

Managing Collaborative Design

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Managing Collaborative Design

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To Lina and Matthew

The LORD is righteous in all His ways
and loving towards all He has made.
(Psalms 145: 17)

Preface

I am delighted to present this dissertation, which is the result of my PhD research project at Delft University of Technology. The research and writing process took place next to my work as a building professional at ARCADIS, PRC Bouwcentrum and TNO. The research interest emerged when I worked at ARCADIS on several large urban projects in the Netherlands, which consisted of buildings designed by many different architects. I worked in a team that was assigned to assist the architects in developing the conceptual design. We carried out tasks to integrate design ideas, decisions, and drawings during collaborative design that involved multidisciplinary designers and advisors, consortia of stakeholders, and various departments of the local authorities. While doing this, I experienced the complexity of collaborative design, especially during the conceptual architecture design phase, in which the client's wishes and requirements were translated into architectural design concepts. The design actors were engaged in creative teamwork for developing the design ideas. I observed the difficulties in stimulating and steering creative teamwork, making decisions and taking actions in a dynamic design process.

I found an opportunity for conducting PhD research at the Department of Real Estate and Housing (RE&H), Delft University of Technology (TU Delft), through Prof. Hans de Jonge, Dr. Matthijs Prins, and Ir. Koos Vercouteren. We decided that the research was to be carried out under the theme architectural design management. Like elsewhere in the academic world, architectural design management is considered a relatively new field in our department. As the field is still developing, there are opportunities to explore different perspectives and paradigms.

I started my research by conducting exploratory case studies to present a description that might help people to better understand the practice of collaborative design. Subsequently, I looked into the literature of several disciplines to find theories that could be used to clarify the problem and the approach for managing collaborative design.

All through the research process and upon its completion, I want to thank God for His blessings. He has also given me a real privilege to meet many friendly people who have supported me through all the ups and downs.

I am especially grateful to Prof. Hans de Jonge and Dr. Matthijs Prins who acted as supervisor and adjunct supervisor of this PhD research. Special thanks goes to Ir. Koos Vercouteren for his advice and support throughout the research process. I would also like to extend my gratitude to the members of the Doctoral Examination Committee: Prof. Erik Andriessen, Prof. Petra Badke-Schaub, Prof. Joop Halman, Prof. Colin Gray, and Ir. Floris Alkemade. Furthermore I would like to express my appreciation to all experts who have given their views on my research in personal interviews, at panel discussions, during presentations, or through correspondences.

Many thanks to my colleagues in the department of RE&H, especially to the PhD researchers, for the colloquia and the conversations that helped me to enhance my understanding of scientific paradigms and research methodology. My appreciation also goes out to RE&H secretariat staff, Cecil, Marja, Ada, Shanti, Angie, Anuschka, Annette, and Marjolein, for their assistance in the research administration and the publication of this dissertation.

I owe my thanks to Ton Damen for trusting and guiding me in managing international research projects. I would like to thank PRC Bouwcentrum where I learned about and gained experience in project management, research, and consultancy. I also want to extend my gratitude to ARCADIS for the years I worked there during which I was engaged in interesting building projects that were useful as case studies for my research. I would especially like to thank TNO and my current colleagues at TNO with whom I work in various research and consulting projects.

Living in the Netherlands has been a heart-warming experience for me since there are friends to rely on. I thank all my friends for their presence and friendship. I am very blessed to have Mom, Dad, and my brother, Edwin, who are always with me in heart and prayer. Thank you for sustaining me through all times in life. Last, but certainly not least, I truly thank my wife, Lina, and our son, Matthew for all the support they have given me.

I hope that all readers of this dissertation, both practitioners and scientists, will find some value in my research for their practice and research. I also hope my research will make a contribution to building the body of knowledge of architectural design management, as well as to encourage future researchers to carry out further scientific studies to elaborate the research subject and to enrich the research outcomes. My appreciation goes out to all readers who are willing to give me constructive feedback from their knowledge and experience.

Delft, 1 May 2007,

Rizal Sebastian

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Managing Collaborative Design

Chapter 1

Introduction

CHAPTER SUMMARY

Collaborative design in a building project is inevitable as the project becomes more and more complex while many problems are ill-defined and widely cross-functional beyond the capacity of any individual to comprehend. This research looks into the collaborative design in the conceptual architecture design phase, especially during the elaboration of the masterplan and the development of the preliminary building designs.

As many people from different organisations and with different competencies are involved in collaborative design, the collaborative design process itself becomes complex. Managing collaborative design in the conceptual design phase is, therefore, timely and important. However, there is still a lack of comprehensive study concerning how collaborative design is initiated and managed in the conceptual architecture design phase, and how the management approach affects the design achievements.

This research is descriptive and it has two main aims. First, to describe the characteristics and difficulties of collaborative design, and the challenges for managing collaborative design; and second, to present a concept for managing collaborative design focusing on the conceptual architecture design phase of a building project. A description of the characteristics and difficulties of collaborative design and the challenges for managing it will provide an insight into current practice. A concept for managing collaborative design will be useful for professionals to reflect on and improve the way of managing collaborative design.

A part of the research consists of exploratory case studies. Four recent projects in the Netherlands, in which multiple architects from different firms are involved, are selected and examined. The projects are: De Resident in The Hague, Nieuw Stadshart in Almere, Oosterdokseiland and Mahler4 in Amsterdam. Another part of the research is built up of literature survey over recent studies on design management in architecture and relevant theories from other disciplines. Based on the empirical and theoretical analysis, a concept for managing collaborative design, which includes a model and several management principles, is presented. .

The research outcomes are verified using expert opinions and a case study of collaborative design in the design competition for Ground Zero / New World Trade Center in New York.

1.1 Background and problem description

Collaborative design in a building project is inevitable as the project becomes more and more complex while many problems are ill-defined and widely cross-functional beyond the capacity of any individual to comprehend. Such problems cannot be solved by simply combining partial solutions or merging individual efforts. Such problems can only be dealt with by an assemblage of people who understand them from different perspectives and provide cross-functional solutions.

Barlow (1990) sees a design team as an interdisciplinary ad hoc creative team. In such a group, the members ought to let go of the sectorial boxes, share information, and experiment with different perspectives and models in order to comprehend the complex problems and solutions. Barlow illustrates this using an old story "The Blind Men and the Elephant". In the story, there were several blind men who touched different parts of an elephant's body and they argued about what an elephant looked like. Interestingly, each blind man was reasonably accurate in describing the specific parts they encountered, yet wrong in their total perception. They never came to the description of what a whole elephant was. Thus, the correct total perception can only be achieved through integrating and synthesising and not by merging individual conclusions.

In a complex building project, collaborative design is important since it allows more alternative solutions to appear as design problems, requirements and solutions are examined from a wide array of viewpoints, multilevel perspectives, and multidisciplinary expertise. In teamwork, other team members may stimulate and improve individual creativity. The design process could therefore, benefit from collective creativity. Collaborative design may become an interactive learning opportunity as one can reflect on what and how others do in designing.

Collaborative design in a complex building project is also important as a way to involve all design actors and stakeholders directly and actively, so that the design can better address and affect their values and expectations. Through good collegial communication and mutual relationship, collaborative design can build a common commitment of all parties towards the design. In other words, all parties possess the sense of involvement and responsibility of the design quality and the success of the project as a whole. In some cases, collaborative design may become the starting point of sustainable partnering in future building projects.

The research presented here, looks into collaborative design in the conceptual architecture design phase, especially during the elaboration of the masterplan and the development of the preliminary building designs. In the conceptual architecture design phase, the architects usually hold the key role in the design process, in direct consultation with clients, local authorities, and multidisciplinary specialists. The activities in the conceptual architecture design phase aim at understanding the requirements and inventing the design concepts. This phase is relatively short compared to the overall project course, but it is very important to lay down the principal design ideas and decisions for the whole project.

As many people from different organisations and with different competencies are involved in the conceptual design phase, the collaborative design process itself becomes complex. Therefore, managing collaborative design in this phase is timely and important. In practice, many professionals and researchers believe that it is possible to improve the current attempt to manage collaborative design. However, no one has a sufficient insight into the complexity of the collaborative design process to be able to identify the core problems and the way in which it should be managed.

The academic world of architecture considers design management as a relatively new knowledge field. The existing knowledge is fragmented and experimental. Until now, there has been a lack of comprehensive study on the process of collaborative design, especially concerning how collaborative design is initiated and managed, and how the management approach influences design achievements.

A few studies relating to collaborative design in the conceptual design phase can be found in the field of urban design. Van Rossem (1996) observed De Resident project in The Hague, the Netherlands, and described the role of the architects in shaping the urban space through collaborative design. Kitao (2005) observed a number of large building projects in Japan and analysed the 'collective form creation' resulted from the consensus between the 'master architect' and 'block architects'. However, Van Rossem and Kitao carried out research from an urban design viewpoint rather than design management. Their focus was on the design products –the urban space and architectural forms– rather than the process of collaborative design. The design process was only described to a limited extent, i.e. in terms of reporting the activities during the design phase according to the project chronology or historical context.

1.2 Research aim

This research is descriptive and it has two main aims. First, to describe the characteristics and difficulties of collaborative design, and the challenges for managing collaborative design; and second, to present a concept for managing collaborative design focusing on the conceptual architecture design phase of a building project. A description of the characteristics and difficulties of collaborative design and the challenges for managing it will provide an insight into the current practice. A concept for managing collaborative design will be useful for professionals to reflect on and improve the way of managing collaborative design.

A further scientific relevance of this research is how it may provoke revealing insights that will extend the horizon of design management in architecture. This research reviews recent literature on design management in architecture, analyses relevant theories from other disciplines and investigates how to transfer these into design management in architecture. A wider discussion that follows the outcomes of this research may present a guiding image for future research to build the body of knowledge of design management in architecture.

1.3 Overall research methodology

The key research question is: How to understand and manage collaborative design in the conceptual architecture design phase of a building project.

Collaborative design is comprehensive, as it comprises many interdependent issues and factors, which cannot be isolated to be understood separately. Therefore, the subject of investigation should include processes, actions, and meanings of people, which are not to be rigorously examined or measured in terms of quantity, amount, intensity, or frequency. Hence, this research adopts qualitative and constructivist methods as described by Denzin et al (2000), Miles et al. (1994) and Yin (1994). It examines collaborative design in the actual setting and through the meaning people bring to it.

A part of the research consists of exploratory case studies. Exploratory case study is a kind of case study that does not need to have any proposition (Yin, 1994). This is the condition – which exists in experiments, surveys, and other research strategies – in which a topic is the subject of exploration. Instead of propositions, the design for an exploratory case study states its purpose as well as criteria by which an exploration will be judged as successful. For the exploratory case studies in this research, four recent projects in the Netherlands, in which multiple architects from different firms are involved, are selected and examined. The projects are De Resident in The Hague, Nieuw Stadshart in Almere, Oosterdokseiland and Mahler4 in Amsterdam.

Another part of the research comprises a literature survey of recent studies on design management in architecture and relevant theories from other disciplines. Based on the empirical and theoretical analysis, a concept for managing collaborative design, which includes a model and several management principles, is presented. The research outcomes are evaluated using expert opinions and supported by the observation of the collaborative design in the case of a design competition for Ground Zero / New World Trade Center in New York.

The overall methodology including the logical linkages between the research parts are presented in Figure 1.1. Further explanation of these figures is as follows.

This research was initially inspired by the personal interest and experience of the researcher in complex building projects that involved multidisciplinary and international design teams. The preliminary problem identification is based on the practice as perceived by the researcher, as well as the quick scan of relevant literature. Findings from the preliminary research phase showed that there was an increasing complexity in collaborative design in the conceptual architecture design phase. This made managing collaborative design a timely and important research subject, moreover, since there is a lack of rigorous knowledge and expertise in the field of design management in architecture for managing collaborative design in the conceptual design phase.

A wider and deeper study of recent literature on design management in architecture is presented in Chapter 2. This research categorises the existing design management approaches according to their focus on the design actors, processes, or products. This research examines to what extent these approaches are relevant for managing collaborative design in practice.

To describe and analyse the practical problems and context of collaborative design in the conceptual architecture design phase of a building project more comprehensively and more deeply, empirical research through multiple case studies is conducted. Four case studies are used and presented in Chapter 3. The investigation focuses on understanding the characteristics of collaborative design, the difficulties of the process, and the challenges for design management to tackle the difficulties. Data collection consists of interviews with professionals directly involved in the building projects.

Literature research into relevant theories in other disciplines is necessary since some essential knowledge for managing collaborative design cannot be found in the literature in architecture. Chapter 4 gives an overview of the relevant theories that are selected. Subsequently an analysis is made of how these theories can be transferred to design management.

After a thorough investigation of the practical situation and the theoretical knowledge, this research takes its own viewpoint to understand the heart of managing collaborative design. This is then explained in Chapter 5.

Using this viewpoint, and based on the empirical and theoretical analysis, this research introduces a concept for managing collaborative design, as explained in Chapter 6.

The main results of this research are twofold: a case-based description of collaborative design in practice, and a concept for managing collaborative design. Neither of these are 'hard products' that can be quantitatively measured and tested. So, in an attempt to verify the research outcomes, expert opinions and an additional case study are used. The experts are asked whether the description in this research of collaborative design applies beyond the cases studied earlier in this research, and whether the concept for managing collaborative design adequately addresses the essence of collaborative design and contributes to the attempts to improve its practice. The verification of the description and the concept is presented in Chapter 7.

In chapter 8 final conclusions are drawn and the results of the research are discussed. In this chapter, it is explained how the research answers the key research question. The results of the research are synthesised. Possible further developments of these results and the relation of this research to a wider discussion in the knowledge field of design management in architecture are then given.

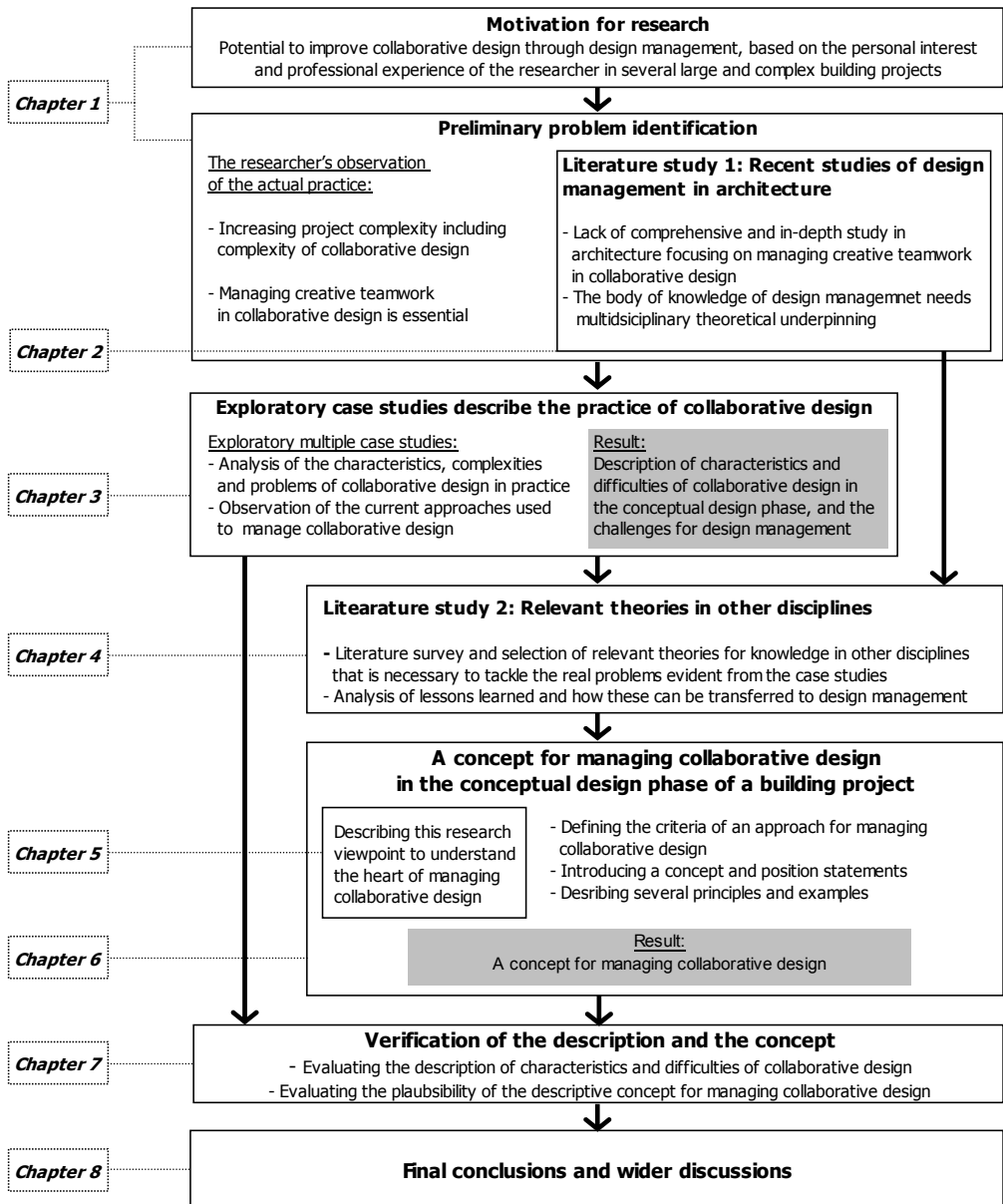


Figure 1.1 Research scheme

1.4 Working definitions

The definitions as listed here are working definitions used specifically as descriptions or terms of reference in this research.

