the variables access of supplier's employees, supplier's personnel's capacity for co-operation, information flow on site, skill of supplier's work supervisors and the quality of the supplier's overall service level. Good communication intensifies the spirit of co-operation and supports the strengthening of shared goals (Woodward 1997). Moreover, it is considered a central quality parameter for projects (Yasamis *et al.* 2002).

Factor 9 (PROF) describes the contractor's employees' abilities from the customer's viewpoint. It comprises two variables: skill of supplier's workers, and commitment of supplier's employees to set goals. The dimension depicting the professional skills of the workers is closely related to the company's recruiting activities, training and education of employees and maintaining skills. The workers' abilities and skills are perceived as a critical

success factor in the construction industry (Songer and Molenaar 1997; Pinto and Slevin 1989).

Factor 10 illustrates the management of a construction project (MANAGEMENT). This factor is intertwined with a group of variables describing the dimensions of management: adherence to schedule in accordance with common agreements, tending to official obligations, skill of supplier's work supervisors, conformity of supplier's subcontracting to contract, and tending to site supervision duties. According to many authors, the role of project managers is vital in accomplishing a successful project (Ireland 1985; Pmbok 1996).

4.3 Building a structural equation model

In order to identify the customer satisfaction factors and study the interrelationships between the factors, a structural equation model (SEM) was created. The general purpose of structural equation models is to test hypotheses about the causal relations between hypothetical constructions. Hypothetical constructions refer to general concepts, such as skills, management of changes, and leadership in construction. They cannot be necessarily observed directly; only indirect information can be obtained about them.

The objective of the structural equation model was thus to illustrate the variables' interdependencies and it can help in assessing how a presented theoretical model fits the material. By doing this, the relationships between variables are revealed, which helps in drawing conclusions on the factors related to customer satisfaction in construction. The idea of structural equation models is to use regression analysis in examining the causal relationships between factors. Structural equation models can assist in studying the sort of a causal effect the various factors (latent factors) have, *e.g.*, on the factors describing the end result of construction and in analysing the interdependencies of the factors.

The starting point in building the model was to examine the different dimensions of construction and decrease the number of variables measured. With the help of factor analysis, the study showed the kinds of hidden, latent factors described by the variables.

As a result of the factor analysis, the original 22 variables formed ten structurally meaningful factors which were then interpreted. Then, the relationships between these factors were examined using the structural equation model. The structural equation model was constructed with LISREL software.

The variables of the RALA material were studied focusing on if they form a logical entity (*e.g.* management) and if they depict an individual method or process (*e.g.* managing the quality assurance procedures). For example, co-operation does not comprise an entity on its

own but it is associated with, for instance, managing the changes. In the model, PROF and MANAGEMENT were defined as explanatory variables that could not be explained by the other variables in the model. The other eight variables were variables to be explained. The purpose of this was to test the influence of the relationship between the factors describing management and skills in the factors describing the construction process itself, its results, and its methods. Further interest lay in perceiving the interdependencies of the latter variables.

Table 7 shows the structural equation model for factors depicting the functionality of procedures and the end result of the process. Table 8 displays the structural equation model for explanatory variables. In the Tables, the first number on the line is the estimate (the estimated value of the parameter), the second one is mean deviation, and the third one is the t-test result that tells us if the probability of the deviation between the coefficient and zero is 95% (if the absolute value of the figure is two or more). An empty cell implies that the factors' impact is zero.

Table 7. *Structural equation model for latent variables.*

	QA-PROCED	**HAND-OVER**	**QUAS-SIMA**	**OFFICIAL**	**CHANGE-MG**	**COMMU-NIC**	**TIME-COMP**
CONTQUAL	0.34 (0.07) 5.11			0.11 (0.06) 1.84	0.23 (0.10) 2.21		0.27 (0.09) 3.18
QAPROCED		0.34 (0.05) 6.54					
HANDOVER			0.20 (0.05) 4.19				0.58 (0.08) 7.54
QUASSIMA							0.23 (0.08) 2.80
CHANGEMG						0.21 (0.08) 2.51	
TIMECOMP					0.56 (0.13) 4.23		

***Table** 8. Structural equation model for exploratory variables.*

	PROF	MANAGEMENT
QAPROCED		0.58
		(0.05)
		11.94
HANDOVER		0.11
		(0.08)
		1.35
QUASSIMA		0.54
		(0.08)
		6.88
OFFICIAL	0.26	0.62
	(0.07)	(0.07)
	3.50	8.84
CHANGEMG	0.16	0.62
	(0.05)	(0.10)
	2.99	6.15
COMMUNIC		0.90
		(0.03)
		35.70
TIMECOMP	0.12	0.23
	(0.07)	(0.14)
	1.67	1.67

Figure 6 is a graphical representation of the variables' interdependencies in which latent factors are described as circles and their interdependencies with arrows. The greater the value of the t-test result, the greater the interdependency between the factors. Only statistically significant interdependencies have been included.

As regards the reliability of the results, it was essential to assess the compatibility of material and the developed structural equation model for customer satisfaction in construction. The RMSEA (root mean square error of approximation) value (0.040) of the model shows that the model matches the material well. RMSE value tells how well a model depicts the variance and covariance of variables. In general, values under 0.050 are considered good for the model. Therefore, the null hypothesis about the model being fit for the material is valid.

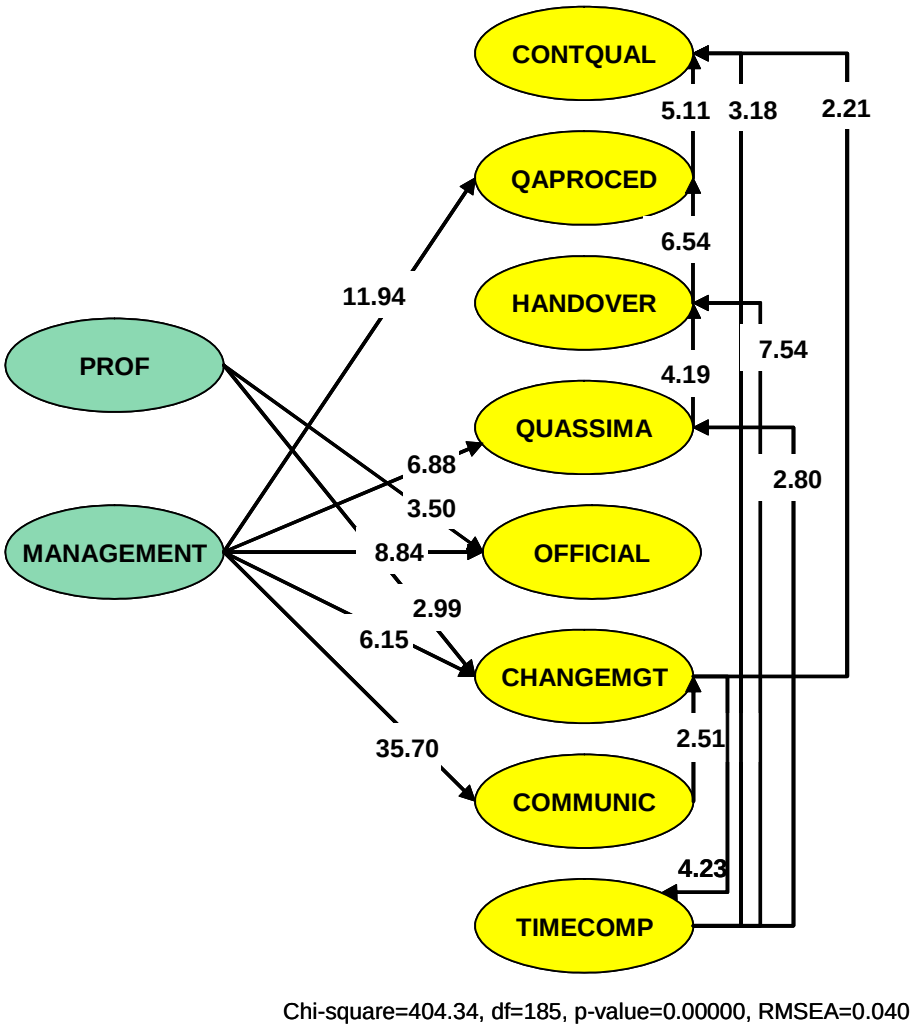

Figure 6. *Structural equation model (t-tests).*

4.4 Interpretation of the model

The structural equation model shows that some variables have direct effects on each other while others had indirect effects. For instance, the MANAGEMENT variable affects the contractual work quality experienced by the customer mostly through quality assurance procedures. TIMECOMP and CHANGEMG have a direct impact on the quality experienced by the customer. The QUASSIMA variable represents the quality of the building's handover material and maintenance manual, and the HANDOVER variable related to the level of functionality of the contractor's handover control influences the contractual work quality as experienced by the customer through quality assurance procedures. Among the explanatory factors, PROF has a direct effect only on variables OFFICIAL and CHANGEMG, whereas MANAGEMENT directly affects the variables QAPROCED, QUASSIMA, OFFICIAL, CHANGEMG, and COMMUNIC, and, through them, indirectly and consequentially, the contractual work quality.