- Collaborative design

Collaborative design is a process in which actors from different disciplines share their knowledge about both the design process and the design content (Kleinsmann, 2006). In this research, the term of collaborative design is used in the context of the conceptual architecture design phase of a building project.

In collaborative design, collective designing can take place. This means that idea generation does not only take place as a secluded creative process (a 'black box') by an individual designer, but also through interactions with the other design actors. In collaborative design, multiple architects and multidisciplinary specialists are appointed to contribute to the creation or refinement of the masterplan and to work together in the elaboration of the masterplan and the development of the preliminary building designs. These design actors share their interpretation of the general and particular problems of the project, rather than each one interpreting the problems of their own parts. Certain parts of the project, usually the connecting space or the articulation between buildings, are developed together. Individual vision and ideas are discussed, criticised, and improved in design workshops, in which there is an informal teamwork atmosphere that stimulates the creativity through face-to-face dialogues and direct decision-making.

- Conceptual architecture design phase

This research uses the term of conceptual architecture design phase to recognise a stage in the building design process in which the design requirements and programme are translated into architectural design concepts in the masterplan and the building designs. In some literature, this phase is known as sketch design prior to preliminary design. This phase is relatively short compared to the overall project course, but it is very important to lay down the principal design ideas and decisions for the whole project. The core activity in this phase is design idea generation.

The design actors involved in this phase are architects, urban designers, multidisciplinary engineers and design specialists, project managers, representatives from the clients and local authorities, and supporting staff. During the design idea generation in this phase, the architects usually hold the key role in the design process, in direct consultation with the clients, local authorities, and multidisciplinary specialists.

- Design and management

This research discusses design management in the context of collaborative design in the conceptual architecture design phase of a building project.

Many people still consider design and management as two poles apart. This perception holds back the attempt to progress with design management. Therefore, this research investigates the similarities between design and management in the way of thinking and working in the conceptual architectural design phase of a building project.

Design is a social process (Dorst, 2003; Bucciarelli, 1994 and 2003; Buchanan, 2001 and 2004). Design is attached to people – the designers and the users. Design is an activity that takes a combination of competencies (implementational, improvisational, creative, and intellectual; as written by Allinson (1997)) that are exhibited by people. Design affects the social environment as it fulfils the human needs for space and aesthetics (Vitruvius, transl. 1999; Popov, 2002).

Management is a social process too (Drucker, 1999; Simon, 1960, 1969 and 1987). Management cannot be seen apart from people – the managers and the people in the organisation. Although what a manager has to be able to do can be learned, it is the vision, dedication, experience, personal integrity, and character of the managers that determines the success. People, rather than forces or facts, manage. Management works with people. Management is needed to hold the society of organisations together and make them work.

Design and management have a common ground if they are acknowledged as social process. Design and management are knowledge intensive human activities that work with and within uncertain situations, to deliberately initiate and devise creative processes for shaping a more desirable reality (Simon, 1969; Jones, 1970).

- Design management

In the line of the definition that design and management are social processes, design management for collaborative design is viewed as a participative role in designing, rather than an authoritative function in the project structure. In this capacity, the one who plays the role of a design manager acts more like a peer rather than a superior leader. It provides consultations to the designer, rather than giving instructions or commands. A design manager plays an important role as a catalyst that opens, stimulates, and guides the mutual interaction between the design actors' idea generation processes.

In the conceptual design phase, design management does not only steer and support collaborative design in problem solving, but also problem finding. It is not the steering of activities and resources towards static and pre-defined goals or requirements, but rather the critical examination and reformulation of both the requirements and solutions in an iterative process. It is not merely an effort to find the single best solution, but a reflective action during the searching process.

- Design actors, design processes, and design products

This research recognises three main aspects of managing collaborative design, namely: design actors, design processes, and design products. The case studies and literature

are analysed through these three aspects. Other writers also recognise these three aspects in design management. Otter and Prins (2001) consider the constituent elements of people, processes, and objects. Badke-Schaub (2004) refers to the capabilities of the designers, the process of designing, and the outcomes. Hoskin (2004) writes that management can be viewed as organisation structure, process, and content. Buchanan (2001) sees design as shaping the values and responsibilities, the world of actions, and the subjects. Design actors in the context of this research represent the professionals in the design team, particularly those involved in design idea generation. The design actors are practitioners with their collective and personal goals, knowledge, and behaviour. The design processes in this context are understood as the design activities performed by the design actors. The design products are the results of these design activities by the design actors.

1.5 Dissertation structure

This PhD dissertation is structured in eight chapters that reflect the interdependency of the research processes, analyses, and results. The title and short description of each chapter are listed in Table 1.1.

Following the introduction in Chapter 1, Chapter 2 reviews recent literature on design management in architecture. Chapter 3 analyses the exploratory case studies to describe the practice of collaborative design and to identify the difficulties and challenges. Chapter 4, 5, and 6 are dedicated to literature studies that are intended to transfer relevant knowledge from the other disciplines into a process of developing a concept for managing collaborative design in the conceptual architecture design phase of a building project. In Chapter 7, the outcomes of this research are verified using expert opinions and another case study. Finally, the final conclusions of this research and the wider discussions are presented in Chapter 8.

Each chapter opens with a subchapter “Introduction” that describes the methodology used for the particular research part.

Chapter title	Description
1. Introduction	The first chapter of this dissertation is a general introduction to the research. It presents the research subject, the importance and goal of the research, and the research design.
2. Recent literature on design management in architecture	Design management in architecture is considered a rather new knowledge field. This chapter reports the latest developments of academic research on design management to understand and review its strengths and weaknesses for managing collaborative design.
3. Exploratory case studies	This chapter presents the analysis of the exploratory case studies of four building projects in the Netherlands. Based on the empirical evidence, the characteristics and challenges of collaborative design are described, and the inadequacy of the current attempts for managing collaborative design is identified.
4. Learning from other theories	This chapter examines relevant theories from the other disciplines beyond architecture and project management, and the way to transfer the knowledge into design management in architecture.
5. Understanding the heart of managing collaborative design	This chapter underlines a socio-psychological viewpoint to complement the technical rationality in managing collaborative design. It presents a study to understand the heart of design, management, and design management, and to seek the scientific paradigm for managing collaborative design.
6. A concept for managing collaborative design	This chapter introduces a concept for managing collaborative design in the conceptual architecture design phase of a building project. The concept includes a model and several principles for managing collaborative design supported with practical examples.
7. Verification of the research outcomes	This chapter verifies the results of the research using expert opinions and supported by another case study.
8. Final conclusions and wider discussions	This chapter synthesises the research outcomes and discusses the wider relevance of the research.

Table 1.1 Outline of PhD dissertation

Managing Collaborative Design

Chapter 2

Recent studies on design management in architecture

CHAPTER SUMMARY

This chapter reviews recent literature on design management in architecture in the context of managing collaborative design. It may be considered as one of the first attempts to review the literature by categorising the existing design management studies according to their focus on the design actors, design processes, or design products.

Recent studies on design management that mainly focus on the design actors include the systematic decision-making approach, which investigates ways to optimise the design decision-making process using mathematical calculations for optimising decisions; and the organisational-protocol approach, which is concerned with the internal and external management of a design office.

Recent studies on design management that mainly focus on the design processes include the design-methodological approach, which sees design processes as an interplay of several methods, and provides a transparent and systematically structured encyclopaedia of scholarly methods; and the engineering-instrumental approach, which considers a design process as a rational problem-solving mechanism employing systems thinking and includes methods, tools, and techniques to coordinate design tasks and information.

Recent studies on design management that mainly focus on the design products include the value, performance, and quality-measure approach, which stresses the creation of objects to meet aesthetic and functional expectations in use, as well as economical and technical requirements in production.

Most approaches are fragmented and seem to focus on the processes around designing, the outputs of the processes, and the organisations and systems that support designing. Most of them overlook the creative activities by the design actors. The design actors are only addressed in formal, structured, and systematic ways, which may neglect the subjective judgement and creative thinking that are essential in collective designing.

2.1 Introduction

In the past, the management of a building project was one the main tasks of an architect. Yet, due to the growing size and complexity of building projects and due to specialisation, project management has been separated from architectural design. Moreover, since architectural design has become very complex beyond the capacity of one architect to handle all processes, there is a need to manage design. This has led to the emergence of design management in architecture.

The term design management was firstly introduced and has become widely known in the fields of product design, corporate design, and marketing. In these fields, design management departs from artistic and business-commercial viewpoints. The background of design management in architecture is different from design management in the abovementioned fields. Design management in architecture was introduced by experts of construction engineering and construction management. It departed from an engineering viewpoint.

Until now, different terms are used to address design management in architecture. Paul Nicholson of the University of Nottingham coined the term 'architectural management' in the 1980s. According to him, architectural management comprises the management of the architectural design process; encompasses the management of the design practice and the coordination role; and extends to the management of the building project and includes construction dispute resolution (Nicholson, 1995). In addition to Nicholson, there was an initiative among academics to establish the Working Commission W096 of CIB (International Council for Research and Innovation in Building and Construction) to network academics and professionals interested in design management through series of conferences and publications.

This research categorises the recent studies on design management in architecture (generally in the last fifteen years) according to their focus on the design actors, design processes, or design products. These three aspects in design management are also recognised by other writers. Otter and Prins (2001) consider the constituent elements of people, processes, and objects. Badke-Schaub (2004) refers to the capabilities of the designers, the process of designing, and the outcomes. Hoskin (2004) writes that management can be viewed as organisation structure, process, and content. Buchanan (2001) sees design as shaping the values and responsibilities, the world of actions, and the subjects. Design actors in the context of this research represent the professionals in the design team, particularly those involved in design idea generation. The design actors are practitioners with their own collective and personal goals, knowledge, and behaviour. The design processes in this context are understood as the design activities performed by the design actors. The design products are the results of these design activities by the design actors.

In reviewing the recent studies on design management in architecture, which is relevant in the context of collaborative design, this research selects up-to-date literature that is widely referred to in the academic world of architecture and project management.

2.2 Design management focusing on the design actors

The literature review finds that recent studies on design management in architecture, which focus on the design actors, mainly discuss two approaches: the systematic decision-making approach and the organisational protocol approach.

The systematic decision-making approach works with systems and tools to optimise decision-making processes in design. It generates instruments for decision-making using computational algorithm and mathematical formulations. Much research develops design management approaches with its root in the design method and systems thinking approach that emerged in the 1960s and has been used in many different fields. The literature review carried out in this research focuses on the implication of design method and systems thinking specifically in design management approaches, rather than discussing the philosophy behind such thinking.

Loon (1998) and Gunsteren and Loon (2001) rely on mathematical programming to recognise the design problem, define the boundaries of the solution area, and explore the edges of solution to pursue the optimisation. Their studies refer to operations research and devise a number of models for various types of decision-making problems. The basic structure of this can be illustrated by quite a simple model of linear programming. For the multi-actor decision-making process, known as inter-organisational design, the design optimisation approach is used to measure the alternative solutions against the parameters assigned on the requirements of each party and the influencing conditions.

Among many studies related to systematic decision-making for design processes, there is research on Design and Decision Support Systems (Vries et al, 2001). The current research activities include the modelling of decision-making and choice behaviour under bounded rationality, and the interactions between the multiple actors involved in planning and design decision processes.

Another approach, the organisational protocol approach, deals with the management of a design office and the relationships between the architects and the other project participants. This approach considers the organisational processes in a design office like a 'production line' where the demand from the market (client order) is acquired; the collaboration with the other parties is formalised; the requirements are analysed; the jobs are assigned to the personnel; and the design ideas, drawings, prototypes, and models are developed and delivered to the clients.

There are many studies, practical and academic, on managing the business and organisational aspects of a design firm. One of the recent studies is by Doorn (2004) that demonstrates how the internal management of a design office should accommodate the architects' necessity of freedom and autonomy by a horizontal and relatively flexible project-based organisational structure. The organisational processes in a design office reflect the unique nature of the architect profession and the building project. In a design office, there are usually two types of manager functions: the chief architect and the corporate manager. The chief architect carries the reputation of the office and is in charge of the projects. The corporate manager – who is usually known as the one exercising design management – runs the organisation, directs the 'production line', controls the office and project administrations, and establishes the contractual relationships with the other parties.

The organisational protocol approach also discusses the management of the external relationships between a design office and other project participants, which applies to design briefing and design contract management. There is much research on contract management, which includes the discussions of the professional codes of practice governed by the (local) architect association, the contractual and procurement types, and the legal terms related to the assignment of an architectural firm. In one of the recent studies on these issues, London (2002) reports the implications of applying a stakeholder analysis to the development of a design management model for performance-based briefing. The model is developed from the viewpoint of construction management and facility management. The model considers the relationship between the user-stakeholder and producer-stakeholder, and the stakeholders' decision roles, and finds two important dimensions: the extent of control and the extent of influence. Studies on how to regulate the relationship between clients and designers have also been carried out, among others, by Lavers (1992), Bell (1995), and Cheetam (1998).

2.3 Design management focusing on the design processes

The literature review finds many recent studies on design management in architecture have their focus on the design processes. These studies can be distinguished into the design methodological approach and the engineering instrumental approach.

The design methodological approach relies on scientific methodology based on empirical or logical knowledge to facilitate the design activities. It sees various design processes as an interplay of several methods. It provides rules, methods, and transparent and systematically structured encyclopaedia of scholarly methods that are expected to assist an individual architect to access and point out the methodological components during his design study or research (Jong et al, 2002). The design methodological approach particularly aims at individual designers who traditionally manage and optimise their own design processes. In the context of managing collaborative design, this approach tends to assemble explicit design knowledge that can be translated into process methodology.

There are different views on the methodology of design process. Lawson (1994) gives an example of broadly known methodology of design process. The design process is generally held to consist of a problem being stated, then analysed; a solution being synthesised and evaluated; followed by a process of communication. This view of design as a sequence of assimilation, analysis, synthesis, evaluation, and communication, is also supported by the Royal Institute of British Architects (RIBA) in its stage-model of design practice. Some other writers suggest that somehow the whole design process is iterated at increasing levels of detail as the designer is assumed to move from the general to the particular.

Another approach focusing on the design processes, the engineering instrumental approach, is based on the construction engineering thinking. The engineering instrumental approach considers a design process mainly as rational problem-solving mechanism. This approach includes methods, tools, and techniques to coordinate design tasks and information. It has three dimensions: programming facilities, constructional issues, and inter-agency coordination (Gray et al, 2001).

Within the engineering instrumental approach, a design process is seen as a technical complex system that includes inter-dependent subsystems. The management principally tries to disentangle the design process into typical activities, whereby, usually, the result is a

formalised and reproducible step-by-step description. The engineering instrumental approach employs systems thinking introduced by Simon (1960) to take out the parts, which can be well defined, and solve them separately.

Within this approach, a design process is also compared to the conversion from input to output, the value generation, and the flow of information (Koskela et al, 2002; Ballard et al, 1998). Design is a process that transforms the client requirements (inputs) into the design objects (outputs). It is a process where values for the customers are created through the fulfilment of their requirements. Design is also a flow of information, which has to be controlled and distributed effectively in time and space to eliminate wastes or inefficiencies. The design process is to be managed using task management, value management, and information management.

When no one can predict the results beforehand, the design process can be considered to be open-ended in nature. In general, it this approach assumes that a process will only be managed properly if the results are consistent with the objectives and characteristics determined beforehand. Since at the outset, the end-result of the design process is vague, design management has to focus on clarifying the outcomes step-by-step. Since, moreover, it is not entirely known how the process will be structured; design management also has to focus on setting-up and altering it (Loon, 1998). Therefore, the engineering instrumental approach extends to the modelling of the multidisciplinary building design process and to the (re)designing of the process (Friedl, 2002).

Design management creates models and infrastructure of the design process to establish which activities should be performed by whom and when. Gray et al (2001) and Austin et al (2001) present a process map of design management. The process map shows a flow chart that systematically states and links the roles, actions, and outputs by the main actors to the definition of requirements, design process, and design management in each stage of a building project, from business case until construction. Prins et al (2001) emphasise the iterative nature of the design process and describe how design management works in a cyclical form, altering between setting-up the strategy, formulating the process layout, and directing the process.

Allinson (1997) and Tunstall (2000) are among those who attempt to transfer project management instruments for the use by architects. They present management instruments for planning, monitoring, and controlling the design process. They aim to help architects to program and frame their design activities using one or more network planning techniques, such as: Gantt (Bar) Chart, Fishbone Planning Diagram, Work Breakdown Structure (WBS), Critical Path Method (CPM), Project Evaluation and Review Technique (PERT), and Transformed Relationships Evolved from Network Data (TREND). Allinson and Tunstall also explain the basic principles of monitoring techniques, such as the Time Sheet and Earned Value Analysis; and the controlling techniques related to costs, risks, and time using the methods of Activity-Based Costing (ABC), Value Engineering, Benchmarking, and Fee Scale.

Besides transferring existing instruments from project management, particular instruments for design management are developed. Ballard et al (1998) and Koskela et al (2002) have developed the Last Planner Concept for an effective and efficient coordination of tasks, information, and quality requirements. They refer to the workflow management, concurrent engineering, and lean construction. Austin et al (2000) have generated a multi-stage method to understand the interdependencies between the design activities in order to overcome the weakness of more conventional management methods, which do not allow the effect of variations and delays within the iterative design process. The heart of the

Analytical Design Planning Tool (ADePT) is a Dependency Structure Matrix (DSM) analysis. The design activities are listed orderly and the dependencies between them are identified in the matrix. The matrix and the priority of activities can be repeatedly re-scheduled to achieve the purpose of maximizing the availability of information required and minimizing the amount of iteration and the size of any iterative loops within the design process. In line with this, Lahdenpera et al (2000) have used DSM in their attempt to create a design management system based on the process optimisation and proactive strategy. They aim at a proactive anticipation of the required design information. These design management routines are expected to control the data and the documents.

Other instruments of design management are designed to optimise communication and the utilisation of the information. Among recent studies, Heintz (1999) proposes a design coordination tool based on the effective communication mechanism between different parties in the design process. He describes design coordination as managing the dependencies between design activities and the information flows required to carry out those activities among a variety of agencies, firms, institutions, or bodies involved in a design project.

2.4 Design management focusing on the design products

The literature review finds that research on design management in architecture that focuses on the design products mainly discusses the way of managing design by measuring the value, performance and quality of design objects. Supporters of the design management approach that focuses on the design products assert that the most important mission of design management is to assure that design can realise buildings that are able to meet the aesthetic, functional, economical, and technical requirements while in use and during production.

The value, performance and quality approach holds design management responsible for the definition of the values to be met, the translation of them into a design brief, and the guidance of the designers so they are able to understand them. Prins et al (2001) and Chang et al (1998) describe this as creating and steering the values and the key performance indicators. Design management is supposed to facilitate the creation and realisation of the architectural values to meet the stakeholders' expectation.

In relation to economic value, the design management approach that focuses on the design products refers to real estate and property management, particularly in accommodating market considerations of building function and location into a design programme.

In terms of building technology, design management attempts to assure the achievement of high performance and high quality buildings, including the constructability and the efficiency during future utilisation (Emmitt, 1996). By assessing the building performance, the value, performance and quality approach supports the thinking and working in terms of ends rather than means (CIB W060, 2002).

In relation to aesthetic quality, design management evaluates the spatial and architectural harmony of a building and its urban environment before a building permit can be issued (Boer, 2001; Graaf, 2001; Winsemius, 2001; Talstra, 2003).

2.5 Relevance for managing collaborative design

In this part of the research, the recent studies on design management in architecture, which were described in prior sections, are reviewed in terms of their relevance in the context of managing collaborative design.

Review of the management approaches focusing on the design actors

The approaches focusing on the design actors mainly comprise a decision-making mechanism and an organisational system. The systematic decision making approach relies on what is supposed to be an objective or rational judgement. In the actual practice of collaborative design in the conceptual architecture design phase, mathematical optimisation for decision-making is not always able to cope with the socially influenced uncertainties, political compromises, and multi-dimensional complexities. Not all considerations can be plotted using system parameters. This is actually the reason why successful managers are those who are not only rationally intelligent, but who are also able to appropriately use professional skills, experience, and intuitive judgement for communication and negotiation with other parties.

Another approach focusing on the design actors is the management of a design office, which is oriented to the business administration and the formal inter-organisational relationship based on rigid rules. Here, design management is not directly involved in the creative activities in collaborative design. Design management is exercised by the office manager whose responsibilities are to assure the availability of the human resources and support facilities needed by the leading architect, as well as the sufficiency of time and budget to carry out the design assignment as stipulated in the contractual agreement. Design management only takes a facilitating and supporting role to the activity of architectural designing.

Review of the management approaches focusing on the design processes

Much literature on design management in architecture concentrates on the design process. This research categorises the existing studies into: the design methodological approach and the engineering instrumental approach. These approaches are developed by the design theorists and construction engineers that aim at achieving an optimal sequence of design tasks, the effective distribution and coordination of design information, and the elimination of loss of efficiency and quality. Experts developing these approaches see design processes as a set of interrelated activities at different levels that are to be structured and synchronised.

In the context of managing collaborative design in the conceptual architecture design phase of a building project, the effort of the design methodological approach to make all design activities explicit before selecting a method for managing these activities is more successful in theory than in practice. The design methods and process models are difficult to apply because most building projects are one-off and unique, and creative designing is less suitable for rigid and generic methodology.

One of the limitations of the design methodological approach is the fact that architects rarely design according to predefined procedures (Lawson, 1994). Lawson draws our

attention to the fact that most architects are at their best when designing, rather than explaining. Of course, architects must sell their services in a marketplace and so they may not always describe their processes honestly. When they like a solution, architects are amazingly creative in imagining the 'logical' processes that lead to that solution. While only a few architects find themselves able to articulate a clear statement about their processes, most are not able to recognise these (over-simplistic) models. Lawson goes further by saying that many models and methods of design process seem to have an almost unassailable logic and would probably have appeared quite convincing to those who are not personally involved in the act of designing. However, while the methodologists gather at conferences to discuss the finer detail of such ideas, practising architects were quietly ignoring them and getting on with the business of design.

Lopez-Mesa (2004) finds that when designers use explicit methods, the results are not always satisfying, and that this dissatisfaction is sometimes caused by a mismatch between the explicit methods used and the design problem. Therefore, the key to successful use of methods cannot be by prescribing steps, but by properly educating designers who understand the need for good design practices, who know where to find good practice examples when required, and who know how to adapt or even redefine good practice examples to specific situations without risking the reliability of results. Thus, design methods are only suitable if the potential users feel a need to use them. The use of methods is dependent on the individual and his needs.

Another weakness of the design-methodological approach for managing collaborative design is that the methodologists intend to study design activities as an object for theoretical modelling rather than a subject for design management practice. Its research focus on the elements and logical structures of design activities serves academic purposes rather than professional practice.

Another approach focusing on the management of design processes is the engineering instrumental approach, which offers various tools for design management. However, if these tools are to be applied for managing collaborative design in the conceptual architecture design phase of a building project, some weaknesses may prevail. For many construction engineers who develop this approach, design is rather a problem-solving process that has to be tamed, rationalised, and structured. Therefore, they attempt to reduce the design complexities and uncertainties by dividing design processes into systems and subsystems that are simple enough to be managed. However, by doing this they may not divide the complexity, but are more likely to obstruct the collective creativity in collaborative design that is needed to understand complex problems and interrelated solutions.

Despite many enhancements, many instruments and methods of design management are largely a spin-off from project management methods. Perhaps, various instruments, tools, and techniques of design management are more suitable for application during the design development and construction phases, in which control and efficiency become the highest priorities, rather than during the conceptual architecture design phase. This phase is very dynamic. It is not always possible to foresee and identify all entities of the task to be systematically linked. In collaborative design in this phase, the design problems are often ill defined. Such problems cannot be statically formulated at the beginning to be resolved by the mechanical problem-solving instruments. Most of them cannot be identified by clear algorithms because there are non-congruent dynamics of the sub-systems. Moreover, they are often vague expressions about a change of some kind, which is needed or desired, rather than a clear statement about a totally defined goal (Lawson, 1994). In a complex project, the definition of the problems, constraints, criteria, and solutions are yet to be

determined in the course of the process (Akin, 1986). In this situation, design management is primarily expected to facilitate the creation of a conducive environment for creative exploration rather than rigidly plan and control the process step-by-step (Friedl, 2002).

Furthermore, design management tools and support systems based only on systematic rationality and logical analysis may neglect some important factors in designing, such as ethics and subjective judgement. Finally, focusing mainly on the processes may contain a weakness since there is no guarantee that if the process is well managed, the results will be excellent.

Review of the management approaches focusing on the design products

The approaches of design management that focus on the design products address the design products in terms of their value for the clients, building parties, and communities; their functional and technical performance during construction, occupation, and maintenance; and their architectural and urban spatial quality. The value and performance concept for design management has become an interesting subject among academics, but its practicality is still lacking.

To apply this approach for managing collaborative design in the conceptual architecture design phase of a building project, one of the barriers is that the definition of value and performance is not clear. In practice, value and performance are often perceived differently by the project participants. Value and performance may continuously change during the course of the project and its aftermath. Value and performance are also under the influence of the leadership, physical and social environments of the project, as well as the development state of the design products. All of these make value and performance too ambiguous to be translated into design management measures. In science, there is an ongoing debate on a coherent definition of value and performance.

Furthermore, if design management is confined to the ends rather than the means, it may overlook the thinking process and creation process in collaborative design in the conceptual architecture design phase, through which the initial demands are assessed and the solutions are generated. If the processes prior to the production of the design products are poor, any effort to manage the products will never arrive at satisfactory solutions to the real problems.

2.6 Conclusions

This chapter presents a literature survey of recent studies on design management in architecture. These studies have been reviewed in the context of managing collaborative design in the conceptual architecture design phase of a building project. These studies are categorised according to their focus on the design actors, design processes, or design products. These three aspects are the main aspects of design management used for analysis in this research.

Much research on design management in architecture has been carried out in the last fifteen years. Various methods, systems, tools, and instruments have been developed. This shows that design management research is timely and important among academics. However, it is not clear whether the academic knowledge has been successfully applied in practice.

Design management in architecture is still considered as a rather new knowledge field. Most approaches are based on experiments in academic research. Many approaches are not practical since many assumptions behind the development of design management by academics deviate from the actual practice. This is indicated by Heintz (2000) in Table 2.1.

Theoretical assumptions used in design management literature	Actual practice of collaborative design
There is a definition of the project (its extent, etc.) that is shared by all participants.	The participants have widely divergent definitions of the project. They 'begin' and 'finish' the project at different times, produce different sorts of products, and reckon success in different ways.
The participants share a common set of desired outcomes or goals.	Participants choose and hold goals associated with the project independently.
There is little potential for conflict between the goals of the participants.	There is no guarantee that the goals held individually and collectively by the participants will be consistent. Usually, there will be several goals that directly contradict one another.
The participants will disclose all relevant information fully and accurately (this has led to the development of technical-systematic planning and control tools).	Participants in collaborative building projects often regard their information as a bargaining or professional advantage. Disclosure is often incomplete or strategically controlled in order to gain a manipulative advantage within the design group.
There is an objective and universal point of view from which design projects can be managed.	No one actor has the absolute, objective, correct point of view. All actors in collaborative building design are already imbedded in a social process and possessed of their individual goals, motivations, and procedures.

Table 2.1 Differences between the assumptions used in design management literature and the actual practice of collaborative design (Heintz, 2000)

Furthermore, much of the knowledge of design management in architecture is not directly compatible for managing the collaborative design in the conceptual architecture design phase of a building project. The reasons are twofold. First, to date there is a lack of research on design management in the conceptual architecture design phase of a building project. Second, little attention is given to the creative activities by the design actors in collaborative design during the conceptual architecture design phase. Most approaches of design management in architecture seem to focus on the processes of designing or on the organisations and systems that support designing, but overlook the core of designing that is the creative activity by the design actors. Therefore, research on managing collaborative design should give more attention to the design actors with their creativity and teamwork.

Managing Collaborative Design

Chapter 3

Exploratory case studies

CHAPTER SUMMARY

Exploratory case studies are conducted in this research in order to understand the characteristics and difficulties of collaborative design, and to investigate the challenges in managing collaborative design. Multiple case studies are used, namely: De Resident in The Hague, Nieuw Stadshart in Almere, Mahler4 and Oosterdokseiland in Amsterdam.

The exploratory case studies focus on the conceptual architecture design phase of the multi-architect building projects, especially during the elaboration of the masterplan and the development of the preliminary building designs. From the analysis of the findings, three characteristics come up consistently in all projects, namely: the masterplan as a platform for collaborative design, the way the design team is composed and the informal design leadership, and the creative design workshop for collective designing.

Furthermore, the exploratory case studies show that the difficulties of collaborative design are related to technical and social complexities. The technical complexity is caused by complex requirements of an integrated multifunctional project. The social complexity is due to the involvement of a large number of stakeholders, the conflicting goals of these stakeholders in the project, the limited information to obtain insight in the process, and the unclear long-term consequences of decisions.

In the design team particularly, the social complexity of collaborative design in the conceptual architecture design phase is related to the closer and more intensive interactions between the design actors. The design actors share their interpretation of general and particular problems of the whole part of the project, rather than each one individually interpreting the problems of their own part. Individual vision and ideas are discussed, criticised, and improved in design workshops. Certain parts of the project, usually the connecting space or the articulation between buildings, are developed together. Differences in perspective, cognitive style, knowledge, culture, value, and behaviour make collaborative design socially complex.

The case studies show that the success of collaborative design is greatly influenced by how group dynamics is managed in the design team. Social complexity in collaborative design may not be really new, but its importance has not been adequately addressed and dealt with by design management.

3.1 Introduction

Multi-architect building projects as relevant case studies on collaborative design

Singular glory is a thing of the past (Yang, 2004). Architecture firms – big and small, young and established, independent and corporate – are collaborating to create new design models, in project and in practice. The idea that architecture is shaped by one all-powerful creative genius is slowly starting to dissipate as built realities become more complicated. Recently, many high-profile design teams have emerged to take on large and complex public projects. For large-scale urban development undertakings such as the Ground Zero, the High Line, the East River Waterfront, speculative projects for New York's Olympic bid, and others, pooling talent has become 'de rigueur', if not 'en vogue'.

Building projects which involve multiple architects from different design firms and sometimes different nationalities are emerging around the globe. These architects are asked to collaborate with each other in designing different buildings that are interconnected within an integrated urban complex, in order to create a rich architectural composition. The design variety, if harmonically organised, is expected to achieve true enrichment in architecture that displays a lively and dynamic impression of the city. In this research, such project is called a multi-architect building project.

A multi-architect building project is usually of key importance and expected to meet high political, economic, and cultural ambitions of various public and private stakeholders. The project consists of different buildings with different functions, designed by different architects, but closely interconnected (there are architectural, technological, or structural overlaps) within an integrated building complex. In terms of aesthetic and spatial quality, each project aims to present a composition of a variety of design by different leading architects worldwide to create exceptional architecture. In such project, the architects are not restrictively assigned to develop a strictly defined part of the project under rigid design guidelines, but given the opportunity to discuss the masterplan and the design of other buildings, and if necessary to propose amendments of certain parts of the project through consensus.

A multi-architect building project serves as an ultimately relevant case of complex collaborative design that needs to be appropriately managed. Moreover, since such project is at the highest level of significance and complexity, it may address various issues and difficulties related to collaborative design. In this sense, the analysis and conclusions of the research on such project are expected to serve as valuable lessons for other projects.

Based on the abovementioned reasoning, four recent multi-architect building projects in the Netherlands were selected for exploratory case studies. These are De Resident in The Hague, Nieuw Stadshart in Almere, Oosterdokseiland in Amsterdam IJ-Oever, and Mahler4 in Amsterdam Zuidas. The project information is summarised in Table 3.1. In addition to the relevance of multi-architect building projects as case studies for research on collaborative design, the selection was also based on the practical considerations of the available resources and time in this PhD research, as well as the personal interest and professional experience of the researcher in these projects.