According to the model, COMMUNIC factors related to communications especially affect the management of changes (CHANGEMG). On the other hand, change management also affects the adherence to schedule and has a direct effect on the contractual work quality. TIMECOMP has a direct affect on the variables CONTQUAL, HANDOVER, QUASSIMA, CHANGEMG, and CONTQUAL. Management influences the factor OFFICIAL which does not have other interfaces on the factors in the model. Hence, OFFICIAL is a very independent factor, a so-called must-have-factor.

The handover procedures in the end stages of the project seem to affect the contractual work quality particularly through quality assurance procedures. Therefore, they have an indirect impact on the customer's assessment on the project's quality as agreed upon, although the handover has been recently completed at the time of the assessment. It is important to see that the customer has an active role in managing the changes and collecting handover material.

Communication and various related systems do not improve the contractual work quality as such. Instead, they form a basis on which procedures and tasks are communicated to the customer. Adherence to schedule has a significant impact on the handover procedures which is only natural. In a situation where schedule is being adhered to, handover procedure appears to be successful. Even if there were problems with the schedule during the project, good management may compensate for problems in the end.

4.5 Cluster modelling

4.5.1 Basis of cluster analysis

The idea of a cluster analysis is to divide the observations into various categories or clusters so that the observations within one category are similar with each other but different from observations of the other clusters. Cluster analysis may be perceived as one of the methods of investigative data analysis. No presumptions of the data are made; the data are only examined (Scmidt and Hollensen 2006).

With the help of cluster analysis, groups that are internally as homogeneous as possible but also, in comparison to each other, as differing as possible can be found in the material. These can then be used, *e.g.*¸ as basis for segmentation. What is essential here is that a group is built based on a criterion. The objective is to examine into which kind of groups the projects can be divided from the perspective of the assessment made by the customer of the construction project. The integral objective is to find out the number and characteristics of the groups. Cluster analysis assists in defining the characteristics of projects assessed as successful and less successful (see *e.g.* Saunders 1980).

All clustering methods are multivariate methods meaning that the grouping is based on several variables. Clustering methods are necessary when building groups based on multiple variables. For example, if observations are categorized on the basis of only one classification variable, we know to which group each observation belongs. However, when there are several classification variables (into which groups may also be divided), comparing the similarities and differences among observations/projects is no longer so easy. Cluster analysis is presented in research Paper III.

4.5.2 Cluster model of CS items

In the modelling for this study, a *latent class cluster model* was used. It is a statistical model whereas a *k-means clustering* is a heuristic method for finding homogeneous groups based on the groups of variables. When compared to the heuristic method, statistical modelling has the benefit of providing standards for judging the suitability of the model material. Thus, it can be tested which model best suits the material and the optimal number of groups that are similar but, compared to each other, as different as possible. Because the best model has unequivocal criteria, decision-making in model selection is not based on an interpretation or presuppositions although naturally the model has to be interpreted.

Statistical modelling showed that by using the material's 22 variables in clustering, the model of seven clusters fitted the material best according to Bayesian information criterion. The

results of clustering are depicted in the Figure 7. The scale of variables was 0 to 1 based on the original ordering scale of 1 to 5.

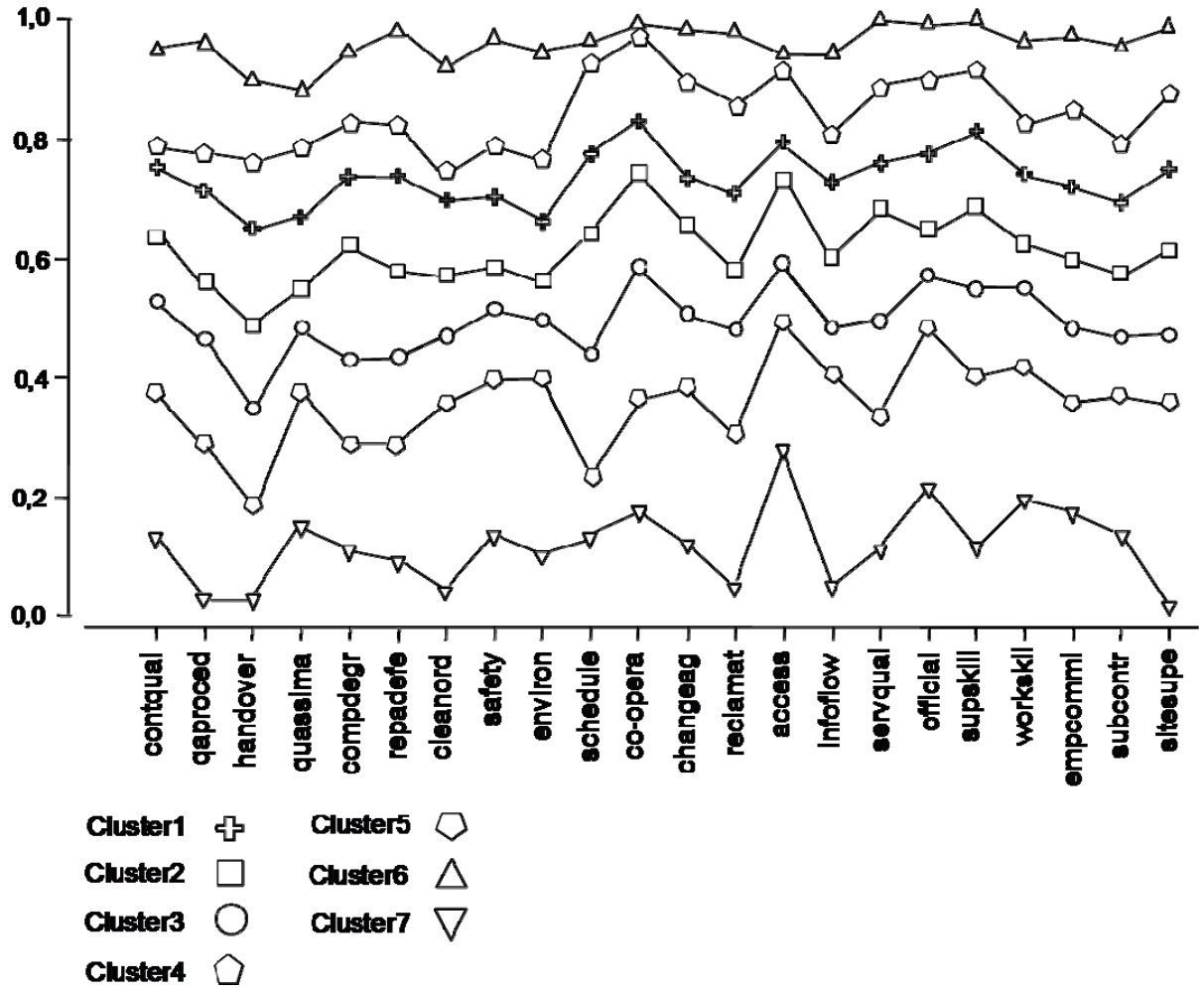

Figure 7*. Results from the cluster analysis.*

The first cluster (Cluster1) is the largest group comprising one fourth (25.8%) of the projects in the material. Compared to better level clusters (Cluster6, Cluster4), it has a lower level of success in the management of environmental issues (environ), work safety (safety), functionality of handover material and maintenance manual (handover), tending to notices of defect (reclamat), and conformity of supplier's subcontracting to contract (subcontr). However, *e.g.* contractual work quality (contqual) in this cluster has been assessed to be at the same level as in Cluster4.

The second cluster (Cluster2) encompasses almost one fourth of the projects in the material. As regards customer satisfaction, it represents the average. Despite problems in the handover stage of the project, (handover), the projects of this cluster have had a relatively good level of completion at the handover inspection (compdegr). This may be so because the defects and deficiencies found in the handover inspection were corrected quickly, and due to the

contractor's supervisors' high level of competence. The contractor's quality of overall service level (servqual), the personnel's capacity to co-operation (coopera), and the access to supplier's employees (access) were also rated high.

The third cluster comprised some 21% of the projects in the material. In this cluster, the inter-variable differences are relatively small although the level of adherence to schedule (schedule) and handover inspections (handover) was lower than other variables, while co-operation and access to supplier's employees scored higher than other variables. Compared to the fifth cluster, the most significant differences between levels originate in the co-operative skills of the employees and the management of work on site.

In the fourth cluster, co-operation and adherence to schedule in accordance with common agreements had a good level of success in the projects. Good co-operation and adhering to schedule have a positive impact on the final stage operations of a project, and these variables did not show the drop seen in other clusters. A further positive factor has been the employees' strong commitment to the goals set for the project. The fourth group comprises approximately 14% of the projects.

The fifth cluster covers some 10% of the projects in the material and customer satisfaction, which is lower than average. In particular, this can be perceived in poor adherence to schedule which is then reflected in failures in the handover process. In these projects, the quality of contractor's service level, co-operational skills, and tending to notices of defect have been evaluated as low. Nonetheless, the official obligations as well as issues relating to the environment and work safety have been satisfactorily taken care of.