Project name	De Resident	Nieuw Stadshart	Oosterdokseiland	Mahler4
Location	The Hague	Almere	Amsterdam	Amsterdam
Project type	Inner city redevelopment	New inner city development	Inner city redevelopment	New urban area development
Period	1988-2002	1990-2008 (est.)	1995-2009 (est.)	1994-2008 (est.)
Functions	- Offices - Apartments - Retails - Parking garage - Public squares	- Offices - Apartments - Retails - Parking garage - Public squares, water park - Leisure facilities - Hotel - Theatre - Library	- Offices - Apartments - Retails - Parking garage - Public squares - Leisure facilities - Hotel - Conservatorium - Library - Trading centre - Congress centre	- Offices - Apartments - Retails - Parking garage - Public squares - Leisure facilities
Clients	- Municipality of The Hague - MAB	- Municipality of Almere - Almere Hart, joint venture between MAB and Blauwhoed	- Municipality of Amsterdam - MAB	- Municipality of Amsterdam - Mahler4 Consortium, joint venture between G&S, ING, Fortis Real Estate
Architects in design team	10 architects: Rob Krier, Michael Graves, Cesar Pelli, Adolfo Natalini, Sjoerd Soeters, Bert Dirrix, Gunnar Daan, Peter Drijver, Thon Karelse, Frank Cardinal	29 architects: a.o. Rem Koolhaas, William Alsop, Kazuyo Sejima, Christian de Portzamparc, Kees Rijnbout, Renee van Zuuk	12 architects: Dietmar Eberle, Rab Bennetts, Albert Herder, Gerald Maccleanor, Jo Crepain, Jeroen van Schooten, Jo Coenen, Frits van Dongen, Erick van Egeraat, Rein Jansma & Mosché Zwarts, Matthew Heywood, Henri Bava	9 architects: Rafael Vinoly, Toyo Ito, SOM, Michael Graves, FOA, Architecten Cie, Erick van Egeraat, UN Studio, Bosch Architecten
Architectural supervisors	Kees Rijnbout, Rob Krier, Sjoerd Soeters	Q-Team, consists of Maarten Schmitt, Rem Koolhaas, Michael van Gessel, Arnold Reijndorp, Tania Concko	Kees Rijnbout, Michael van Gessel, Erick van Egeraat	Pi de Bruijn
Technical coordinator	Arcadis	Various advisors	Various advisors	Ove Arup

Table 3.1 General project information of the case studies

The main thrust of all four projects is the combination of office, residential, and commercial functions. Added to these are public open spaces, leisure and cultural facilities, and parking garages that connect all buildings on the underground level. All projects are built at urban centre locations, and thus, address the issues of urban development. All projects are developed based on public-private partnerships between the municipalities and private real estate developers.

A private client, MAB, is involved in three of the four projects in the case studies. This was not one of the case study selection criteria. There are only a few recent multi-architect

building projects in the Netherlands. The involvement of MAB in several projects shows its particular interest and strategy in developing such type of project. Despite the involvement of the same client, different approaches were used for managing collaborative design in different projects. Different MAB representatives were also involved in different projects. Therefore, this is not a factor that obstructs the analytical comparison between the cases.

Furthermore, the number of architects involved in each project is around ten, except for the Nieuw Stadshart in Almere. Despite the fact that the project in Almere involves almost thirty architects and covers a much larger urban area, it serves the same relevance for studying collaborative design in the context of this research since the most important collaborative design processes occur between a fewer number of architects designing integrated buildings in parts of the project. On this scale, the collaborative design can be compared to that in the other three cases.

Case study as a research strategy

Case study can be recognised as a research strategy to develop detailed and intensive knowledge about a situation, individual, group, or question whereby the real physical and social context of the case is considered (Robson, 2002; Yin, 1994; Christiaans et al, 2004). Case study is a suitable strategy to answer 'how' and 'why' research questions in research about a subject in daily practice. Case study gives the researcher the possibility to consider the reality through a holistic way, including the internal and external processes, links, and structures. This is in contrast to, for instance, a laboratory experiment focusing on investigating rather isolated variables with the emphasis on a static generalisation based on random sampling.

In this research, case studies were conducted to understand the characteristics and difficulties of collaborative design, and the challenges in managing collaborative design. Because of the comprehensive subject and complex context of the investigation, a fully specified problem or hypothesis cannot be stated in the beginning of the research. Therefore, exploratory case studies were used.

The exploration was based on multiple case studies. The main reason for using multiple case studies was that the combination of cases might result in relevant insight to answer the research question. With the use of multiple case studies, Yin (1994) calls the underlying logic of 'replication': a number of cases from which similar findings can be expected (literal replication), or a number of cases from which contradictory results can be expected based on predictable reasons (theoretical replication).

In this research, the case study data were mainly collected through exploratory and open interviews with the project participants, supported by project reports, documentation, and field observation during the professional involvement of the researcher in the projects. According to Yin (1994), interview is among the most important data sources for a case study. Through interview, individual opinions and perceptions can be obtained. As a form of interview, open interview is used. According to Robson (2002) and Christiaans et al. (2004), open interview is an example of qualitative research interview, which is appropriate to be applied when investigating the meaning of a specific phenomenon.

During the interviews in this research, open questions were used as reference leading to various aspects of the research subject. At the same time, the researcher reserved sufficient flexibility to explore different viewpoints used by different respondents in looking at the

research subject. Since direct questions do not always deliver the required information, some 'how' questions were used to lead to the answer of the 'why' questions. During the interviews, the researcher also asked questions regarding facts, personal behaviour, opinions, and standpoints.

In this research, the case study data obtained included the 'tangible' aspects of the projects, e.g. the project brief, scope of assignment, organisation structure, design process, and project results, as well as the 'intangible' aspects related to the project participants, e.g. the personal visions and goals regarding the project, interpretation of successes and failures, experience of collaborative design, appreciation and criticism of design management, and future expectations. The respondents were interviewed individually. Each interview took 1 to 1.5 hours, and focused on one of the four cases in which the respondent was directly involved. Besides these cases, the interview was opened to references in other relevant projects according to the experience of the respondent.

A number of professionals that represented the key actors in the conceptual architecture design phase were selected for the interviews. These included architects, urban designers, architectural supervisors, project managers, representatives of the clients and local authorities, and researchers.

After each interview, interview reports were made. These reports were considered as verbal reports which were supported by other information sources (project documentations, articles, etc.). This was the basis for the case study analysis. Whenever this dissertation refers to a situation in a case, or arguments from a respondent, the name of the case and the name and function of the respondent are stated, as far as it is possible. Arguments that are publicly sensitive and do not contain essential information for this research are not included in this dissertation. The brief summary of the results of the interviews can be found in Annex 1.

The data obtained and analysed in this research were by nature qualitative. An advantage of qualitative data is that they are rich in meaning, in contrast to abstract quantitative data. A disadvantage is that large amount of qualitative data is more difficult to be systematically processed and analysed. There is no standard method to analyse qualitative data, yet Robson (2002) has taken an attempt to lay down some references for a systematic way for qualitative data processing (Wynia, 2006). Such systematic way for qualitative data processing is a requirement, but not a guarantee, for scientific quality of the research.

As an analysis method, the template approach was chosen. In the template approach according to Robson (2002), initial categories are defined. This gives a certain structure to the data and is used as 'template' for the analysis. The categories can be adjusted during the analysis process. This method often uses matrices, diagrams, tables, and network schemes. The analysis method as described by Robson is, among others, inspired by Miles and Huberman (1994). They see qualitative data analysis based on a flexible research subject as a very suitable method for identifying mechanisms in a complex reality. Robson states that the combination of a flexible way of qualitative data processing and systematic data processing will assure adequate cogency.

3.2 Overview of the projects

De Resident in The Hague



Architects from upper-left clockwise: Cesar Pelli, Michael Graves, Sjoerd Soeters, Rob Krier, Adolfo Natalini, Frank Kardinal, Peter Drijver, Thon Karelse, Gunnar Daan, Bert Dirrix

Figure 3.1 De Resident in The Hague

The urban complex De Resident is located at the historical inner city of The Hague, the Netherlands. The urban renewal programme contains various functions, namely office space (115000 m²), retails (4000 m²), housing (315 units), an underground parking garage for 800 cars, and three open public spaces. The development took a total period of almost fourteen years, starting from the initiation in 1988 by the Municipality of The Hague and the Dutch Government Building Agency, to the delivery of the last block in 2002. The development was undertaken by MAB, a major private developer in the Netherlands, supported by Bouwfonds Property Finance. Ten well-known Dutch and foreign architects were involved in the design of the masterplan and the buildings, namely: Rob Krier (Austria), Michael Graves (US),

Cesar Pelli (US), Adolfo Natalini (Italy), Sjoerd Soeters (NL), Gunnar Daan (NL), Bert Dirrix (NL), Peter Drijver (NL), Thon Karelse (NL), and a landscape architect Frank Cardinal (NL). The architects were supported by ARCADIS, an engineering firm which made detail and construction drawings for all buildings.

De Resident had the mission to be a multifunctional urban renewal, a renovation to transform an inner city part of The Hague from an urban 'no man's land' or simply a connecting route, into a convenient place to live and work. The architecture design referred to the historical background and architectural tradition of The Hague, which had grown organically reflecting the architectural richness of a European city. The development was also meant to strengthen The Hague's position as an international institutional and business centre at the global and regional economy network.

The chronology of the development process can briefly be described as follows. The preparation of the urban plan and masterplan took place from 1988 to 1993. De Resident was a public-private partnership project. The Government Building Agency and the Dutch Railways owned parts of the site. The site was designated as one of the key area developments under the supervision of the Chief Government Architect. In 1988, the Municipality of The Hague, the Dutch Government Building Agency, the General Civil Servants Pension Funds, and the Dutch Railways commissioned Rob Krier, an Austrian architect and urban designer, to carry out an urban design study of the area development in the city centre of The Hague, which included the site of De Resident. In 1990, it was decided to commission Rob Krier together with four Dutch architects (Sjoerd Soeters, Gunnar Daan, Bert Dirrix, and Peter Drijver) to carry out the further study under the supervision of Kees Rijnboutt, the Chief Government Architect at that time. From January to April 1991, seven design workshops were held. These resulted in an urban design plan.

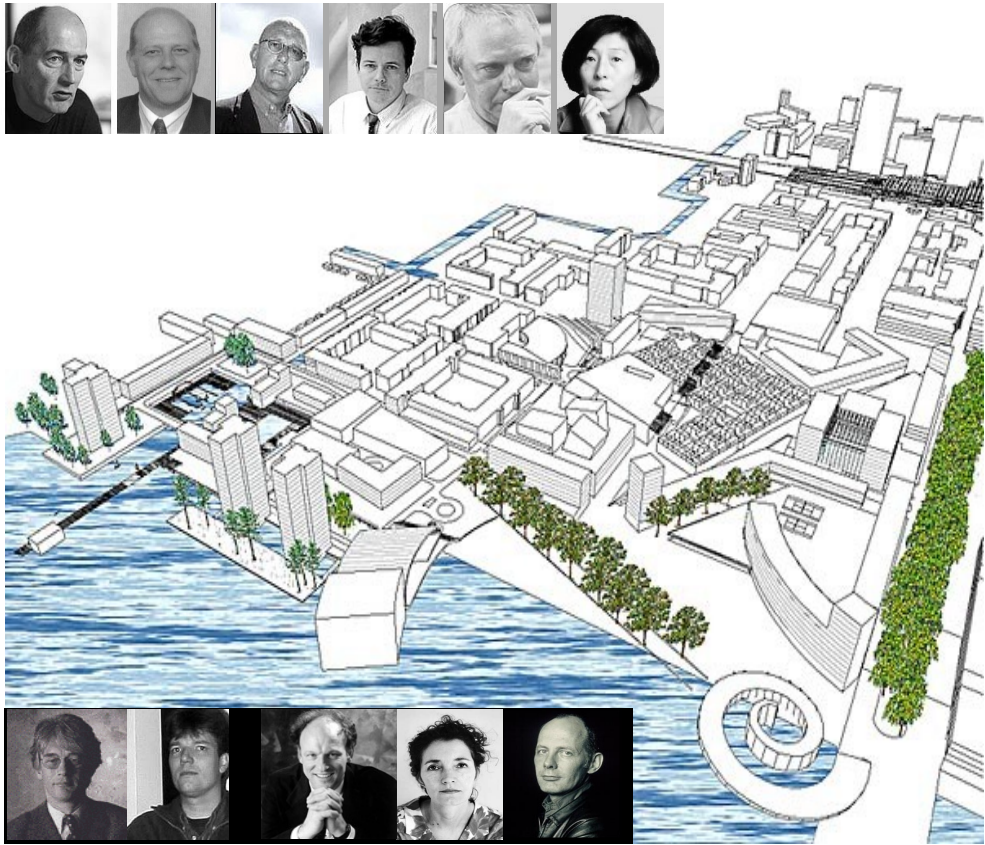
The project coincided with the governmental decision to allow market parties a greater participation in government accommodation in public-private partnership. MAB, a private real estate developer, was initially appointed as a development advisor. In the early 1992, it was agreed to work out a development plan and to appoint MAB as the real estate developer. MAB assigned three international architects (Michael Graves, Cesar Pelli, from USA and Adolfo Natalini from Italy) and another Dutch architect (Thon Karelse) to join the design team. Several design workshops were held from February to October 1992. These resulted in the masterplan that was approved by the city council in December 1992. Following this, the building design stage started in 1993 and continued until 1998. Two architects (Rob Krier and Sjoerd Soeterds) were elected supervisors of the design team next to Kees Rijnboutt and were asked to improve the masterplan and write the design guidelines. In October 1993, the first plenary meeting was held and a landscape architect (Frank Cardinal) was appointed. An engineering firm (ARCADIS) was commissioned to work out the technical design and all detailed drawings up to the construction stage. Each architect was assigned to design certain blocks. Regular meetings were arranged between each block architect and the supervisors while plenary meetings were held twice during the preliminary design stage and twice during the design development stage. After the design development stage, meetings between each architect and the supervisors were arranged on ad hoc basis.

The construction of the first block began in 1995. The project as a whole was completed in 2002. De Resident marked an urban development in The Hague that was fully completed as expected. Formerly, The Hague had always been known for its history of stagnation with half-finished urban projects (Maarten Schmitt, interview).



Figure 3.2 Some buildings in De Resident in The Hague (source: www.voormolenbouw.nl)

Nieuw Stadshart in Almere



Several architects from upper-left clockwise: Rem Koolhaas, Wil Alsop, Kees Rijnboutt, Christian de Portzamparc, David Chipperfield, Kazuyo Sejima, Ben van Berkel, Caroline Bos, Frits van Dongen, René van Zuuk, Mels Crouwel

Figure 3.3 Nieuw Stadshart in Almere

Almere is a relatively new town in the Netherlands. It is a part of the Southern Flevoland, the last area of the IJsselmeer polders, which has been developed since 1968. The city of Almere was originally meant to alleviate the housing shortage in the surrounding cities, especially Amsterdam. It was developed as a multi-core or poly-nuclear city. Residential districts were built around these cores, each with their own individual character, while green areas were left open between these cores. The first residents of Almere settled in their new homes in 1976. Currently, Almere is expanding in terms of population and area, and becoming the fifth biggest city in the Netherlands. Besides providing housing, employment opportunity in the city becomes a consideration in order to reduce the commuting traffic. Thus, Almere is also growing as an economic centre.

In response to the rapid growth, a new city centre needs to be developed. The development of a completely new large-scaled urban complex is unique compared to any other city in the

Netherlands. The new development consists of office space (120000 m²), retails (65000 m²), housing (930 units), leisure facilities including a theatre and a hotel (17000 m²), a public library, an underground parking garage (for 2500 cars), four open public squares, and a water park. The development was initiated in 1990 and the completion is planned to take place in 2008. Two private real estate developers, MAB and Blauwhoed Eurowoning, have established a partnership called Almere Hart to undertake the development.

A multifunctional city centre is expected to provide the residents of Almere with a full range of diversified facilities, and to lead Almere to become a complete city with metropolitan status. The main objectives of the development are to reinforce the economy, to broaden the urban platform, to build a more attractive and active urban centre with better accessibility by cars, and finally to make a more lively city. The new city centre will be the centralisation and accumulation of communal activities, such as recreation, shopping, working, and living for the growing population with increasing income level. It should meet the existing demand and anticipate the future one. Hence, the location was chosen at the centre point of the city hierarchically and geographically. Furthermore, the new city centre must be able to reinforce the identity of Almere as a new city by presenting an innovative and radical architecture. It aims to establish top quality architecture for international recognition and to strengthen the economy of the city. These were some of the reasons why various renowned architects were selected to shape the masterplan and the building designs.

The project as a whole involved almost 30 architectural firms. Among them were the Dutch architects: Rem Koolhaas and Floris Alkemade (OMA), Frits van Dongen (De Architecten Cie), Kees Rijnboutt (De Architectengroep), Maarten Groeneveld (ZZ+P Architecten), Hans Witt (OIII Architecten), Marc a Campo (ADP Architecten), Bjarne Mastenbroek (SeARCH), Cees Dam, Winy Maas, René van Zuuk, Erna van Saambek, Frank van Waes, UN Studio Van Berkel & Bos, Benhtem & Crouwel Architecten, Meyer & Van Schooten, Claus & Kaan Architecten, Groosman & Partners, Brouwer Steketee, Wiegerinck Architecten, S333 Architecten, and DS Landschaparchitecten. Next to the Dutch architects, there were also foreign architects working on the project: Kazuyo Sejima, SANAA (JP), William Alsop (UK), David Chipperfield (UK), Christian de Portzamparc (FR), La Noir et Courrian (FR), Michel Desvigne Payagiste, DPLG (FR), and Gigon & Guyer (CH).

The chronology of the development process can be briefly described as follows. The urban planning and the masterplan design were carried out between 1990 and 1997. The Municipality of Almere took the initiative to develop the new city centre and commissioned a project leader to manage the process. The mission statement consisting of the objectives of the development was presented in a city council resolution in 1992. Further studies conducted in 1993 resulted in another city council resolution in March 1994, which defined the basic requirements and the starting points for the urban design. Following this, four architecture firms were invited to join the design competition. At the end of 1994, Rem Koolhaas with his Office for Metropolitan Architecture (OMA) officially won the competition and received the commission to design the masterplan. Subsequently, City Centre Development Corporation was established as a municipality body in charge of the project. In February 1995, the city council released a resolution about the vision of the masterplan. MAB and Blauwhoed Eurowoning were then selected as the real estate developers. During the feasibility study phase that followed, the Municipality of Almere, OMA, MAB, and Blauwhoed worked together to refine the urban design concept to become a masterplan.

OMA decided on a radical approach that introduced a completely different scale to Almere: a mega-structure that concentrated all the required uses into separate layers on top of the

existing infrastructure. OMA abandoned the existing grid structure with its horizontal separation of infrastructure and development, opting for vertical zoning instead (Provoost, 1999). However, MAB had serious doubts about OMA's plan, as it was found not convivial. Since the direction of the development of the masterplan was not clear and the progress was not fully satisfying, MAB released the "10 Points Notes" in September 1995 that clarified the functional requirements to be met in the masterplan. MAB specifically criticised the curved ground level, the deviation from the grid structure, the lack of vistas towards the water, the uncanny atmosphere of the parking garage, the lack of new shopping concepts, and the quality of the residential environment.

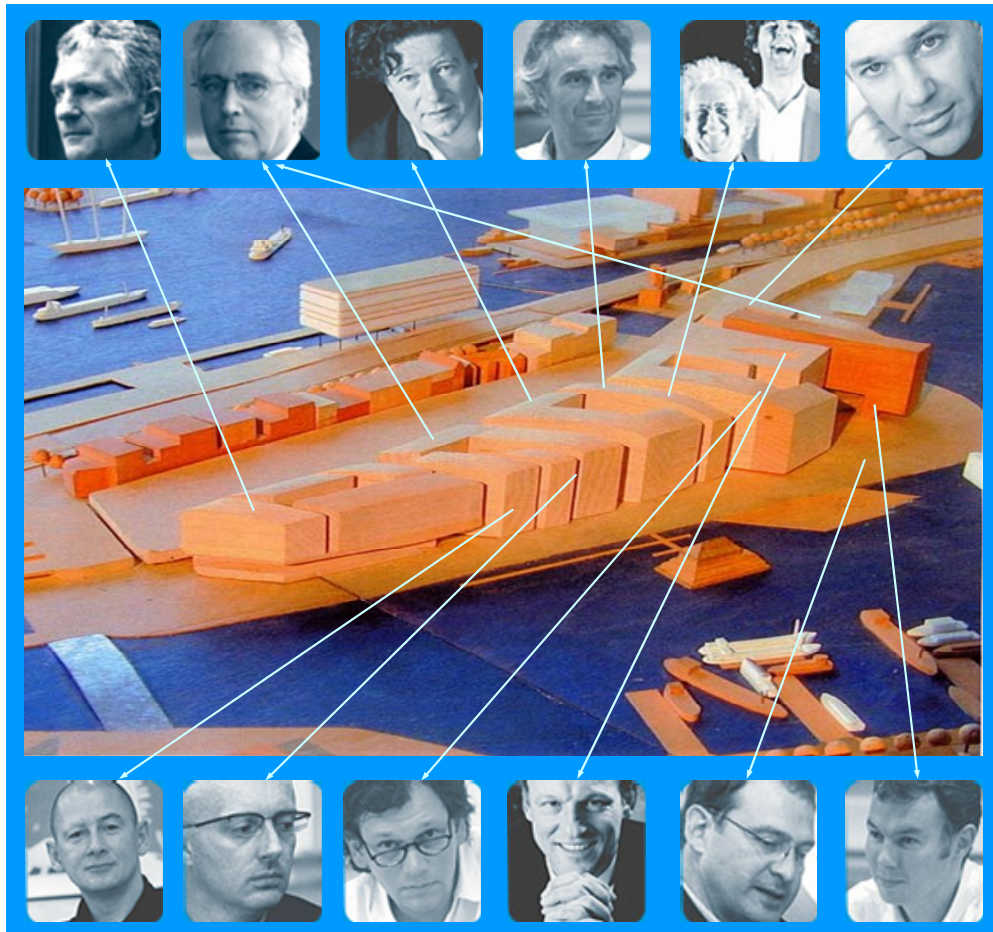
OMA responded by trying to prove that its vision could satisfy MAB's demands. OMA demonstrated how the grid continued across the curved ground level, how a vista would be created from the curved ground level to the water, how the programme above and below the curved ground level could be connected by means of sunken and raised sections, and how the curved ground level was linked on all sides to the existing surroundings. As the study for the masterplan went further, the feasibility report was released in 1996, and the masterplan was officially accepted in 1997.

The building design stage began in 1997 following the finalisation of the development and zoning plans. The architects for the building blocks were then selected. The design activities took place within the design team of each block under a centralised coordination. The construction of the underground parking garage started in 1999. The project is to be delivered in phases, starting from the urban entertainment centre in 2004 until the completion expected to take place in 2008.



Figure 3.4 Some buildings in Nieuw Stadshart in Almere
(source: Office for Metropolitan Architecture)

Oosterdokseiland in Amsterdam



Architects from upper-left clockwise: Rab Bennetts, Dietmar Eberle, Jo Crepain, Jeroen van Schooten, Rein Jansma & Mosché Zwarts, Erick van Egeraat, Matthew Heywood, Henri Bava, Frits van Dongen, Jo Coenen, Gerald Maccreanor, Albert Herder

Figure 3.5 Oosterdokseiland in Amsterdam

Oosterdokseiland is part of the series of man-made islands at the Southern IJ River Bank. It is situated at the commercial heart of Amsterdam, directly connected to the city centre and central railway station. The redevelopment project of Oosterdokseiland contains office space (82000 m²), international network trading facilities, hotel and congress facilities (30000m²), retail shops, cafes, and restaurants (17000m²), public library, conservatorium and leisure facilities (44000m²), housing (300 units), two open public squares, and an underground parking garage for 1500 cars and 500 bicycles. The architectural design team consists of Dutch architects: Erick van Egeraat, Frits van Dongen, Jo Coenen, Jeroen van Schooten, Albert Herder, Gerard Maccreanor, Rein Jansma and Mosché Zwart; and foreign architects:

Rab Bennetts (UK), Matthew Heywood (UK), Henri Bava (France), Dietmar Eberle (Austria), and Jo Crepain (Belgium). These architects represent 12 architecture offices.

The project aimed at realising a waterfront inner-city redevelopment. It intended to promote Amsterdam to become the world's fifth congress city in the global economy network. At the same time, by targeting at international communities as future users and by presenting international architectural quality, the project would give a significant impulse for revitalising the inner city of Amsterdam as an international business, commercial, and cultural centre. Furthermore, Oosterdokseiland was a part of the Southern IJ River urban renewal project, which was intended to restore the historical waterfront between the city of Amsterdam and the IJ River. In the past, Amsterdam had grown to become a big city through the benefit of the city's location at the IJ River, however, the city's waterfront was broken by the construction of the railway station in the 19th century.

The development process of Oosterdokseiland can briefly be described as follows. In 1995, the Municipality of Amsterdam published a policy note that established the basis for improving the relation between the Southern IJ River Bank and the inner city. In 1998, the municipality organised a competition involving selected real estate developers. MAB in partnership the architect Erick van Egeraat (EEA) won the competition with a development proposal and a masterplan of an integral mixed-used urban complex. Several urban design workshops were subsequently organised involving MAB/EEA and the Municipality of Amsterdam (representatives of the Department of Spatial Development and the municipality board). In 2000, these workshops delivered the main result: the programme of requirement consisting of the guidelines for an urban skyline, urban space allocation or zoning plan, expected technical quality, and possible traffic arrangement.

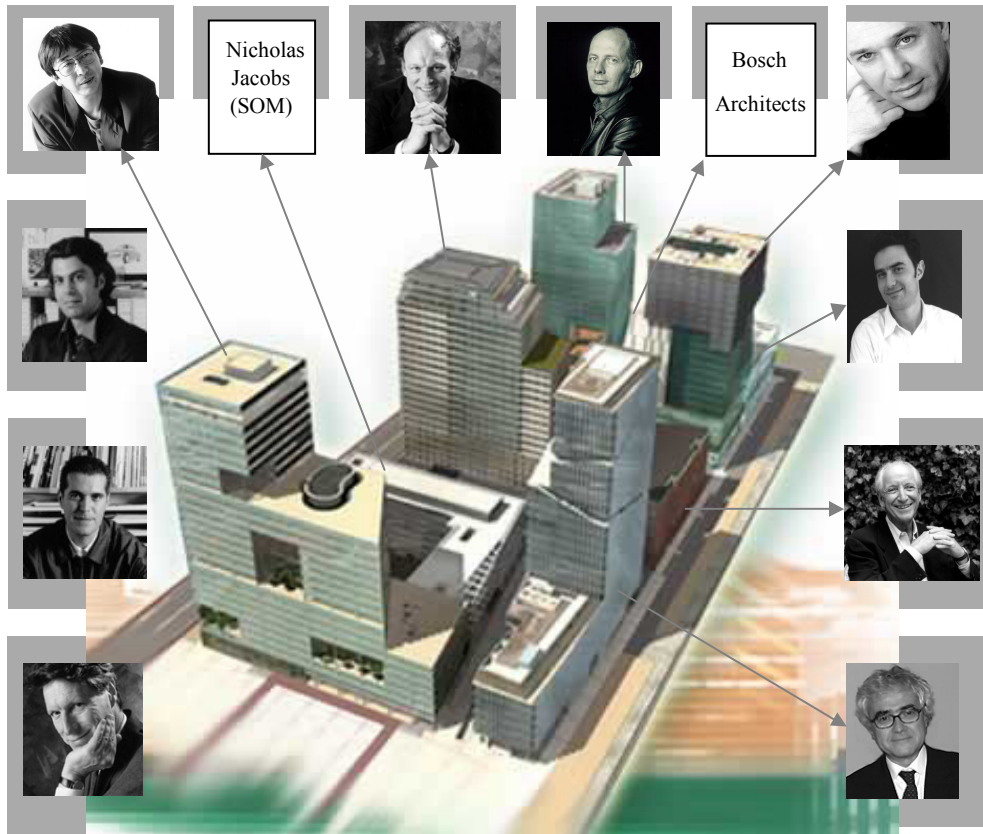
For the selection of architects for different buildings, MAB/EEA listed the candidates and consulted with Kees Rijnboutt, the architectural supervisor of IJ River Bank development. Besides, European tender procedure was used to select the architect of the conservatorium building. In 2001, a number of Dutch and foreign architects were commissioned by MAB and subsequently the architectural design process was started. Until the beginning of 2002, there were five design workshops involving all architects, specialists, managers, and the clients. These workshops resulted in preliminary building and landscape designs of Oosterdokseiland. During the design development phase that followed, each architect elaborated the individual building or block in close consultation with the architectural supervisor, the project leaders from MAB, and the building specialists.

The construction was started in 2004. It was carried out in phases simultaneously with the completion of the final designs. In 2007, the first four blocks are expected to be finished. The completion of Block 5 and 6 will follow in 2009. The project is expected to be delivered as a whole in 2010.



Figure 3.6 Some buildings in Oosterdokseiland in Amsterdam (source: www.oosterdokseiland.nl)

Mahler4 in Amsterdam



Architects from upper-left clockwise: Toyo Ito, Nicholas Jacobs, Frits van Dongen, Ben van Berkel, Bosch Architects, Erick van Egeraat, Alejandro Zaera Polo, Michael Graves, Rafael Vinoly, Pi de Bruijn, Pero Puljiz, Branimir Medic

Figure 3.7 Mahler4 in Amsterdam

The Mahler4 project contains 161000 m² office space, 10000 m² retail facilities, 37700 m² (230 units) housing, and an underground parking garage for 2100 cars. Its site is situated at the core of a new urban area development, Zuidas, between Amsterdam city centre and Schiphol Airport. The Zuidas area is designated to accommodate high intensity business and mobility activities as well as high quality living environment. Its strategic location makes Zuidas a potential new centre for urban activities. The Municipality of Amsterdam has the ambition to develop Zuidas as a 'top office location' in Europe.

The development of Zuidas area was one of the six New Key Projects declared by the Dutch central government in December 1997 related to the realisation of the European high-speed rail link. The sustainable integration of urban infrastructure and architecture was, therefore, a central issue in Zuidas. At the same time, it aimed to reunite the residential areas in the historical urban plans by Berlage (the area of Amsterdam South) and Van Eesteren (the area of Buitenveldert). The urban designer and architectural supervisor, Pi de Bruijn

(interview), said that the idea for the multifunctional development was raised and worked out by a small think-tank. Being a part of an urban location with such excellent accessibility, the Mahler4 project aimed to realise offices and dwellings. By combining business functions with residential and leisure facilities, the area was expected to become a lively urban centre.

With the ambition to present top architecture to accommodate renowned international businesses, the client (Consortium Mahler4) appointed highly reputable architects to design nine buildings. The client composed a design team consisting of several international architects (Toyo Ito from Japan; Rafael Vinoly, Michael Graves and, Skidmore Owings & Merrill from USA), contemporary well-known architects from the Netherlands (Ben van Berkel and Erick van Egeraat), and several 'young talents' (Branimir Medic and Pero Puljiz representing Architecten Cie from the Netherlands, John Bosch from the Netherlands, and Foreign Office Architects from the UK). By assigning each building to a different architect, the client aimed to achieve architectural plurality. The ensemble of nine buildings formed a unity at urban design scale and at the same time presented a diversity of architectural infill in order to present a lively built environment at the human scale. The architect of each building had the liberty to propose materials and colours which differed from those of the other buildings (Egbert, 2005).

The development process of Mahler4 can be briefly described as follows. On 9 February 2000, the city council of Amsterdam announced the implementation decree of the Mahler4 project. Architecten Cie, represented by Puljiz and Medic, was assigned to develop a masterplan of the project. In order to prepare the urban programme of requirements, zoning plan, and other urban related studies, an urban design atelier was established under the leadership of the urban architect / architectural supervisor, Pi de Bruijn. This design office consists of urban designers from the Department of Spatial Planning of the Municipality of Amsterdam. These urban designers worked in studio and workshop settings to generate the urban plan.

The real estate developer is Consortium Mahler4, which consists of ING Real Estate, Fortis Real Estate, and G&S Real Estate. In consultation with the architectural supervisor, Consortium Mahler4 selected and commissioned the architects. Three design workshops were organised involving all architects, urban designers, advisors, and the clients. The workshops were meant to translate the urban plan into architectural (building) concepts. Subsequently in the preliminary design phase, each architect elaborated the individual building.

On 28 September 2001, Consortium Mahler4 and the Municipality Amsterdam signed the joint venture agreement to realise the project in three construction phases. The first phase was to realise the buildings designed by Vinoly and Ito/SOM; the second phase the buildings designed by Graves and Architecten Cie; and the third phase the buildings designed by Van Egeraat/Bosch and UN Studio/Foreign Office Architects. The preliminary building designs for phase 1 and 2 were completed at the end of 2002, and those for phase 3 were completed in 2003. On 9 December 2002, the construction of the first two phases was started. The first phase was planned for delivery in 2005. The overall project completion is planned to take place in 2008.



Figure 3.8 Some buildings in Mahler4 in Amsterdam (source: www.mahler4.nl)

3.3 Description of the characteristics of collaborative design

The exploratory case studies focus on the conceptual architecture design phase of the multi-architect building projects, especially during the elaboration of the masterplan and the development of the preliminary building designs. The data are mainly based on the comments and opinions of the project participants supported by the project facts and documentation. Based on their professional experience in the design process and in the attempt of managing the collaborative design, the respondents are asked to mention and explain what characteristics distinguish the creation of masterplan and conceptual building design through collaborative design with various design firms, from the production of the conceptual design by a single design firm.

In multi-architect building projects, collaborative design is significant. The following characteristics of collaborative design distinguish the multi-architect building projects from the other building projects in which there is only a single architect (single architectural firm) or in which different architects develop the design for the masterplan and different buildings individually.

The analysis of the interview findings reveals that three characteristics of collaborative design in the conceptual architectural design phase come up consistently in all cases: first, the masterplan as a platform for collaborative design; second, the way the design team is composed and the informal design leadership; and third, the creative design workshop for collective designing.