The sixth cluster depicts a very successful project from the customer´s viewpoint, consisting of approximately 5% of the projects in the material. It is to be noted that in these projects, the level of customer satisfaction is high in all fields of the project, and the differences between fields are very small. However, the functionality of the handover inspection and material as well as the quality of the maintenance manual scored a bit weaker than the others. Compared to other clusters, the projects of this one were successful in all fields.

The seventh cluster represents only a bit over one percent of the entire material with the lowest level of customer satisfaction. The problems of this cluster concentrate on the management on site, quality assurance procedures, and the information flow, and they are reflecting on tending to notices of defect and the project's handover procedures. The project's poor quality may be caused by poor management of work on site, leading to large amount of errors and problems in tending to notices of defect.

In all clusters, except for the cluster of the best projects (Cluster6), the level of the access to supplier's employees is good compared to the other variables. The best clusters, (Clusters 6, 4, 1, 2, and 3) share the good level of the managerial skills and co-operation in comparison to the other fields of the cluster. Also, the functionality of co-operation procedures is a sign of a high level of customer satisfaction. In the clusters with less success (Clusters 3, 5, and 7), official obligations are well tended to when compared to the other variables.

In all clusters, the handover process and other final stage methods of the project scored the poorest. On the other hand, the factors related to the contractor's co-operation were evaluated high in all clusters. The best clusters (Clusters 6, 4, and 1) had the greatest deficiencies in the cleanliness and order on site.

The fields of the project were assessed in quite a similar manner in the best and the poorest group. In the best group, all fields were a success and, correspondingly, in the group that scored the lowest in the overall customer satisfaction, all fields have been assessed as poor except for the access to the supplier's employees. In the other groups (Clusters 1, 2, 3, 4, and 5), the project's fields have differences. The co-operational skills of the supplier's employees has been assessed as the best variable in all of the clusters except for Cluster6 in which differences between fields were very small. The groups do not overlap but they have differences between levels.

When the defects and deficiencies in the project have been effectively corrected, also the level of completeness in the handover inspection is good (Cluster2). The supplier's employees' good co-operational skills and adherence to schedule had a positive influence on the building's handover process (Cluster4). Poor adherence to schedule had an impact on failures in the handover process as well (Cluster5). In spite of problems in the functional quality of the project, the contractual quality can be assessed as good (Cluster5). Cluster analysis focuses on describing the differences between levels in the projects since the variables do not overlap.

4.6 Other analysis

4.6.1 Customer groups: public vs. private

In addition to the SEM model and cluster analysis, also other analyses were completed in order to understand the different perspectives and dimensions of customer satisfaction in construction. The first examination was to explore customer satisfaction in construction as perceived by two customer groups: public and private customers. It is presented in research Paper I. The analysis of data was performed using the chi-square test to compare the responses for the customer groups[3].

[3] The distribution of respondents between two groups: private (n=200; 56%) and public (n=154; 44%).

Typically, both customer groups were satisfied with the contractor's abilities to co-operate and the skills of the contractor's workers and supervisors, whereas low satisfaction could be found for the items related to quality assurance and handover. The common feature of the low satisfaction items is that they come out in later phases of the construction project.

According to the result, public customers have a lower satisfaction rates for each attribute than private ones. The most significant differences were amongst groups in attributes contracted work quality, management of work safety on site, tending to official obligations, and access of supplier's employees. Although there is a significant difference in the customer groups' perceptions of the contractors' performance, both groups behave similarly in relation to low and high satisfaction items.

4.6.2 Nature of the project: new construction vs. renovation

The study was conducted to compare satisfaction in new construction and renovation projects and it is presented in Paper II. Analysis was also made using project types which were industrial, infra, residential, and office projects. First, a factor analysis was explored and the results were used to create a general linear model in order to compare the differences between new construction and renovation. The model examines the differences in the means of the groups in variables which are inspected. The question was whether these groups (type and nature of the projects) differed by mean.

In general, co-operation is more successfully managed in new construction than in renovation projects. When regarding the type of the project, industrial new construction projects are managed better than other type of projects, and industrial buildings renovation projects are poorly carried out.

Co-operation in office renovation projects is at a lower level than in new construction as perceived by customers. As regards the nature of the project, the only significant differences could be seen in the offices where in renovation projects, professional skills were at a higher level than in new construction.

When studied by the project type, distinctive differences between industry and office projects can be perceived. In the dimension which describes professionalism, there were significant differences in the project type in this dimension. It is also remarkable that official duties are more poorly managed in renovation than in new construction with the exception of infrastructure projects.

When considering the nature of the project in relation to the contract variable, statistically significant differences between new construction and renovation could be observed in

residential projects. In that case, especially factors related to schedules and the degree of completion at handover are critical.

5. DEVELOPING THE MODEL FOR MEASURING MUTUAL FEEDBACK

5.1 Antecedents of mutual feedback systematic

This chapter presents the framework for feedback systematic in the construction presented in Paper VI. Earlier sections have considered customer satisfaction which has been examined through versatile analysis. The focus has been in a customer-main contractor relationship, where customer gives feedback to contractor on his/her performance in the construction project.

In a project environment, it is also essential to that project feedback should cover the most important parties in the supply chain and be bidirectional. There are several reasons for that kind of thinking:

1. The complex nature of the construction process, changes in project organisation, the uniqueness of each project and the project parties' different objectives make it difficult to make use of past experiences and customer feedback in future projects. These fundamental characteristics of construction projects also complicate the evaluation of the project outcome and emphasise the need for developing effective and efficient evaluation system (Kumaraswamy and Thorpe 1996).

2. Project organisation usually involves complex goals. Each project member (owners, architects and engineers, construction management consultants, general contractors and sub-contractors) look at the project from their own perspectives and also have their own criteria for measuring success. In order to attain the project goals, a systematic evaluation of the organizations' performance is required to provide feedback for guiding the participants' behaviour (Liu and Walker 1998).

3. Traditional project success measurements, expressed in terms of time, cost and quality no longer meet the needs of today. Also the end-user's satisfaction, customer satisfaction and the participants satisfaction has been used as important measures of project success (Chan and Chan 2004; Cheung *et al.* 2000).

4. Each firm in the construction supply chain is both a customer and a supplier, and that the value created by them is a fundamental factor in the project's success (*e.g.* Love *et*

al. 2000). Because the performance of each participant in the construction project coalition is interdependent, other participants should assess their performance. In other words, when evaluating co-operation between parties in the construction supply chain, it is essential to exploit mutual feedback. It is also well known that the poor performance of one party will affect the performance of the next party (Kanji and Wong 1998).

The challenge then is to create a feedback system which takes into account the customers' and the other parties' perceptions of the contractor's performance both during the construction development phase and after the completion of the facility. Moreover, all central parties in a construction process should be able to give and receive feedback through a common system in the construction supply chain. Developing mutual feedback during the construction phase could contribute to identification of the essential areas in which problems arise during the project and it could also improve the project parties' mutual learning. It could also improve the reliability of the feedback when evaluating the success of the project.

5.2 Demands and features of a feedback systematic

The study was conducted to explore the demands, features, and benefits of a mutual feedback systematic. The aim was to develop a versatile web-based tool for measuring mutual feedback in the construction supply chain. With the help of the feedback system, the various parties can observe the essential needs for development and target the necessary actions. Through openness and mutual learning, co-operation between parties will develop and the customer orientation of the entire industry is improved.

In the initial stage of the development project, interviews were conducted among the target individuals in the companies participating in the project and associations representing the industry in order to find out the various needs and objects for development as regards the feedback system. The interviewees represented the development department and strategic management of the companies involved. Together with a literature review, they formed a basis for the requirements of feedback taxonomy. Altogether 12 interviews were conducted and used as a basis for determining requirements for developing the project feedback system.

The interviews could be summed up by stating that systematic utilisation of project feedback has been poor in the construction business. Typically, construction companies conduct customer surveys separately, and their quality and exploitation is underdeveloped. In addition, the utilization of the information has been found to be sporadic and ineffective. Customer feedback is also mainly collected only late in the project, in which case the feedback that has been collected has no effect on operational procedures during the project.

According to the interviews, the essential requirements and system properties were the following:

- The system should cover the entire industry as a technically developed and versatile web interface
- The central parties of the project should be involved in the system
- It should be possible to give and receive feedback in the various stages of the project and to utilise the feedback during the project
- Reporting in the system should be clear and illustrative as well as real time in relation to the comparison material selected
- It should enable multipurpose benchmark comparisons
- It could be flexibly adapted to different projects and forms of implementation

As the project progressed, the requirements were specified with focus groups targeted at different parties in the construction business. A total of five focus group meetings were organised in 2005 and 2006. Each meeting had 10 to 15 participants from the strategic management of associations and companies as well as persons responsible for development and quality matters. The themes of the meetings involved the openness of the system, defining the feedback flows of the participants of construction projects, information needed by the parties, and the potential to utilise the feedback in the organisations. The last item is especially important as the goal for feedback should always be concrete improvement of operations, quality, and customer satisfaction, not mere measuring (Goodman 2001).

5.3 Main characteristics of the results

Figure 8 illustrates the feedback flows between parties in the system. Each arrow represents the direction of the feedback and one questionnaire. Thus, the project feedback system enables using 15 different questionnaires in which various actors assess the operations of each other. All feedback flows between parties were bidirectional except for the customer as his/her operations are not assessed here.