The masterplan as a platform for collaborative design

In all projects analysed in the case studies, the masterplan had not been completely finished when various architects were assigned to design the buildings. All architects were asked to understand the bigger idea behind the masterplan, and they were invited to contribute to the refinement of the masterplan and to discuss the way to integrate a building design into the masterplan and with the other buildings. In a multi-architect building project, the masterplan and the process to develop it served as a platform for collaborative design. In the following, the design actors, the creation process, and the importance of the masterplan for collaborative design are analysed.

The basic masterplan of the BANK-urban area, which included the site of De Resident was laid down by an Austrian architect and urban designer, Rob Krier. Krier introduced an 'organic design' that was uncommon to the grid pattern of Dutch urban design at that time. The clients were keen on Krier's design proposal, but still had some hesitations whether the design would be successful in the Netherlands. In order to fit Krier's approach to the local context and architecture, four Dutch architects (Sjoerd Soeters, Gunnar Daan, Bert Dirrix, and Peter Drijver) were assigned to work together with Krier to develop the masterplan under the supervision of the architectural supervisor, Kees Rijnboutt. As the masterplan took its almost definitive shape, three foreign architects (Michael Graves, Cesar Pelli, and Adolfo Natalini), another Dutch architect (Thon Karelse), and a landscape architect (Frank Kardinal) were added to the design team to work together to refine the masterplan and elaborate this into the conceptual building design.

In contrast to the 'classic approach' in which the masterplan is established or proposed by one party, the creation process of the masterplan of De Resident was unique. The public

client (RGD), the private client (MAB), the local authority (Municipality of The Hague), the architectural supervisor (Kees Rijnboutt), and the architects worked together intensively in the creation process. The real estate developer (represented by Ton Meijer) and the municipality (represented by Peter Noordanus) had so much interest in the urban and architectural design (Nanno Vaartjes, interview), that instead of only giving directions in terms of strategies, regulations, and programme, they were directly involved in the collaborative design with the architects and the architectural supervisor. For everyone in the design team, the creation process of the masterplan was an interesting experiment and an exploration into a range of architectural possibilities.

To create the masterplan through collaborative design, different architects were asked to work together. Four Dutch architects were expected to make critical and creative contributions that would show Krier precisely what could and could not be achieved in an urban project in the Netherlands. Krier was faced with the task of defending an urban vision that was not yet fully understood in the cradle of modernist urban design in the Netherlands. This sparked off heated emotional discharges during the design workshop. However, through the first series of workshops supervised by Kees Rijnboutt and Peter Noordanus, a climate of mutual understanding gradually evolved. Krier was able to defend his ideas of 'organic urban design' passionately and persuasively. The pursuit of 'rationalisation' in urban design (characterised, for instance, by gallery flat buildings and the solitary office buildings) was proven to fail to improve the design quality. It was to the credit of all involved that the outcome really merited a collective design (Van Rossem, 1996).

As it was a new experience, the collaborative design was not without shortcomings in the preparation. Kees Rijnboutt, an architectural supervisor of De Resident, modestly admitted his 'beginner's error' for not involving the real estate developer in the first series of design workshops (Van Rossem, interview). MAB was appointed as the real estate developer for the project after several workshops had proceeded. After being appointed as the real estate developer of the project, MAB wanted to submit the masterplan for further critical examination. The architects assumed that the masterplan was already definitive, so they greeted MAB's initiative with lack of enthusiasm. In the face of this impasse, MAB director, Ton Meijer, became convinced that a fresh injection of architectural creativity, by involving several international architects, was needed. After consulting with Rijnboutt and Noordanus, the design team was extended with Graves, Pelli, and Natalini. The result, as Meijer had expected, was quite spectacular. Not only did each of these architects produce a remarkable building design for De Resident, their enthusiasm for the project and their genuine interest in Dutch architecture served to stimulate and inspire the other architects during the second series of workshops.

In a different way, the masterplan of Nieuw Stadshart in Almere was also used as a platform for collaborative design. The masterplan had been finished to a certain extent by the masterplan architect and agreed by the clients before different architects were appointed. This masterplan presented a provocative design vision and contained several interconnected buildings. Collaborative design through the masterplan took place as two or more architects whose buildings were connected to each other interpreted the provocative design vision and worked together to translate the design vision into conceptual building design.

One of the architects, Floris Alkemade (interview), explained that the architects of Nieuw Stadshart in Almere were asked to understand the design vision of Rem Koolhaas in the masterplan, and then to improvise the design of their own sites / building blocks in order to give creative inputs to refine the masterplan in direct consultation with the masterplan architect, the Q-Team (architectural supervisor), and the clients. Alkemade said that the

masterplan was somewhat controversial – proposing a curved ground level to create the space for a new city centre above and beneath the ground. Such controversial masterplan should challenge the creativity of the architects to propose an innovative design. In case of a major change, consultations with all parties were required before a decision was made. Alkemade's description is supported by an example given by one of the architectural supervisors, Maarten Schmitt (interview): When Wil Alsop proposed to break down his block into four separate smaller units, the Q-Team had to assure that the whole masterplan remained intact. The landscape design was used as an element of spatial and aesthetic cohesion. To do this various parties were invited to the design workshops to shape the open public spaces.

In Oosterdokseiland in Amsterdam, the basic masterplan was created by Erick van Egeraat who was appointed by MAB to prepare the project proposal for the competition for project development. After the competition had been won, the masterplan was refined in collaboration between MAB and the municipality of Amsterdam. More intensive collaborative design took place in the stage in which the building designs were conceived based on the masterplan. The high density and close connections between the buildings required the architect of a building to discuss his design with the other architects of the adjacent or connected buildings.

In Mahler4 in Amsterdam, the intention for collaborative design was also underlined in the masterplan. The project was divided into several blocks. In some blocks, two buildings assigned to two different architects were combined. The original intention was to assign the low-rise building (the podium) to a 'younger' architect and the high-rise building (the tower) to a 'more senior' architect so that radical innovation and rich experience could merge. The design workshop was meant as an event where all design actors could collaborate in translating the masterplan into an architectural design concept of the buildings.

From all cases, one of the characteristics of collaborative design in a multi-architect building project is the use of masterplan as a platform for collaboration. For this purpose, the masterplan of a multi-architect building project has the following significance.

First, a masterplan can introduce a challenging and somewhat provocative design vision that stimulates the design actors to create an extraordinary yet harmonious design through collaboration. The challenging design vision requires all design actors to be critical. Only through a commitment to the design vision and to each other can the participants realise the design successfully. In all cases, in their first reaction, the stakeholders were hesitant whether such design vision could be successfully realised. It seemed that the 'controversial' idea would not survive. However, through a lot of discussions and brainstorming sessions, the added value of the idea was discovered. All stakeholders were then convinced to commit to the design and to each other.

Second, the creation process of the masterplan can become a real opportunity for collective designing, such as in De Resident. The unfinished masterplan that was presented to the design team served as the starting point for collaborative design in which all architects could and were expected to contribute to the refinement. The masterplan became a product of idea generation of all design actors through creative design workshops.

Third, the masterplan can establish, at the outset, the interrelation between different buildings that requires collaboration to develop the design solution. As several buildings are interconnected or combined in the masterplan, the architects of these buildings are required to collaborate with each other. The masterplan as a platform for collaborative design also

means giving a certain degree of freedom by allowing design proposals and adjustments for interconnected buildings to be agreed in the collaboration. This is in contrast with the 'conventional' masterplan of a large building complex that tries to assure the harmony by confining each building as a single entity to be designed individually by an architect within rigid boundaries and rules.

Fourth, the masterplan reconciles different architecture using certain common design elements. In De Resident, the harmony of different design was reflected through the building contours, open spaces, materials, and colours. In Nieuw Stadshart in Almere, this was achieved using the visual orientation towards the elevated ground level and waterfront; and in Oosterdokseiland towards the waterfront. Another way to achieve harmony was using the patterns of the surrounding urban context, for instance the composition of high and low-rise building blocks in Mahler4 and Zuidas, or the city skyline in Oosterdokseiland.

Fifth, the masterplan is useful to assure that the building architecture fits its urban context. De Resident had a mission to revive the historical urban architecture of The Hague. Therefore, organic streets, squares, galleries, and detailed building articulations are the main ideas of the masterplan and building design. Oosterdokseiland intended to resemble the complexity, variety, high density, and atmosphere of Amsterdam inner city – following the 'architecture tradition' of Amsterdam. Narrow streets separate adjacent building blocks while different design styles and functions were piled up in sandwich architecture. Nieuw Stadshart and Mahler4, in contrary to the classical-historical design, intended to present contemporary-futuristic architecture as the distinguished identity of the newly built city of Almere and the new urban centre of Amsterdam Zuidas. Unconventional forms and new materials were used to underline the innovation.

The way the design team is composed and the informal design leadership

Another characteristic that makes multi-architect building projects unique in terms of collaborative design is the way in which the design teams are composed as well as the informal design leadership. The design team consists of multiple architects, urban designers, multidisciplinary engineers and design specialists, project managers, representatives from the clients and local authorities, supporting staff, etc. During the design idea generation in the conceptual architecture design phase, the architects usually play a key role, in direct collaboration with the other design actors.

An interesting aspect of the multi-architect building projects studied in this research –which does not always appear in other building projects– is that the clients appoint many leading architects worldwide to join the design team. There are various reasons for this, as suggested by Yang (2004). One of the most important reasons is that the involvement of top architects gives added value to the project marketing, as well as to the cultural aspect. Yang writes that image might have everything to do with the trend towards collaboration. This includes the marketer's, developer's and politician's dream to have top architects in the design team of a prominent building project. As the project is strategically located in city-centre areas, it is also expected to present the city to the global network through exceptional architecture. In aesthetic and architectural line of reasoning, one of the reasons may be the client's intention of creating an ensemble of architectural 'styles' (Gunnar Daan, interview).

A 'star-studded team' gives an external effect (e.g. to the design quality, marketing purposes) as well as an internal effect (e.g. to the members of the design team). The

internal effect becomes clear as there is a combination between 'young' experts expected to bring 'radical' innovation (usually younger designers with 'radical' ideas) and 'more senior' experts with rich experience expected to assure the realisation of 'trusted' solutions. The design team is heterogeneous in terms of age and experience. One of the architects, Peter Drijver (interview), said that he was enthusiastic to join the design team of De Resident since he could work directly with Rob Krier, whose design he had admired since he was an architecture student. Another architect, René van Zuuk (in a seminar), mentioned that working on the project of Nieuw Stadshart in Almere was a unique opportunity in which a relatively young architectural firm could present its creation among the designs of Dutch and international leading architects. Not only the 'young' architects, but also the 'more senior' architects, like Michael Graves and Cesar Pelli, take pleasure in collaborative design. Having observed the design process, Vincent van Rossem (interview), described Graves' and Pelli's genuine interest to get involved in a project like De Resident since they wanted to be able to work together with contemporary European architects to explore the history and future of European architecture.

Beyond the consideration of selecting the 'stars', there were other key considerations for selecting the members of the design team. One of these key considerations was certainly the specialisation of the design actors in particular building types and functions, project scopes, and construction methods.

Another key consideration of selecting the members of the design team, especially the architects who are supposed to work together, was the commitment of the design actors to collaborative design. In all studied cases, a kind of social assessment to understand the personal style and motivation of the architects that were relevant for collaborative design was performed through personal acquaintance with the architects after evaluating their design portfolio and qualifications. A visit to the design office of the candidate team member and an informal conversation with the architectural supervisor, the client representative and a few other design team members, were some of the ways to get to know a candidate team member better in person. An example of the 'social assessment' in De Resident project was described by an architectural supervisor, Kees Rijnboutt (interview). Rijnboutt found that it was important to have a chat and a drink at Rob Krier's office to know him better as a person before assigning him a key role in the design team of De Resident. Based on his long-time experience as an architect, Rijnboutt said he could recognise whether or not some architects would have the interest, ability, and commitment to collaborative design. Through similar assessments, some candidate team members were not selected because they did not agree to conceive the design in teamwork with the other architects from different firms.

This was a reason why most of the architects in these cases were appointed rather than selected through an open design competition. The architects were contracted by the real estate developer, yet the list of candidates was always discussed with the public clients and the architectural supervisors. Nevertheless, there were a few situations when certain architects withdrew from the project during the design process due to the difficulties in the collaboration with the clients or with the other members of the design team.

For the architects, it seemed from a number of individual interviews that, the commitment to collaborative design was strengthened by the willingness of everybody to learn from the others' design 'style', expertise, and approach. Through this, one's individual ego was balanced with the consciousness of making a collective effort to ensure that a very important project will be successful through collaboration, as well as with the true appreciation of the quality of the other design actors in the team.

In addition to the way the design team was composed, the configuration as well as the formal and informal division of tasks and responsibilities within the design team was also unique to multi-architect building projects when compared to many other projects. The case studies show the importance of informal leadership in the design team. In the design team, some design actors had the natural tendency to become an informal leader. A project manager, Louis Lousberg (interview), described that among the architects in the project of Oosterdokseiland in Amsterdam, Jo Coenen and David Chipperfield (note: David Chipperfield was also involved in the design team at the beginning of the project) often took the initiatives and moves that were followed by the other members of the design team regarding the strategy for presenting and defending the design ideas before the clients. The formal leadership of the design team was usually held by the project manager, who represented the clients. However, during the conceptual architecture design phase of all cases, it was often the architectural supervisor who guided the collaborative design. The architectural supervisor was considered as an informal leader of the design team.

Architectural supervisor is a considerably new role in a multi-architect building project in the Netherlands. The main task of an architectural supervisor is to sustain the harmony between different designs (Graaf, 2001; Winsemius, 2001). The architectural supervisor evaluates the design proposals by the architects. He carries a mission to realise the ambition of high quality architecture by instilling visions, giving inspirations, and introducing design guidelines. Usually, he does not hold the formal mandate to take the final decisions, but takes up the role of an advisor to the client and the building permit commission. His tasks and responsibilities are not yet formally defined by professional codes of practice, and thus, dependent to the commission in each project.

Talstra (2003) discusses the role of the architectural supervisors in enhancing the spatial quality of urban projects as apparent in several multi-architect building projects in the Netherlands. In urban design context, the role of an architect supervisor is managing spatial quality that includes the functional, aesthetic, and future values in terms of economical, social, ecological, and cultural aspects.

Based on their own experience as architectural supervisors, Kees Rijnboutt and Maarten Schmitt (interview) explained that the leadership approach of the architectural supervisor towards the members of the design team could be best described as a consultative approach rather than an instructive or judgmental approach. An architectural supervisor was usually assigned to a project containing public interest to arrange different architectural elements into a grand ensemble of an urban composition. The task to supervise the urban spatial quality made an architectural supervisor like a conductor of a big orchestra. His formal assignment was actually to become an advisor to the design team, to the clients, and to the local authorities regarding the urban and architectural design quality. However, a harmonious total design could not be created only by steering on the physical objects. Making an urban composition involved dynamic understanding influenced by perceptions of different parties on the potentials of the environment. This extended the role of an architectural supervisor from evaluating the design products to leading the design actors by means of a more personal approach.

The person appointed as an architectural supervisor is usually a very experienced and respected architect or urban designer. An architectural supervisor possesses rich knowledge and experience in urban design and architecture, as well as the personal quality as a respected senior professional whose approach and advice are credible. His extensive practice and personal network often give him the privilege in terms of a good insight into the design method and teamwork attitude of different design actors. The social role of an

architectural supervisor becomes clear as he acts as a social catalyst in creative design workshops. In the design workshop, his charismatic leadership is essential to encourage critical design reviews and creative discussions.

Sometimes, more than one supervisor was assigned in a multi-architect building project; one would then work for the local authority and the other – usually the masterplan architect – would work for the real estate developer (Mariet Schoenmakers, interview). In the project of De Resident, Kees Rijnboutt was the supervisor working for the (local) authority. Rijnboutt was the Chief Government Architect and he was involved because some parts of the project were owned by the government organisations represented by the Government Building Agency. Rob Krier and Sjoerd Soeters were the architectural supervisors working on behalf of MAB. In the project of Oosterdokseiland, Kees Rijnboutt and Michael van Gessel were the urban supervisors of IJ-Oever area, which included Oosterdokseiland. They worked on behalf of the Municipality of Amsterdam. Besides them, Erick van Egeraat who created the master plan of Oosterdokseiland was appointed by MAB as architectural supervisor. In the project of Mahler4, Pi de Bruijn was the urban supervisor of Zuidas area, which includes Mahler4. He was also the architectural supervisor of Mahler4. In Nieuw Stadshart in Almere, a special supervisory team, called as the Q-Team, was formed by the city council following the completion of the concept masterplan. The Q-Team consisted of experts in urban planning, urban design, architecture, and sociology, and included the masterplan architects: Rem Koolhaas and Floris Alkemade from OMA. Its main tasks were to reinforce the design concept according to the project goals and visions, and to enhance the urban design and architectural quality. The Q-Team also advised the municipality in terms of architectural design in the evaluation process of design proposals before the building permit was granted.

During the development of architectural design concepts, important design coordination took place through dialogues (consultations rather than contractual relationships) between the architects and the architectural supervisors, and between the block architects and the masterplan architects. In De Resident and Mahler4, the design coordination was supported by the technical coordination carried out by an engineering firm. In Nieuw Stadshart in Almere, the technical coordination, especially during the construction phase, was carried out by the City Centre Team. In the same project, the design and technical coordination on the strategic level became the responsibility of the Strategy Team, which represented the stakeholders. In addition to this, the project leaders' meeting was semi-formalised as a 'coordination body' on strategy implementation and technical issues. In De Resident and Oosterdokseiland, the design workshops during the conceptual phase were important opportunities in which the coordination took place. In Nieuw Stadshart in Almere, due to the bigger scale of the project and much greater number of design participants, the interactions between the designers occurred through dialogues between the individual architects and the architectural supervisors. The frequently exercised dialogue and consultation lines for architectural design coordination in the conceptual design phase are illustrated in Figure 3.9.

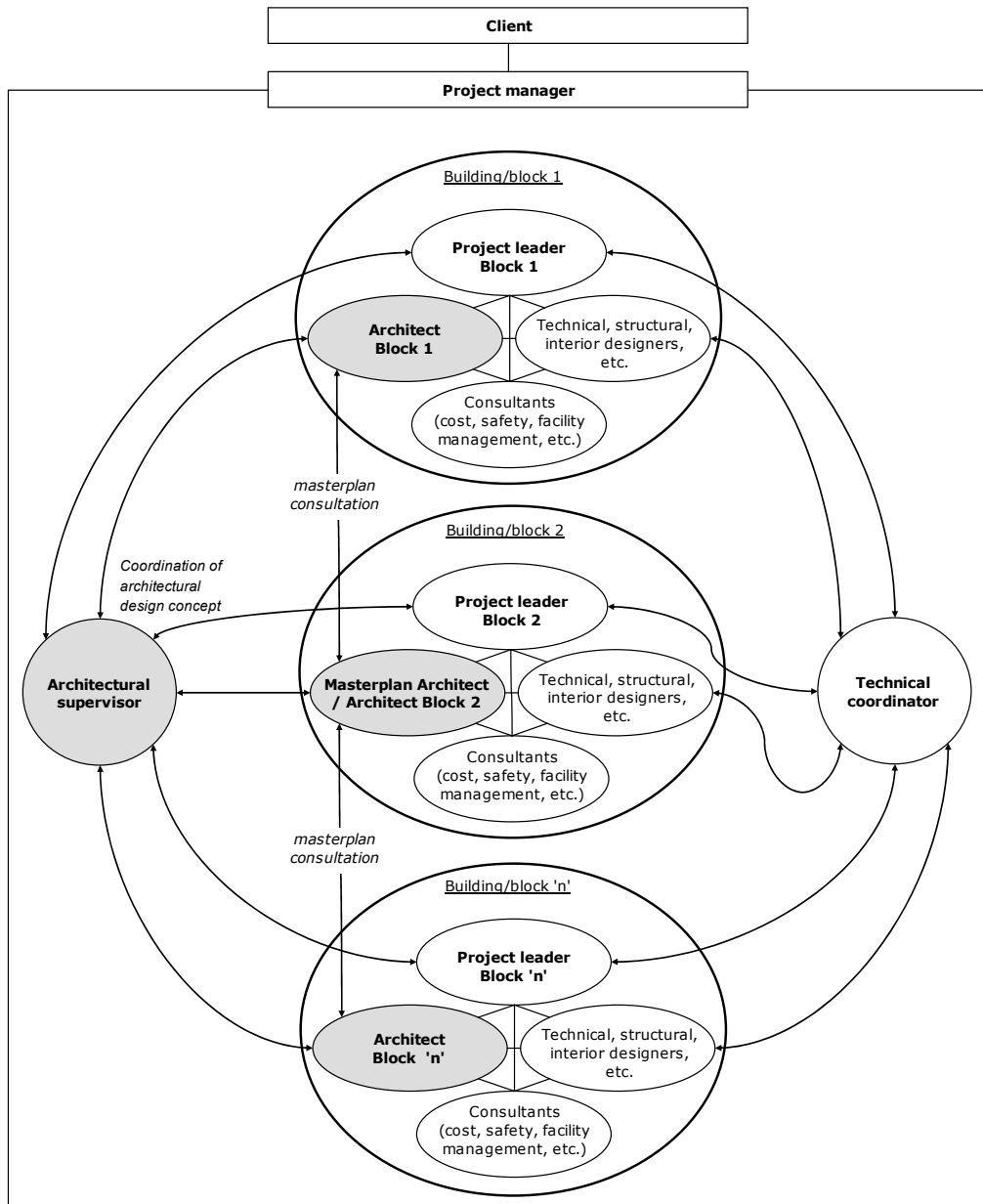


Figure 3.9 Dialogue and consultation lines for architectural design coordination

Creative design workshop for collective designing

Next to regular project meetings, in the multi-architect building projects studied in this research, there were also creative design workshops as opportunities for collective designing. Design workshops were special meetings that were usually organised during the conceptual architecture design phase to accommodate collective design idea generation. Unlike a formal project meeting, a design workshop was like a 'pressure cooking' session where teamwork and informal dialogues took place to review and enhance individual design ideas that were being introduced, sketched, visualised, and modelled. Each design workshop took one or two consecutive days. All who were in charge of design must come in person so that key decisions could be made directly.

Before a workshop, each design actor prepared his design for particular parts of the project. During the workshop, the ideas and problems of each particular part were shared for discussion. The chair of the workshop (usually the architectural supervisor) presented the overall design vision. Subsequently, the partial designs were put into the integral context using scale models or other visual presentation devices. All workshop participants then examined the overall design and its parts to find a comprehensive solution to the design problems. The design changes and revisions were decided directly. After a workshop, each designer revised his design to be presented in the next workshop. Usually, between two workshops, there were several bilateral consultations between the architects of the related parts of the project as well as between the architects, the architectural supervisors, and the clients.

The design workshop may be considered as a rather new way for collaborative design in the Netherlands (Vincent van Rossem, interview). In *De Resident*, the design workshop was a daring experiment. The workshop was intended to gather very different design perspectives and knowledge of various design participants to examine and improve Rob Krier's design ideas to be realised. Often there were disagreements during the workshop. Bridging different interpretations by the architects from different design schools and nationalities sometimes involved some emotional discussions (Sjoerd Soeters, interview). Fortunately, everyone had a great respect to each other so that strong argumentations during the workshop were taken up professionally while the good personal relationships between the members of the design team were preserved.

Design workshops can be organised in different stages during the conceptual architecture design phase of a multi-architect building project. In *De Resident*, two series of workshops were held, the first series held during the masterplan development and the second one during the conceptual building design stage. In *Nieuw Stadshart* in Almere, the design workshop was particularly dedicated to discuss the open public spaces between the building blocks. In *Oosterdokseiland*, the workshops were organised during the conceptual building design stage. In *Mahler4*, there were two kinds of design workshop. The design workshops on urban design took the form of urban ateliers. These workshops were organised in an atelier led by Pi de Bruijn, and involved the urban designers of the Municipality of Amsterdam, the urban designers of Architecten Cie, and the representatives of the real estate developers. Sometimes, certain project managers, advisors, architects were invited to join. The design workshop on building design was organised involving all architects to translate the urban plan into architectural concepts.

Regarding the importance of a design workshop as an opportunity for face-to-face interaction between the design actors during the creative design process, all respondents agreed that the success of collaborative design was much determined by social-

psychological factors, such as trust, shared understanding, cross learning, commitment, enthusiasm, emotion, and fun. All respondents said that the open, flexible, informal, and dynamic social atmosphere during the workshop made it possible to do collective design idea generation. Another success factor was the participative and charismatic leadership of the architectural supervisors.

3.4 Description of the difficulties of collaborative design

Learning from the exploratory case studies, the difficulties of collaborative design in the conceptual architectural design phase of a multi-architect building project are caused by a set of multidimensional complexities. In general, collaborative design is strongly influenced by the project complexity in terms of politics, market, and engineering; the social complexity resulted from the involvement of a large number of stakeholders with often conflicting goals and visions; and the social complexity in the design team during collaborative design.

The projects are expected to meet very complex political, economic, and cultural requirements from various public and private stakeholders, among others to meet the political ambition to promote the city through architecture. In the Netherlands, the collaboration between different parties in an urban project is encouraged by new government policy and market trends (Piet van Suijdam, interview). The government policy invites private parties to take a more significant role in planning and developing large city-centre areas. The policy allows greater control on growth since the local authority could accommodate the whole project within an integrated development strategy rather than executing steering on incremental processes. It provides adequate room for innovation and synergy in urban-environmental design, technology, socio-economy and urban culture. It also supports intensive mixed land-use in the city-centre areas to yield a greater long-term appreciation in land and property values.

A project located at very strategic and valuable urban sites is always expected to meet complex economical and market expectations (Nanno Vaartjes, interview). As mixed-use developments, the projects contain several significant revenue producing functions, such as offices, hotels, housing, retails, or leisure. These functions are blended symbiotically to reinforce each other and to achieve greater long-term appreciation in land and property values. The realisation and marketing of the projects have to take into account the uncertain market situation. In daily life, the projects have to deal with the issues of the high density and intensity of land use, building volume, users' operations, and the mobility and public transportation nodes. Knowing that a city is a living organism, the issues of how a building project – involving large-scale construction and infrastructure changes – can be realised amidst the daily urban activities, has to be taken into account from the beginning, even as far back as the initiative and the conceptual architecture design phase.

Furthermore, multi-architect building projects such as those investigated in the exploratory case studies, are complex due to the large scale, the involvement of major investment, the long-term development period, the interdependency between different functions and sub-projects, and the low failure tolerance. A multi-architect building project can, to a certain extent, be recognised as an engineering complex project according to the description by Shishko et al (1993). Such a complex project can be very much a self-contained entity, which makes comparisons to any other project very difficult to make. It may also mean that very little use can be made of the experience from previous projects, and that performance cannot be easily measured to a standard.

Moreover, the complexity is the result of the fact that the project consists of a large variety of buildings with different functions and designed by different architects, but are closely interconnected (in terms of aesthetic, technology, and planning) within a large integrated building complex. For instance, in De Resident there were many difficulties related to the connections between different buildings, between the substructure (including an integral parking garage) and the superstructure, and between the urban facilities and building utilities (Johan Galjaard, interview). Realising a harmonious articulation between different architectural and spatial shapes, 'styles', materials, details, articulations, and colours was a job full of challenges (Dik-Geert Mans, interview). Regarding the development process, a multi-architect building project was usually divided into a number of blocks or clusters to be carried out in phases. Collaborative design faced difficulties concerning the synchronisation of concurrent activities and the integration of the resulting design solutions (Anton Harms, interview).

On top of the abovementioned project complexity, collaborative design faces social complexity in the design process because architectural design contains many unrecognised, unquantifiable, and immeasurable parameters, while many constraints are socially constructed. In the conceptual architecture design phase, the social complexity in collaborative design relates to the following factors: the inclusion of the considerations of urban communities in the design of a multi-architect building project; the complex relationships between the architects and the clients or other stakeholders; and the dynamic teamwork within the design team.

A large building project creates important social environments for urban communities (Arnold Reijndorp, seminar in Almere on 16 December 2002). The building project becomes the catalyst for socio-cultural and economic integration and the accommodation for various urban functions, such as business, transport, leisure, and living. Since building projects contain public importance, architectural projects always need to go through an accumulation of political decision-making processes, made by many, over a long period of time. In this sense, the case study findings support Popov's argument (2002) that architectural design must therefore be considered as a social process, which is susceptible to political and social transformations and changes.

All architects and urban designers who were the respondents of the interviews argued that the social complexity in collaborative design was mainly the result of the involvement of a large number of stakeholders and design actors. They said that clients might be a bigger problem than the design requirements. The client was usually a consortium of multiple organisations including public-private partnerships. They often had diverse, sometimes also conflicting goals and visions on the project. The discrepancies between the private and public clients as well as among the private clients (e.g. when there are several real estate developers in the consortium) often resulted in ambiguous decisions, which negatively influenced the morale of the designers. Collaborative design was strongly affected by how different preferences and approaches by the stakeholders were played in the design process.

The analysis of the exploratory case studies is in agreement with Buciarelli's (2003) argument that design is a social process. In a building project, a great number of interdependent parties are involved. Although the participants work in different domains on different features of the system and they have different responsibilities; the creations, findings, claims, and proposals of one individual will be at variance with those of others. While they all share a common goal at some level, at another level their interests may conflict. This, in turn, makes architectural designing very much a social process. Designing is

a social process that requires exchange, negotiation, trade-off, and consensus to bring the efforts into coherence.

The social complexity in collaborative design is also related to the facilitation of the designers' skills in dealing with the unique nature of design problems, solutions, and processes. All cases show how designers employ subjective judgement, tacit knowledge, and personal experience to reconstruct and reframe the problems and solutions. Especially during the conceptual architecture design phase with inadequate information and under intense budget and schedule pressure, it really takes skilful judgement and experience to make a decision when designing has reached its goals. The design problems are ill defined and comprehensive. They cannot be completely and statically formulated at once since they are always in dynamic relation to the design solutions. Many problems and constraints during the conceptual architecture design phase are negotiable. They are interactive and interconnecting all factors, while the solutions involve many trade-offs to satisfy the conflicting requirements. The problems and solutions, and the links between them, are to be clarified during the process. The design process can therefore be recognised as an innovative endeavour to explore the complex situation and interpret the potential of achieving certain goals. Designers often come to a better understanding of the design problems while creating and synthesising the solutions. The design process is iterative and can be repeated as many times as possible. Experienced designers have a unique competence to balance the divergent and convergent thinking through heuristic and holistic strategies.

Furthermore, the social complexity can be found in dynamic teamwork in the design team. Collaborative design faces difficulties due to the increase in the number of design actors with different expertise, the distribution of design activities, and the interactions between the design actors. The architects have to cooperate with each other and consult the specialists from various fields. This is known as "collective form creation" (Yasunori Kitao, interview). The fact is that architects rarely work alone. It becomes almost impossible for a single architect to possess all necessary knowledge and skills to develop the design of a large and complicated project (Dingeman Lievense, interview). In a design workshop, the architects are engaged in teamwork, hammering out rather than easily conceiving their ideas individually (Kess Rijnboutt, interview). The architects are affected by group behaviour and, in turn, influenced by the thinking of other members of the group. The analysis of the exploratory case studies finds that design can never be practiced in a social vacuum. This is in line with what is written by Lawson (1990), Heintz (1999), and Dorst (2003). Designers are used to work in a knowledge intensive organisational context, which has relative autonomy and diffused hierarchical stratification and which can be compared to Mintzberg's (1979) definition of an operational adhocracy.

Moreover, since internationalisation has been widespread in the architecture world, a design team – especially that of a multi-architect building project – often consists of a large number of international architects that come together for a short period of the project, from a few months to a few years. The language, knowledge of the local situation, and cultural differences add to the complexity of collaborative design. The differences in the design approach and working culture of the Dutch and foreign architects in De Resident were indicated by an urban designer of the municipality of The Hague, Fred van den Burg (interview), who was involved in the design process. Many Dutch architects began by critically exploring the design issues and sharpen the design requirements through discussions or debates. They usually concentrated on the programme and asked more details before proceeding with the design. In contrast, many British and American architects gave their first attention to the building envelope and exterior shape. After receiving the

design commission, they looked into their project portfolio to decide their involvement in the project. They often accepted the commission because they already possessed much expertise on certain building types (e.g. high-rise office buildings), so that they could present many variants within a short time derived from their project portfolio. They explored the programme and refined the design using these alternatives.

One of the difficulties of collaborative design is caused by lack of experience of many principal architects to create and shape the design together with other architects of the same calibre from different design firms. One of the key findings from all cases is that such collective designing in design workshops was the first time for many leading architects involved in the projects. In the multi-architect building project investigated as cases, most of the architects are nationally or internationally renowned. Many of them are principals in their design firms, where they usually generate the main design concept to be elaborated by their (subordinate) design staff.

Nevertheless, in the interviews all architects admitted to be enthusiastic about the collaborative design as they were looking forward to the opportunity to personally know the other renowned architects, work together in a challenging and prestigious project, and openly learn from each others design. For them, collaborative design did not only give a new valuable experience, but also extended their professional and personal networks. After the projects, many of them built partnerships for future projects. One of the key success factors of collaborative design was having competent and loyal designers, who worked with heart and soul on the project (Kees Rijnboutt, interview). All respondents mentioned that although the true project success was yet to be assessed over a long time, they were proud of the fascinating design results. They were satisfied in the representative urban architecture, lively public space, and effective mixed-use. They accepted that such a result cannot be achieved by a single design firm on its own.