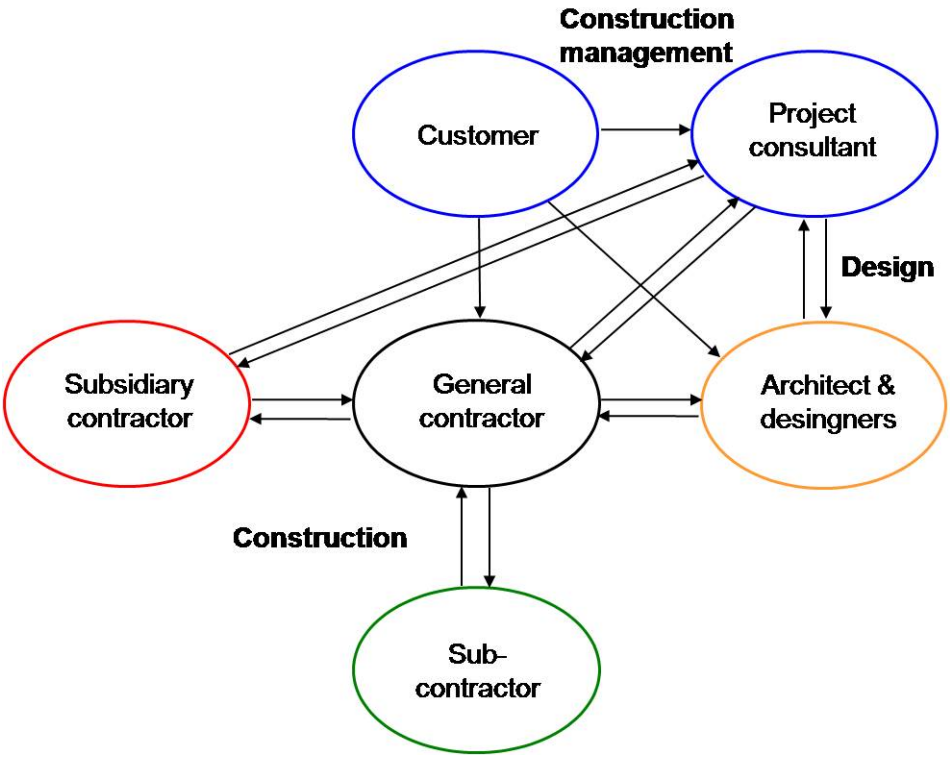

Figure 8. *Feedback flows in the construction supply chain.*

The afore-mentioned feedback flows provided the starting point for the development of feedback questionnaires. The basis for the contents of the questions was formed by the various tasks in construction and the requirements they set for a construction project. The feedback questions concentrate on the matters each party considers important, and, on the other hand, those which each party can assess. The tasks and requirements of various parties in construction were grouped into fields which are similar with each other although the contents of the questions are determined by the role and task of the actor. The evaluation areas common to all parties were these:

- project management
- co-operation
- staff
- accomplishing goals

Project management refers to general factors related to project management which have traditionally been measured through quality, costs, and schedule. Project management should be systematic and premeditated, and it should cover risk management and, for general contractors, effective guidance of subcontractors. Factors for measuring co-operation are, for instance, the functionality of the co-operation, and factors related to information flow and problem solving capabilities. The personnel are strongly connected to skills and expertise and resource-related questions. Accomplishing goals naturally refers to the assessment of

attainment of various goals, which usually takes place after the project has been completed. The system also enables a question that can be modified for each company.

In addition, we can recognise benefits for each party in the project organisation by adopting the customer feedback system:

- Common benefits
    - Perceiving needs for development and targeting operations
    - Improving co-operation and operations through openness and mutual learning
    - Developing customer orientation
- Customer
    - Can be used as a supplier evaluation and ranking tool
    - Process management and administration
    - Ensuring the fluency of the construction project
- Construction companies
    - Enabling company level comparisons and shows needs for development
    - Providing initial data for customer relations management
    - Producing initial data for the company’s standards
- Designers and suppliers
    - Persistent development of co-operation and operations
    - Perceiving needs for development and targeting operations

6. DISCUSSION AND CONCLUSIONS

6.1 Summary of research

In the construction business, customer-orientation is gaining importance, and the industry has adopted new practices when striving towards closer co-operation with customers. The customers have become more demanding and they require more open co-operation, flexibility, and more transparent operations from the contractors. Today, customer satisfaction should be a part of the parameters used in measuring the performance in every construction project. It is indeed seen as one of the central success factors in project business along with the traditional parameters such as quality and costs. At its best, customer-orientation in construction is an on-going process closely related to all of the contractor's operations. Then, it is not an unconnected success factor but it creates added value to the selection offered by the contractor. Moreover, this creates a competitive edge for a customer-oriented company: a company that is better able to satisfy its customers' needs than others are is improving its own competitive position and is able to form long-term customer connections.

The objective of the study was to explore customer satisfaction in construction. Customer satisfaction can be seen either as a goal or as a measurement tool in the development of the quality of construction process. Versatile analysis was conducted to deepen the understanding of this project success factor which has been stated to be under-researched so far. A number of analyses were made in order to get information about the concept of customer satisfaction as such and different features of it. The subgoals of the study were related to identify customer satisfaction factors and examine the interrelationships between factors. The study also describes the utilization of customer organization in the organizations and creates the model for assessing the mutual performance in the construction supply chain.

6.2 Interrelationship with factors

Based on the structural equation model, it may be stated that customer satisfaction in a construction project is a multi-dimensional entity. The customer satisfaction model created in the study matches the material well and is therefore well suited to describe the research subject. Furthermore, it provides a versatile view on the investigated phenomenon. In a project-focused environment, it is often argued that everything affects everything, at least consequentially. On the other hand, this study showed that the interdependencies and relationships between the factors are different. Moreover, the model developed can assist in perceiving various direct and indirect relationships between the factors. For instance, the contractual work quality experienced by the customer is influenced by the factors describing the handover procedures and their quality via the quality assurance procedures whereas it is directly influenced by the factor describing the temporal management of the construction process.

The nature of customer satisfaction in construction is well illustrated by the fact that in projects with a lower level of success, the feedback has been negative in all areas. Thus, the customer has assessed the project as entirely poor although this was actually not the case in all areas. Therefore, negative experiences seem to have a great impact on the customer's entire image of the project. This result emphasises the significance of quality assurance throughout the project and suggests that in some cases, quality assurance methods could be further developed. When comparing the more and less successful projects, it may be stated that in both groups, the same factors proved a success. In other words, if a project succeeds in one field, it is likely to succeed in all of them, and vice versa. This result is also a good example of the accumulative nature of customer satisfaction in project production.

It should be noted that co-operation and the supplier's service level are intertwined with several of the core processes in construction. Thus, they are not separate, independent dimensions. According to this study, the contractor's ability to co-operate from the customer's perspective is clearly divided into two: management of changes, and communication. This result emphasises the significance of communication in project production. It is a part of customer-oriented construction, and its management is one of the central sectors of project management. Since the contractor's co-operative skills and service level are intertwined with several of the core processes in construction, developing the contractor's service skills should be more customer-oriented in order to develop the central processes. This stresses the importance of the contractor's entire selection of services as regards customer satisfaction. The result is in accordance with prior studies, as well (*e.g.* Al-Momami 2000; Ozaki 2003; Maloney 2002).

One of the central features of service is that the customer participates in the production process at least to some extent (*e.g.* Grönroos, 2000). Also in construction, the commissioner of the project is a customer who participates in the various aspects of construction depending on the form of implementation. This emphasises the nature and significance of service in construction. This result is similar in other studies examining services in construction (Yasamis *et al.* 2002; Torbica and Stroh 2001).

6.3 Towards project success by identifying CS factors

When examining the commissioner's satisfaction with various factors, it can be argued that different factors have different significance and impact on the satisfaction as experienced by the commissioner. The Kano model (Kano *et al.* 1984) can be used in categorising the factors causing further satisfaction and dissatisfaction. The first create added value for the customer, and taking good care of these matters will improve customer satisfaction and added value. On the other hand, so-called must-be-factors can also be perceived. These should always be tended to. Success with these factors does not necessarily improve the customer satisfaction of the commissioner but failure will definitely cause dissatisfaction. One of such factors is the

OFFICIAL factor that describes the operational surroundings guided by legislation. This includes the variables cleanliness and order on site, management of work safety on site, management of environmental issues and related know-how on site, and tending to official obligations in practice. The structural equation model displaying the interfactoral causal relationships can also help in seeing that the OFFICIAL factor is a very independent factor that does not directly influence the other factors whereas, *e.g.* the CHANGEMG covering management of changes in the project has a direct effect on the contractual quality experience by the commissioner. The CHANGEMG factor is directly influenced by the communication-related COMMUNIC factor which in turn has an indirect, consequential impact on the contractual quality as seen by the customer. Therefore, some factors have direct impact on experienced customer satisfaction and some indirect. The various factors in customer satisfaction also have a different impact on the quality as perceived by the customer.

The negative factors of the projects in the feedback data had one characteristic in common: they will appear and occur in the final stages of the project. More extensively, this may be due to problems in adhering to schedule and planning which affect the success of the entire project and which may be seen as a critical factor as regards the entire business. In these cases, the contractor may have sought short-term customer satisfaction at the expense of longer-term one. Problems in adhering to schedule correlate strongly with factors related to quality assurance and handover which means that the level of contractual quality has been merely satisfactory.

Problems with the schedule are also related to the construction companies' process management and effectiveness of internal communication. It is characteristic of construction projects that errors made in the beginning of the project will multiply by the final stages and manifest themselves, for instance, as schedule problems. Neglecting to inform the customer about negative matters and unfounded optimism about catching up in the final stages are one of the most significant problems in the construction industry. Normally, problems that have occurred are hidden and it is hoped that they be solved later on. Often, the errors will appear in the final stages when nothing more can be done. Problems may have their origins in deep rooted ways of thinking and the lack of service culture in the entire construction industry. Proper and timely communication can influence and diminish the problems related to schedule and affect the project's entire customer satisfaction.

Methods related to co-operational skills received almost always praise from the commissioners. This result is partly contradictory to other international studies in the field (Egan 1988) in which factors related to the contractor's abilities to co-operate has been one of the most significant areas of dissatisfaction. Thus, good co-operative skills seem to compensate for some of the defects in technical quality.

In the light of examining differences in customer satisfaction, public customers were found to be less satisfied with the contractor's performance than private customers. Public customers could be more professional than private ones, in which case their demands and expectations would be at a higher level. Public owners typically operate with a larger number of contractors and therefore, contractors' qualitative deviation (small and big contractors) is greater than in the case of private customers.

In addition, private customers could be more established partners in co-operation, which would then be reflected in customer satisfaction, whereas public customers have to follow legislative procurement, which essentially narrows the criteria for selecting contractors. Competitive bidding is usually based on price criteria, and therefore, contractors do not have enough incentives to exceed customer's expectations, and may see customer satisfaction as insignificant. In the case of public customers, contractors participate in new competitive biddings despite the success or failure of their earlier projects, whereas private customers would drop unsatisfactory contractors from the competition.

When studied by the project type, distinctive differences between industry and office projects can be perceived. This might suggest that industry projects are usually wider and better-defined than office projects. When regarding the nature of the project, industrial new construction projects are managed better than other type of projects, and industrial buildings' renovation projects were carried out poorly. In addition, co-operation in office renovation projects is at a lower level than in new construction as perceived by customers. This might indicate that buildings are in operational use during the project, in which case the need for information and the form of co-operation become strongly emphasised.

In general, co-operation is more successfully managed in new construction than in renovation projects. This result might indicate that the initial data, concerning the customer's demands and needs, and on the other hand, functional prerequisites are at a higher level in new construction. Moreover, the parties may be more familiar with new construction projects.

Typically, some unexpected surprises may occur during projects for which the parties could not have prepared in the design phase. These unexpected situations might weaken the relationship between the contractor and the customer. It could also be argued that the management of information flow is more difficult to execute in renovation due to the greater number of parties involved in the project.

In new construction, official duties managed better in industrial projects than in the other project types. The scale of the industrial projects is different and, therefore, the status of cleanliness and work safety on site are not as significant as in the other type of projects. Furthermore, infrastructure projects differ from office projects in the management of official

duties. It is remarkable that official duties are more poorly managed in renovation than in new construction with the exception of infrastructure projects. This result could indicate the nature of renovation: there is more handicraft work on site and the area of the site is more restricted than in new construction.

When considering the nature of the project in relation to the contract variable, statistically significant differences between new construction and renovation could be observed in residential projects. The result implies that the performance of the companies in renovation is at a substantially lower level than in new construction. This might indicate that contract-related variables are critical if users are using the building during the renovation project. In that case, especially factors related to schedules and the degree of completion at handover are critical. In renovation, the corrective actions by the residents might vary throughout projects, and well-established demands exist. In the office projects, no such clear differences between new construction and renovation exist. However, it is definitely suggested that contract-related office projects are managed better in renovation than in new construction. This might occur due to the fact in new construction, the demands of procurement and contracts vary and are also emphasised in different factors than in renovation. Generally stated, new construction projects clearly differ in this dimension from each other, for example, between office and residential projects and, on the other hand, between industrial and office projects.

6.4 Mutual feedback as a tool for learning and improving quality

In the construction industry, the quality of the end product and, thus, customer and end-user satisfaction is highly influenced through independent work done by the parties involved in the construction project and the co-operation between parties. Using the customer feedback system, the owner would establish goals in terms of performance quality. By monitoring the project team’s progress in reaching these goals, team members can re-evaluate the quality of the processes necessary to reach them. A multifaceted feedback system also denotes the areas needing improvement in the whole branch of industry and gives opportunities for setting benchmarks of customer satisfaction. In addition, a standard feedback system may be considered more objective than a contractor’s own feedback survey because social interaction components do not exist in the standard system. Moreover, it is strong tool for mutual learning and continuous improvement.

6.5 Implications for industry

This study offers several possibilities for developing the business in the field. The actors in the field of construction and real estate need versatile and systematic customer satisfaction information about the quality of building and construction process in order to act in a customer-oriented way and develop their operations.

The factors with a negative effect on the customer satisfaction are related to two entities:

- Communication and reporting
- Handover process

By developing the related methods, customer satisfaction can be improved by removing the factors having a negative effect on customer satisfaction. In the management of a construction business, mere routine and technical competence are not enough but alongside technical competence, co-operational skills and the importance of communication and information flow are highlighted. A functioning communication system is a significant precondition for the operations of a work site organisation and in building customer satisfaction. The importance of communication is further stressed by the fact that business is based more and more on long-term customer relations. Therefore, the contractor and the builder have to interact in developing their own activities

The single most important factor causing customer dissatisfaction is inefficiency in the handover stage. Indeed, this requires thorough planning and development of project-related handover processes. A prerequisite for a functional handover process is that the tasks and persons in charge have been clearly determined and depicted and that the people participating in the handover know their own tasks. Moreover, the methods related to the handover must be planned in time and the plan should be approved by the customer. In the other hand, the methods related to the constructor's co-operational skills have almost always brought about good feedback so, to some extent, they may compensate for the defects in the technical quality. Adhering to schedule and the workers' good co-operational skills have a strong impact on the successfulness of the handover stage. However, if there have been problems in the intermediate stage of the project, they can be alleviated or even removed with good management.

A functional handover process requires that the tasks and responsible persons in the handover phase are clearly defined and described, and that the participants know their tasks. Also procedures related to the handover must be planned well beforehand, and the plan must be reviewed with the customer. Additionally, procedures related to the maintenance manual and other handover documents must be agreed upon in the early stages of the project. Deficiencies in handover documents are often caused by, for instance, the fact that the material has not been collected in an adequately systematic manner. Often, documents are collected in a rush when the project is almost completed when it could be done during the construction with more efficiency and less trouble.

As service is becoming a part of the core processes of construction, a new kind of service culture has emerged which benefits all parties in construction due to improved quality and enhanced customer orientation. In the competitive market in which the core product only

rarely can obtain an overwhelming competitive edge, it is natural to seek benefits in the services. The service may be aimed at the use and support of the core product. It can be a new way of dealing with the repair project of a tenant building, an innovative process to develop the handover procedures, or development of plans together with the customer. Services will always emphasise interaction between parties, common procedures, and common goals. Hence, services should be seen as a perspective covering the entire company so that developing the operations will focus on the entire selection offered by the company. This brings added value to the company's core operations, and poses challenges especially to the management culture. Since it intertwines with all of the company's levels both vertically and horizontally, the companies' operational systems should also be holistically developed.

In construction projects, satisfaction of the future end user and commissioner depends on the actions of each actor as well as on the co-operation of the entire production chain. In the value production chain of construction, the ability of each actor to create value for the project and other actors impacts the value observed by the end user and is an essential factor of a successful project.

Due to the nature of construction, the goals of the project are not unambiguous to all parties but they form a complex entity. Each party in the project team observes the goals from his/her own viewpoint and each actor may have their own bases of evaluation regarding the success of the project and attaining the goals. Therefore, attaining the project goals requires systematic evaluation or feedback of the operations of the project organisation. This feedback steers the operations of the parties and helps in attaining the common goals.

6.6 Evaluation of research

Reliability

In the light of reliability and validity of the study, it is important that a questionnaire made reflects right information. According to Hayes (1998), when constructing a questionnaire or scale that assesses customer attitudes and perceptions towards customer requirements, it is necessary to consider measurement issues to ensure that scores derived from such instruments reflect accurate information about the construct, customer satisfaction. It is important to be sure that the true underlying level of perception of satisfaction is accurately reflected in the questionnaire score. A reliable measure is one to which a respondent responds in the same or in a very similar manner as to an identical question. In other words, reliability is the degree to which a respondent is consistent in his answers (Burns and Bush 2006).

Standard for Educational and Psychological Testing (1985) observes that reliability is a generic concept and it is seen as essential that the reliability of a measurement is studied from the viewpoint of the conclusions drawn. According to Nummenmaa *et al.* (1997), this extends

the researcher's responsibility from calculating the reliability factors and measurement errors to responsibility for the conclusions made on the basis of the measurements. In this study, customer satisfaction in the dynamic project surroundings of construction has been widely discussed and the conclusions drawn are based on versatile tests and knowledge of the construction industry. The reliability of this study is further enhanced by the fact that the same phenomena is studied using multiple variables and multi-faceted examination. Moreover, the respondents were professional constructors who assessed the operations of the company as such, which could also be seen to increase the reliability of the study.

As regards statistical analyses, it was shown that the SEM model fit the material well and a logical interpretation of the content was also obtained. Furthermore, in factor loadings, the error variances and inter-factor correlations have been reported as recommended by Nummenmaa *et al.* (1997).

The evaluation of the project success here is conducted at the end of the project, which may somewhat weaken the reliability of the research. This may occur because the customer might overemphasise the later stages of the project as a consequence of the project's long duration and the fact that defects during the hand-over period stay most clearly in the customer's mind.

Validity

In general, validity refers to the validity of an indicator, *i.e.* if it suits its task. Standards for educational and Psychological Testing extends this definition and states that *validity stands for the suitability, sensibility, and usefulness of the conclusions made based on the results.* The kinds of validity most commonly assessed are content, criterion, and structural validity (Polit and Hungler 1997).

The items covered by the questionnaire are familiar, commonly used indicators of project management used daily by the professionals (*e.g.* Pmbok 1996). Additionally, the third party in the questionnaire, the Finnish Construction Quality Association (RALA) is a valued actor in the field striving to improve quality of construction. Moreover, anonymous feedback increases the validity of the study although the marked in Finland is relatively small and the actors know each other. On the other hand, there should be more detailed information about respondent's background in the survey.

In the chapter 5 was presented model for measuring mutual feedback in the construction. The model was created by using literature analysis, interviews and focus group-method. Tuomi and Sarajärvi (2009) have presented evaluation criteria for qualitative research, which are: 1) Clearness of the research report 2) Conformity of methodology 3) Analytical accuracy 4) Theoretical connection 5) Good relevance. Wide literature analysis and interviews were preceding focus group meetings, which improves theoretical connection and conformity of

methodology of the study. Challenges in the customer orientation in the whole branch of industry brought also relevance in the study. In the focus group meetings features and the content of the feedback model was explored in the point of view of all major parties in the construction supply chain, which improves analytical accuracy of the study.

Future

Empirical studies on customer satisfaction and its development are gradually becoming available in the field of construction. Next, it would be interesting to see how it has affected the financial factors such as the profit of a company or, on a project level, the coverage of a construction site. In this way, its possible financial benefits could be clearly demonstrated, among other benefits. When the factors contributing to and threatening customer satisfaction are discovered, the development should focus on turning the weaknesses into strengths. The distinctive features of the type and nature of the project should be understood as only then can segmentation be improved and selection offered be expanded.

The feedback systematic created as a part of the study has been further utilised to develop a web-based feedback system (ProPal) which is gradually gaining importance in the construction market as a group of large actors have adopted it. Using the information yielded by the feedback system, the companies can observe the needs for development and compare their own performance level with those of other companies in the various fields of project operations. The system enables flexible use of various feedback enquiries based on the nature of the project and the needs of the company, and it can be used in different projects and forms of implementation. When a common system is used, all parties can utilize the information given and received in an equal manner. Later on, it can be complemented with new items which can comprise, for instance, the various services during the building's life span, or the evaluations of the premises' users as regards the building's functionality and usability.

Naturally, in this phase of development, as the project feedback system is first introduced in Finland, there is not enough empirical data in the system for wide benchmarking in the construction industry level. Nonetheless, the first experiences of using the feedback system have been encouraging. As the system benefits the company's development operations directly, it also creates indirect potential for development for other actors. In this way, the quality in the entire industry improves, customer satisfaction increases, and a win-win situation beneficial for the entire industry has been created.

REFERENCES

Ahmed, S.M. and Kangari, R. (1995) Analysis of client-satisfaction factors in construction industry. Journal of Management in Engineering. Vol. 11 No. 2, pp. 36-44.

Al-Momani, A.H. (2000) Examining service quality within construction process. Technovation. 20, pp. 643-651.

AMA The American Marketing Association. (2007) Definition of Marketing in AMA webpage: http://www.marketingpower.com

Anderson, E.W. and Sullivan, M.W. (1993) The Antecedents and Consequences of Customer Satisfaction for Firms. Marketing Science. Vol. 12 No. 2, pp. 125-143.

Anderson, E.W., Fornell, C. and Lehmann, D.R. (1994) Customer Satisfaction, Market Share, and Profitability: Findings From Sweden. Journal of Marketing. 58 (July), pp. 53-66.

Arditi, D. and Gunaydin (1997) Total quality management in the construction process. International Journal of Project Management. Vol. 15 No. 4, pp. 235-243.

Argyris, C. (1977) Double Loop Learning in Organizations. Harvard Business Review (September-October), pp. 115-125.

Atkinson, R. (1999) Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. International Journal of Project Management. Vol. 17 No. 6, pp. 337-342.

Baden Hellard, R. (1993). Total quality in construction projects, achieving profitability with customer satisfaction. Thomas Telford, London.

Barrett, P. (2000) Systems and relationships for construction quality. International Journal of Quality and Reliability Management. Vol. 17 No. 4, pp. 377-392.

Barnes, W.R. (2003) Designing customer satisfaction programs for actionability. Quality Congress . ASQ's Annual Quality Congress Proceedings; 57.

Beatham, S., Anumba, C., Thorpe, T. and Hedges, I. (2004) KPI's: a critical appraisal of their use in construction. Benchmarking: An International Journal. Vol. 11 No. 1. pp. 93-117.

Bertelsen, S. (2004) Lean Construction: Where are we how to proceed? Lean Construction Journal. Vol.1, pp. 46-69.

Bitner, M.J. and Hubbert, A.R. (1994) Encounter Satisfaction versus Overall Satisfaction versus Quality: The Customers Voice. In Rust, R.T and Oliver, R.L. (Eds). Service Quality: New Directions in Theory and Practise. Sage, London, pp. 79-94.

Burati, J.L., Matthews, M.F. and Kalindi S.N. (1992) Quality management organizations and techniques. Journal of Construction Engineering and Management. Vol. 118 No 1, pp. 112-128.

Burns, A. and Bush, R. (2006) Marketing Research. 5th ed. Pearson Prentise Hall.

Chan, A.P.C. and Chan, A.P.L. (2004) Key performance indicators for measuring construction success. Benchmarking: An International Journal. Vol. 11 No. 2, pp. 203-221.

Cheung, S.O., Tam, C.M., Ndekuri, I. and Harris, F.C. (2000) Factors affecting clients project dispute resolution satisfaction in Hong Kong. Construction management and Economics. Vol. 18 No. 3, pp. 281-294.

CCI Centre for Construction Innovation, (2004) An introduction to Key Performance Indicators. Constructing excellence in the North West.

Construction Quality Association (Rakentamisen Laatu RALA ry) Rakentamisen laatu RALA ry (Web pages and databases; available at (http://www.rala.fi/).

Creswell, J.W. (2003) Research Design, Qualitative, Quantitative and Mixed Approaches. 2nd ed. Sage Publications.

Cronin, J.J. and Taylor, S.A. (1992) SERVPERF versus SERVQUAL: reconciling performance-based and perceptions-minus-expectations measurement of service quality. Journal of Marketing. Vol.58 (January), pp. 125-131.

Dainty, A., Cheng, M. and Moore, D. (2003) Redefining performance measures for construction project managers: an empirical evaluation. Construction Management and Economics. Vol. 21, pp. 209-218.

Delgado-Hernandez D.J and Aspinwall A.M. (2005) Improvement tools in the UK construction industry. Construction Management and Economics. Vol. 23 Issue 9, pp. 965-977.

De Vaus, D.A. (1994), Surveys in Social Research, 3rd ed., UCL Press, Guildford.

Drucker, P. (1990) The emerging theory of manufacturing. Harvard Business Review, May-June 1990, pp. 94-102

Eden, C., Williams, T., Ackermann, F. and Howick, S. (2000) The role of feedback dynamics in disruption and delay (D & D) in major projects. Journal of the Operational Research Society. 51. pp. 291-300.

Egan, J. (1998) Rethinking Construction: The Report of the Construction Task Force to the Deputy Prime Minister, Department of the Environment, Transport and the Regions, Norwich.

Foil, C.M. and Lyles, M.A. (1985) Organizational Learning. Academy of Management Review. Vol. 10 No. 4, pp. 803-813.

Fornell, C. (1992) A National Customer Satisfaction Barometer: The Swedish Experience. Journal of Marketing. Vol. 56 (January), pp. 6-21.

Garvin, D. (1993) Building a Learning Organization. Harvard Business Review (July – August), pp. 78-91.

Goodman, J. (2001) Using Complaints for Quality Assurance Decisions. International Journal of Customer Relationship Management. Vol. 4 (June/July), pp. 59-72.

Grönroos, C. (1984) A Service Quality Model and Its Marketing Implications. European Journal of Marketing. Vol. 18 (4), pp. 36-45.

Grönroos, C. (2000) Service Management and Marketing –a customer relationship management approach, 2nd ed. John Wiley & Sons, LTD.

Gummesson, E. (2000) Qualitative Methods in Management Research. Second edition. Sage publication.

Haupt, T.C. and Whiteman, D.E. (2004) Inhibiting factors of implementing total quality management on construction sites. TQM Magazine. Vol. 16 Issue 3, pp. 166-173.

Hayes, B.E. (1998) Measuring Customer Satisfaction – Survey Design, Use and Statistical Analysis Methods, 2nd ed. ASQC Quality Press.

Hellard, R.B. (1993) Total quality in construction projects, achieving profitability with customer satisfaction. Thomas Telford, London.

Hill, R. and Bowen, P.A. (1997) Sustainable construction: principles and a framework for attainment. Construction Management and Economics. Vol 15, pp. 223-39.

Holm. M.G. (2000) Service quality and product quality in housing refurbishment. International Journal of Quality and Reliability Management. Vol. 17, pp. 527-540.

Homburg C. and Rudolph B. (2000) Customer Satisfaction in Industrial Markets: dimensional and multiple role issues. Journal of Business Research. Vol. 52, pp. 15-33.

Hradesky, J.L. (1995) Total Quality Management Handbook. McGraw-Hill, NY.

Ireland, V. (1985) The role of managerial actions in the commercial building projects. Construction Management and Economics. Vol 3, pp. 59-87.

Jennrich, R.I. (2004). Rotation to simple loadings using component loss functions: The oblique case. (Manuscript July 30, 2004). http://preprints.stat.ucla.edu/403/revision5.pdf

Jones T.O. and Sasser, W.E. (1995) Why Satisfied Customers Defect. Harvard Business Review. Nov-Dec, pp. 88-99.

Juran, J.M. ed. (1979) Quality Control Handbook. Third edition. McCraw-Hill.

Jöreskog, K.G. and Sörbom, D. (1996) LISREL8 Users Reference Guide. Chicago: SSI, Inc.

Kamara, J.M., Anumba, C.J. and Evbuomwan, N.F.O. (2000) Establishing and processing client requirements – a key aspect of concurrent engineering in construction. Engineering, Construction and Architectural Management. 7/1, pp. 15-28.

Kanji, G.K. and Wong, A. (1998) Quality culture in the construction industry. Total Quality Management. Vol. 9 Issue4/5, pp. 133-140.

Kano, N., Seraku, N., Takahashi, F. and Tsuji, S. (1984) Attractive quality and must-be quality. Journal of Japanese Society for Quality Control. Vol. 14 No. 2, pp. 39-48.

Karim, A. and Adeli, H. (1999) CONSCOM: An OO construction scheduling and change management system. Journal of Construction Engineering & Management. Sep/Oct99, Vol. 1 Issue 5, pp. 368-378.

Kometa, S.T, Olomolaiye, P.O. and Harris, F.C. (1995) An evaluation of clients' needs and responsibilities in the construction process. Engineering, Construction and Architectural Management. Vol. 2 No.1, pp. 57-76.

Kotler, P. (2000) Marketing Management. The Millennium Edition. Prentice Hall International, Inc.

Kovàcs, G. and Spens, K.M. (2005) Abductive reasoning in logistics research. Journal of Physical Distribution & Logistics Management. Vol. 35 No. 2, pp. 132-144.

Kumaraswamy, M.M. and Thorpe, A. (1996). Systematizing Construction Project Evaluations. American Society of Civil Engineers Journal of Management in Engineering. 12, 1, pp. 34-39.

Latham, M. (1994) Constructing the Team: Final Report of the Government/Industry Review of Procurement and Contractual Arrangements in the UK Construction Industry, HMSO, London.

Lehtonen, T. (2006) Partnering Relations – Justification and Success Factors from Facilities Management Services Perspective. Dissertation - Helsinki University of Technology Construction Economics and Management - A Research Reports 7.

Leonard-Barton, D. (1992) The Factory as a Learning Laboratory. Sloan Management Review. Vol. 34 No.1 (Fall), pp. 23-28.

Levitt, B. and March, J.G. (1995) Chester I. Barnard and the Intelligence of Learning, In: Oliver E. Williamson (ed.): Organization Theory, From Chester Barnard to the Present and Beyond. Oxford University Press, Oxford, pp. 11-37.

Lin, C., Chow, W., Madu, C., Kuei, C-H and Yu, P. (2005). A structural equation model of supply chain quality management and organizational performance. International Journal of Production Economics. Vol. 6, pp. 355-365.

Liu, A.M.M. and Walker, A. (1998) Evaluation of project outcomes. Construction Management and Economics. Vol. 16, pp. 209-216.

Love, P.E.D., Smith, J., Treloar, G.J. and Li, H. (2000) Some empirical observations of service quality in construction. Engineering Construction and Architectural Management. Vol.7 No.2, pp. 191-201.

Macintosh, G. (2007) Customer orientation, relationship quality, and relational benefits to the firm. Journal of Services Marketing. 21/3, pp. 150-159.

Maloney, W.F. (2002) Construction product/service and customer satisfaction. Journal of Construction Engineering and Management. November/December, pp. 522-529.

Mbachu, J. and Nkado, R (2006) Conceptual framework for assessment of client needs and satisfaction in the building development process. Construction Management and Economics. 24, pp. 31-44.

Molinari, L.K., Abratt, R. and Dion. P. (2008) Satisfaction, quality and effects on repurchase and positive word-of-mouth behavioural intentions in a B2B services context. Journal of Services Marketing. 22/5, pp. 363-373.

Naumann, E. and Giel, K. (1995) Customer satisfaction measurement and management: using the voice of the customer. International Thomson Publishing, USA.

Niiniluoto, I (1990) Maailma, minä ja kulttuuri: Emergentin materialismin näkökulma. Helsinki: Otava. In Finnish.

Nummenmaa, T., Konttinen, R. Kuusinen, J. and Leskinen. (1997) Tutkimusaineiston analyysi. WSOY, Porvoo. In Finnish.

Normann, R. (1991) Service management. Strategy and leadership in service business. John Wiley, Chichester.

Ozaki, R. (2003) Customer-focused approaches to innovation in housebuilding. Construction Management and Economics. Vol. 21, pp. 557-564.

Palaneeswaran, E., Ng, T. and Kumaraswamy, M. (2006) Client satisfaction and quality management systems in contactor organisations. Building and Environment. Vol. 41 Issue 11, pp. 1557-1570.

Parasuraman, A., V.A. Zeithaml, and L.L. Berry. (1985) A conceptual model of service quality and its implications for future research. Journal of Marketing. Vol. 49 Fall, pp. 41-50.

Parasuraman, A., Zeithaml, V.A. and Perry, L.L. (1988) SERVQUAL: A Multiple-Item Scale for Measuring Consumer Perceptions of Service. Journal of Retailing. 64 (Spring), pp. 12-40.

Peirce, C.S. (2001) Johdatus tieteen logiikkaan ja muita kertomuksia. Valinnut ja suomentanut Markus Lång. Vastapaino, Tampere. In Finnish.

Pekkanen, J. (2005) Threats and Opportunities with Customer Relationships in Construction Projects. Dissertation - Helsinki University of Technology Construction Economics and Management - A Research Reports 5. In Finnish.

Pinto, J.K. and Rouhiainen, P. (2001) Building Customer-Based Project Organisation. Wiley. London.

Pinto, J.K. and Slevin, D.P. (1989) Critical Success Factors in R&D projects. Research Technology Management. 32 Jan/Feb, pp. 31-35.

PMBOK. (1996) A guide to the project management body of knowledge. PMI Standards Committee. Project Management Institute, USA.

Pocock, J.B., Hyun, C.T., Liu, L.Y and Kim, M.K (1996) Relationship between project interaction and performance indicators. Journal of construction engineering and management. Vol.122 No. 2, pp.165-176.

Polit D.F. & Hungler B.P. (1997) Essentials of Nursing Research. Lippincott, Philadelphia, PA.

Reicheld, F. and Sasser, W.E. (1990) Zero Defections: Quality Comes to Services. Harvard Business Review. 68, pp 105-111.

Rust, R., Zahorik, A. and Keiningham, T.L. (1994) Return on Quality. Measuring the Financial Impact of Your Company's Quest for Quality. Irwin Professional Publishing.

Salminen, J. (2005) Measuring Performance and Determining Success Factors of Construction Sites. Dissertation - Helsinki University of Technology Construction Economics and Management - A Research Reports 3.

Salonen, A. (2006) Relational Risk and Relationship Management in Facilities Management Partnerships. Helsinki University of Technology Construction Economics and Management - A Research Reports 6.

Sanvido, V., Grobler, F., Parfitt, K., Guvenis, M. and Coyle, M. (1992) Critical success factors for construction projects. Journal of Construction Engineering and Management. Vol. 118 No 1. pp. 94-112.

Saunders, J.A. (1980) Cluster analysis for segmentation. European Journal of Marketing. Vol. 14 Issue 7, pp. 422-435.

Schmidt, M.J. and Hollensen, S. (2006) Marketing Research: An International Approach. Pearson Education Limited.

Senge, P.M. (1990) The Fifth Discipline. The Art and Practice of the Learning Organization. New York, NY. Doubleday Currency.

Seymour, D. and Low, S.P. (1990) The quality debate. Construction Management and Economics. Vol.8, pp. 13-29.

Songer, A.D. and Molenaar, K.R. (1997) Project characteristics for successful public-sector design-build. Journal of Construction Engineering and Management. Vol. 123 No. 1, pp. 34-40.

Stata, R. (1989) Organizational Learning – The Key to Management Innovation. Sloan Management Review. Vol. 30 No. 3 (Spring), pp. 63-74.

Standards for Educational and Psychological Testing. (1985) Washington DC, American Psychological Association.

Storbacka, K., Strandvik, T. and Grönroos, C. (1994) Managing Customer Relationship for Profit: The Dynamics of Relationship Quality. International Journal of Service Industry Management. Vol. 5 No. 5, pp. 21-38.

Torbica, Z.M. and Stroh, R.C. (2001) Customer Satisfaction in Home Building. Journal of Construction Engineering and Management. Vol. 127 Issue 1, pp. 82-86.

Tuomi, J. And Sarajärvi, A. (2009) Laadullinen tutkimus ja sisältöanalyysi. Kustannusosakeyhtiö Tammi, Jyväskylä.

Wilson, D.T. (2000) An integrated Model of Buyer-seller relationships. In: Handbook of Relationship Marketing, (ed.) Sheth, J.N. and Parvatiyar, A. Sage Publications.

Winch, G., Usmani, A., and Edkins, A. (1998) Towards total project quality: a gap analysis approach. Construction Management and Analysis. Vol. 16, pp.193-207.

Woodruff, R.B. (1997) Customer value: The next source for competitive advantage. Journal of the Academy of Marketing Science. Vol 25 No 2, pp. 139-153.

Woodward, J.F. (1997) Construction Project Management. Getting It Right First Time, Thomas Telford, London.

Yasamis, F., Arditi, D. and Mohammadi, J. (2002) Assessing contractor quality performance. Construction Management and Economics. Vol. 20, pp. 211-223.

APPENDIX 1: RALA SURVEY

Rakentamisen Laatu RALA ry ylläpitää rakennusalan yrityksille tarkoitettua palautetietojärjestelmää. Hankepalautteen keräämisen tavoitteena on auttaa yrityksiä toimintatapojen kehittämisessä. Järjestelmään rekisteröityneet tilaajat ja toimittajat saavat mm. käyttöönsä organisaatiokohtaisen palauterekisterin.

Palautetiedot voitte lähettää RALA:an kätevimmin suoraan internet-sivumme kautta www.rala.fi tai tarvittaessa tällä paperilomakkeella. Kiitämme antamastanne palautteesta.

Tapiolan Keskustorni, 02100 Espoo p. 020 595 5110 fax 020 595 5120 www.rala.fi

30.11.2004

Palautelomake

*Toimittaja *(urakoitsija)* _____

Toimittajan Y-tunnus _____

*Toimiala *(ko. hankkeessa)* _____

Kuuluivatko urakkaan päätoteuttajan velvollisuudet: ☐ kyllä ☐ ei

Kohde _____

Osoite _____

*Kohdetyyppi _____

Hankkeen luonne: ☐ uudisrakennushanke ☐ korjaushanke

*Työlaji _____

*Tilaaja _____

Tilaajan Y-tunnus _____

Palautteen antaja *(ja puh.no)* _____

*Täyttöohjeet

Täyttäkää kaikki kentät.

TOIMIALA valitaan seuraavista vaihtoehdoista: Talonrakennus - talotekniikka - maa- ja vesirakentaminen - erikoisurakointi (kuten maalaus, päällystys) - muut rakentamisen palvelut

KOHDETYYPPI valitaan seuraavista vaihtoehdoista: Teollisuus - toimitilat - asunnot - infra - muu

TYÖLAJI RALA:n toiminto- ja työlajinimikkeistön mukaan (www.rala.fi): Talonrakentamisen runkorakennustyöt - ulko- ja sisäverhoukset - LVI-tekniset asennukset - sähkö- ja tietojärjestelmäasennukset - sillat ja liikennealueet - päällystys, louhinta ja murskaus - maarakennus - radanrakennus - vesirakentaminen - putki- ja johtolinjat - pohjanvahvistus ja -rakentamien - alueurakointi, hoito ja kunnossapito - ympäristörakentaminen - purkutyöt - kone- ja laitevuokraus ym. rakentamisen palvelut - talonrakentamisen pääurakointi - mvr-rakentamisen pääurakointi - talotekniset kokonaisuudet.

Käsite TOIMITTAJA kuvaa lomakkeessa työn toteuttanutta rakennus- tai asennusyritystä toimialasta riippumatta; TILAAJA työn tilannutta organisaatiota.

Palautekyselyn arviointiasteikko

1 = heikko, paljon parantamisen varaa
2 = välttävä, jonkin verran parantamisen varaa
3 = osa-alue toimii
4 = hyvä, osa-alue toimii hyvin
5 = erittäin hyvä, osa-alue toimii erittäin hyvin

Palautelomakkeen täyttämisen kannalta on suositeltavaa käydä arvioitavat osa-alueet yhdessä läpi hankkeen projektinjohtajan ja työmaavalvojan kanssa. Arvio tulisi suorittaa mahdollisimman pian kohteen vastaanottamisesta, kuitenkin viimeistään kuuden viikon kuluessa.

Arvioikaa yrityksen onnistumista hankkeessa seuraavilla osa-alueilla:
(kohtiin, jotka mahdollisesti eivät sovellu ko. hankkeen arviointiin, jätetään vastaamatta)

	heikko…				…erittäin hyvä
1. LAATU					
Työn sopimuksenmukainen laatu	1	2	3	4	5
Sovittujen laadunvarmistusmenettelyiden hoitaminen ja toteuttaminen	1	2	3	4	5
Itselleluovutusmenettelyn toimivuus	1	2	3	4	5
Luovutusaineiston ja huoltokirjan taso	1	2	3	4	5
Valmiusaste vastaanottotarkastuksessa	1	2	3	4	5
Vastaanottotarkastuksessa havaittujen virheiden ja puutteiden korjaaminen	1	2	3	4	5
2. YMPÄRISTÖ JA TYÖTURVALLISUUS					
Työmaan siisteys ja järjestys	1	2	3	4	5
Työturvallisuusasioiden hoitaminen työmaalla	1	2	3	4	5
Ympäristöasioiden hallinta ja osaaminen työmaalla (jätteiden käsittely, ympäristönsuojelu)	1	2	3	4	5
3. AIKATAULUN HALLINTA					
Aikataulun toteutuminen yhteisten päätösten mukaisesti	1	2	3	4	5
4. YHTEISTYÖ					
Toimittajan henkilöstön yhteistyökyky	1	2	3	4	5
Muutoksista sopiminen	1	2	3	4	5
Reklamaatioiden hoitaminen	1	2	3	4	5
Toimittajan henkilöstön tavoitettavuus	1	2	3	4	5
Tiedonkulku työmaalla	1	2	3	4	5
Toimittajan palvelutaso kokonaisuutena	1	2	3	4	5
5. TOTEUTUKSEN LAILLISUUDEN VARMISTAMINEN					
Toteutukseen liittyvien viranomaisvelvoitteiden hoitaminen	1	2	3	4	5
6. HENKILÖSTÖ					
Toimittajan työnjohdon ammattitaito	1	2	3	4	5
Toimittajan työntekijöiden ammattitaito	1	2	3	4	5
Toimittajan työntekijöiden sitoutuminen asetettuihin tavoitteisiin	1	2	3	4	5
7. TYÖMAAN JOHTAMINEN JA TOIMITTAJAN ALIHANKINNAT					
Toimittajan alihankintojen sopimuksenmukaisuus	1	2	3	4	5
Työmaanjohtovelvollisuuksien hoitaminen	1	2	3	4	5

8. LISÄTTÄVÄÄ

_____

_____

_____

Kiitos!

APPENDIX 2: RALA SURVEY TASK GROUP

Hanna Kaleva, KTI Institute for Real Estate Economics
Riitta Lehtinen, KTI Institute for Real Estate Economics
Risto Mykkänen, Etelä Suomen YH-Rakennuttajat
Kim Kaskiaro, RTK Uudenmaan piiri
Heikki Pesu, Tekmanni
Hannu Huhtala, Kuntaliitto
Erkki Ruuska, JYDA
Pekka Soini, RALA
Nina Flinck, RALA

TKK STRUCTURAL ENGINEERING AND BUILDING TECHNOLOGY DISSERTATIONS:

TKK-R-DISS-1 Seppänen, Olli
Empirical research on the success of production control in building construction projects.

TKK-R-DISS-2 Kärnä, Sami
Concepts and attributes of Customer Satisfaction in Construction.

ISBN 978-952-248-132-0
ISBN 978-952-248-133-7 (PDF)
ISSN 1797-4836
ISSN 1797-4844 (PDF)