Further analysis of all cases shows that one of the difficulties of collaborative design as well as one of the most important success factors is related to the social aspect, especially regarding the design actors. Differences in perspective, cognitive style, knowledge, culture, value, and behaviour make collaborative design become socially complex. More specifically, there are two issues that make collaborative design very complex: the different perspectives may conflict with each other and the fact that people do not only bring diverse knowledge sets, but they also differ in cognitive style, cultural background, personality, and value. Good relations and openness among all design actors promote conducive teamwork that is essential when exploring the complex problems and conceiving the design ideas. In teamwork, reaching a consensus is important, but constructive conflicts are also essential parts of collaborative design. In literature, this case study finding has similarities to findings of relevant studies by Barlow (1990), Tilman (2002), Putte (2004), Spaen (2003), Boer (2001), Roelofs (2001), and Hofstede (1997).

3.5 Description of the challenges in managing collaborative design

A common practice for managing a large and complex building project is by dividing the project into sub-systems or sub-phases. The case studies show the advantages and disadvantages of this approach.

In Nieuw Stadshart in Almere, the project covered a vast urban area. Hence, it was decided to adopt a strategy through which the architects were selected in phases. The municipality built the infrastructure, utilities, and parking garage first. The most important blocks were then designed and constructed. The other blocks followed in several sequential and parallel phases. This strategy enabled the local government to urge the private developers to realise the public buildings before the commercial ones. The main shortcoming of such approach was that not all design problems could be discovered and discussed at the same time. Another problematic situation caused by this strategy was that the architects who were selected earlier most likely had more freedom in setting the line of design than the architects who were selected later (Dingeman Lievense, interview).

A concurrent design strategy was applied in De Resident and Oosterdokseiland with the expectation that most design problems could be solved at once by all design actors in collaboration. However, there was a disadvantage that some architects had to wait for the others before they could eventually progress to the next stage. In Oosterdokseiland, designing all blocks at the same time was very difficult due to the architect selection for certain blocks using European tender procedure, the changes in the design team members, the agreements on the ownership transfer of the ground and the existing buildings, and the establishment of agreements with different users. Responding to this, the original strategy was diverted to allow some blocks to advance ahead of the others in the design process (Mariet Schoenmakers, interview).

The essential aspect of either concurrent or consecutive design strategy is instilling and maintaining a comprehensive and unbroken vision by the design actors over an integral design solution. By collaborative design, the underlying problems – and respectively, the main ideas that give the directions towards the solutions – are expected to be perceived and clarified by multiple experts using multiple perspectives. In the conceptual architecture design phase, one of the biggest challenges to do this is the fact that fundamental decisions must be taken amid the uncertainty and lack of detailed information. Communication protocols and advanced information and communication technologies may support multi-actor decision-making only if everyone has the willingness, openness, and consistency in handling and sharing the knowledge.

A rule-based approach should be based on some references. However, there is no sufficient track record of managing multi-architect building projects to build a reference on a well-managed design process. All cases show that the success of collaborative design has been dependent on the knowledge and skills of a few experienced architects, architectural supervisors, and project managers whose rich experience in different complex building projects have implicitly crystallised in their tacit judgements, rather than on sophisticated planning and control instruments. An architectural design project is never entirely comparable to another. Therefore, it is essential to have competent professionals whose rich knowledge and long-time experience in many different complex projects can become much better equipments to be used to tackle new problems, rather than standardised procedures (Mariet Schoenmakers, interview).

The case studies show that the core issue of collaborative design in the conceptual design phase is collective designing in dynamic social circumstances. The exploratory case studies also show that the biggest challenge and, at the same time, the success of collaborative design are dependent on human factors, especially in terms of competencies and teamwork attitude of the design actors.

Social complexity in collaborative design may not be really new, but its importance has not been adequately addressed and dealt with by design management. How the design team is composed of experts with certain personal qualities and how one's creativity engages with that of the other team members in a creative workshop are essential subjects that cannot be managed solely through rigid procedures and rules.

At this point, this research intends to emphasize the contrast between two possible approaches used in managing the design process of a large and complex project in which multiple architects are involved. The 'classical' design process is compared to the collaborative design process in such a way that the contrasting difference between the two is shown. In De Resident project, to a certain extent, both approaches have been applied. Years before the project that was based on the current masterplan was started, another masterplan was proposed. This earlier masterplan was created by a single architect, Carel Weeber (Rossem, 1996). Later on, collaborative design was chosen for the development of the current masterplan. This finally implemented masterplan was resulted from the collaboration between Rob Krier, Sjoerd Soeters, Gunnar Daan, Bert Dirrix, and Peter Drijver. Each architect was asked to actively contribute to the conception of the overall urban plan, masterplan, and design guidelines.

In the 'classical' design process, an urban plan is drafted by the urban planner, a fixed masterplan is generated by the urban designer, and rigid design guidelines are written by the client or the local authority. The project is divided into several parts. The design requirements are divided into several design briefs for different designers, each containing specific project parts and design problems to be solved. Each designer is assigned to work on his design brief in accordance to the rigid design guidelines and to create the partial design at his own firm. The idea generation by each designer is often seen as a 'black box', which does not interact with that of the other designers from different design firms.

For many managers until now, architectural designing is often considered as a 'black box' or a 'wild card' in the project management pack because its values are poorly understood and its methods are difficult to explain, even by the architects (Allinson, 1997). The 'conventional' ways to manage such a design process is carried out by coordinating and facilitating tasks, information, and decision-making. The partial design solutions are then put together in the masterplan while the integral technical solutions are being developed. The 'conventional' ways to manage the design products are carried out by optimising design programme and requirements, by assuring the delivery of partial and integral architectural and technical solutions, and by arranging the architectural morphology.

A common practice based on the rule-based approach for managing collaborative design is by developing guidelines for arranging different buildings into a grand ensemble of urban composition; integrating the architectural, structural, and installation designs; and realising the buildings according to the functional programme, on time, and within budget. The most important criticism of such practice is that the overall design cannot be created by combining design elements and partial design solutions.

In an attempt to tackle the complexity, the rule-based approach for management is often practiced by mapping the activities and processes to be particularly steered based on certain protocols. The main weakness of such practice for managing collaborative design is that a design process cannot be made entirely tangible for mapping, and thus less feasible for systematic protocols. Despite attempts to thoroughly map the interrelated activities and influencing factors, there have always been unanticipated problems, which lead to inadequate ad hoc solutions, delays, and unnecessary redesigns.

In contrast to the 'classical' approach, the collaborative design approach is illustrated in Figure 3.10. This illustration clarifies that collective designing occupies other thinking and working approaches than individual designing, and therefore, needs to be managed differently.

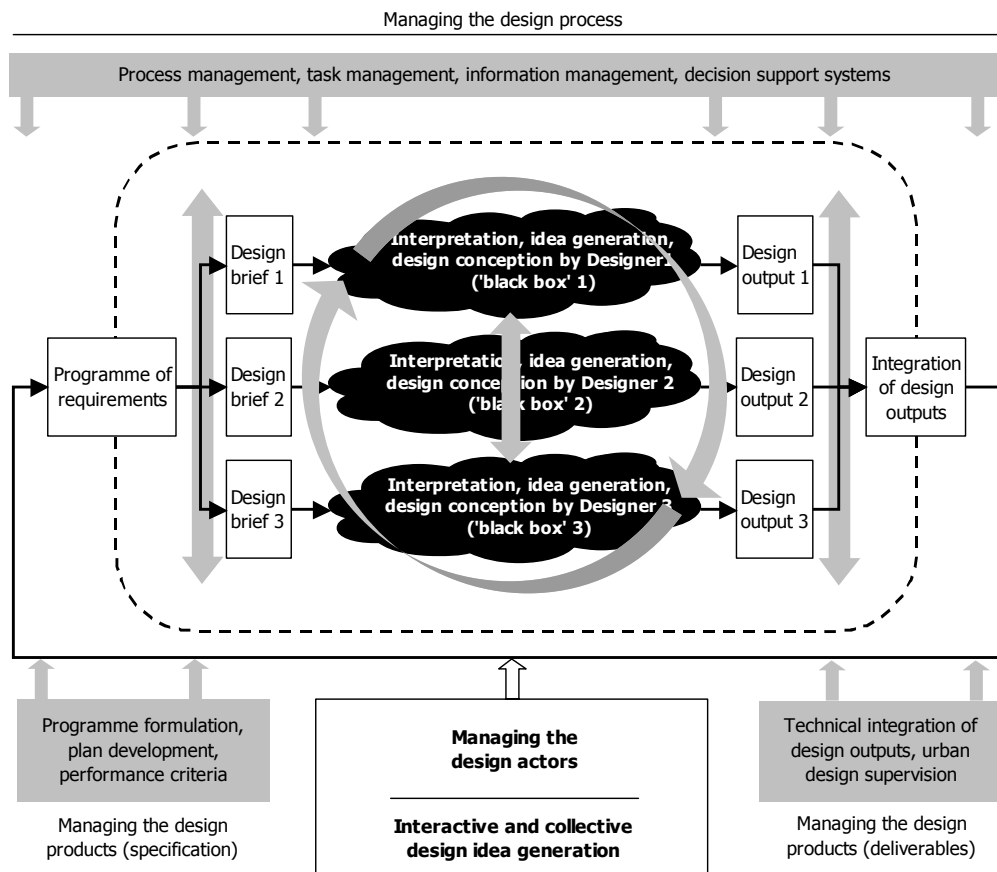


Figure 3.10 Collaborative design with interactions between the design processes of multiple designers

In collaborative design, multiple designers are asked to contribute to the creation and refinement of the masterplan and to work together in the elaboration of the masterplan and the development of the preliminary building designs. The designers share their

interpretation of the general and particular problems of the whole part of the project, rather than each one individually interpreting the problems of their own part. Individual vision and ideas are discussed, criticised, and improved in design workshops. Certain parts of the project, usually the connecting space or the articulation between buildings, are developed together. Therefore, there are closer and more intensive interactions between the design actors in the conceptual architecture design phase.

More intensive interactions between the clients and the architects are required because in a complex design situation the problems and requirements cannot be specified by the clients just in the beginning of the process. The design process is an innovative endeavour to explore the complex situation and interpret the potential of achieving certain goals. Therefore, the architects are not only commissioned to translate the programme of requirements into building design, but often to work together with the clients to discover new possibilities in design, as well as in function, business, strategy, and use.

More intensive interactions between the designers from diverse disciplines are required because collaborative design is not a linear process in which planners, designers, engineers, and builders work one after another. Multidisciplinary specialists are already involved in the conceptual architecture design phase to advise and support the architects on comprehensive aspects related to design.

More intensive interactions between the architects in the design team are required to achieve collective creativity to stimulate innovative solutions and to present the design as a harmonious composition of different designs. The interactions between the 'black boxes' become essential. The designers are engaged in dynamic consensus of competing values and cross-functional synthesis of various individual interpretations. Other members of the design team may trigger individual ideas and creativity. The design brief encourages each designer to consider the overall design and to give necessary inputs to improve the others' designs. The integration of the design outcomes is not solved at the end of the process, but discussed repeatedly from an early stage onwards.

Such collaborative design usually takes place in a creative design workshop. Here, creativity and innovation are often found more important than standard rules and precedents. This requires an innovative management approach that is able to deal with the design actors in order to stimulate and guide the mutual interactions between individual 'black boxes'.

These case study findings find similarities to the research carried out by Kleinsmann (2006) on the influencing factors for creating shared understanding in collaborative design. According to Kleinsmann, shared understanding is a similarity in the individual perceptions of the design actors about the design content (conceptualising the design product) or the design process (the collaborative working process). Kleinsmann describes the factors that influence the creation of shared understanding in collaborative design. On the actor level, the influencing factors are the ability of actors to make a transformation of knowledge and the equality of the language used between the actors. On the project level, the influencing factors are the efficiency of information processing and the quality of project documentation. On the company level, the influencing factors are the organisations of resources and the allocation of tasks and responsibilities.

3.6 Conclusions

In this research, four recent multi-architect building projects in the Netherlands were selected and studied for exploratory case studies. The case studies resulted in a description of the characteristics and difficulties of collaborative design, and a description of challenges to manage collaborative design. The findings from the multiple case studies can be concluded as follows.

There are characteristics with regards to collaborative design that distinguish a multi-architect building project from other projects in which there is only a single architect (single architectural firm) or in which different architects develop the design for the masterplan and different buildings individually. Three characteristics, which appear consistently in all cases, are: the masterplan as a platform for collaborative design, the way the design team is composed and the informal design leadership, and the creative design workshop for collective designing.

The masterplan is useful as a platform for collaborative design since it serves the following functions:

- introducing an innovative design vision and theme for the whole design;
- as a starting point for collective design in which all design actors are invited to contribute to refine the unfinished masterplan;
- establishing the interrelation of different buildings that require collaboration to develop the design solution;
- presenting common design elements that reconcile different architectural 'styles';
- assuring that the building designs fit the urban context.

The way the design team is composed and the informal design leadership form the basis for an effective collaborative design. This includes:

- the selection of the members of the design team based on both design qualifications and technical expertise as well as the willingness to engage in collaborative design;
- the informal design leadership role of the architectural supervisors;
- the dialogues and consultation lines for coordinating the development of architectural design concepts.

The creative design workshops, where collective designing can take place, facilitate and enhance collaborative design. Design workshops, unlike regular project meetings, are rather new in building projects. Design workshops give the design actors the opportunity to share design ideas, criticise and improve individual design products, and work together to develop integral design solutions.

The multiple cases analysis leading to this conclusion is summarised in Table 3.2.

Characteristics of collaborative design in the conceptual architecture design phase observed in the case studies of multi-architect building projects in the Netherlands				
Characteristics	De Resident, The Hague	Nieuw Stadshart, Almere	Oosterdokseiland, Amsterdam	Mahler4, Amsterdam
Masterplan as a platform for collaborative design				
Establishing an innovative overall design concept	'Organic design' that was new to Dutch grid-pattern urban plan	'Curved ground level' creating upper and underground urban space	High density built environment resembling the 'traditional' architecture of Amsterdam	A part of Zuidas urban plan with integral transport nodes and infrastructures
- As a starting point for collective design - Establishing the interrelation of different buildings that require collaboration to develop the design solution	The masterplan is a result of collective design through workshops	The masterplan contains some degree of flexibility by allowing the building architects to and refine parts of the plan	The masterplan is discussed and adjusted as the design of connected buildings is developed	The masterplan outlines the combination between two building parts by two different architects in each block
- Presenting common design elements - Assuring that the building architecture fits its urban context	Red-coloured bricks as main building materials; high level of detailing	Spatial design of the 'curved ground level'; orientation to waterfront; non-conservative building shapes	Urban skyline towards the central station building; narrow city streets; waterfront	High and low-rise pattern on Zuidas urban area; 'strong' outline of the building envelope
The way the design team is composed and the informal design leadership				
Selection of the architects based on design and technical qualifications as well as willingness to engage in collaborative design	Selection based on the variety of design 'styles' by renowned architects, commitment for teamwork in workshops, and initial dialogues with candidates	Selection based on design 'styles' by renowned architects; design competition for certain buildings	Selection based on design 'styles' by renowned architects as well as commitment for teamwork in workshops; design competition for certain buildings	Selection based on design 'styles' by renowned architects as well as combination between 'more senior' and 'younger' architects in a building block

The informal design leadership role of the architectural supervisor	- Kees Rijnbouts assigned by the municipality and the state as urban area supervisor, chief government architect for governmental buildings, chairman of design workshops - Rob Krier and Sjoerd Soeters assigned by the real estate developer as masterplan supervisor / architect	Q-Team consists of Maarten Schmitt, Rem Koolhaas, Michael van Gessel, Arnold Reijndorp, Tania Concko assigned by the municipality to consult each architect over the line of design according to the masterplan and urban design vision	- Kees Rijnbouts assigned by the municipality as IJ-Oever architectural supervisor and chairman of design workshops - Michael van Gessel assigned by the municipality as landscape supervisor - Erick van Egeraat assigned by the real estate developer as masterplan supervisor / architect	Pi de Bruijn assigned by the municipality as urban architect of Zuidas area and chair of the municipal urban design atelier
The dialogues and consultation lines for coordinating the development of architectural design concepts	Design workshops, consultations with the supervisors and technical coordinator	Consultations with the Q-Team, Strategy Team, and Project Leader Meeting	Design workshops, consultations with the supervisors	Consultations with the urban architect and technical advisor
Creative design workshops for collective designing				
Design workshops to facilitate and enhance collaborative design	Several times during the masterplan development for collective design, several times during the elaboration of building designs	A workshop on the vision of urban spaces with the use of metaphors and analogies and the involvement of artists to assist multidisciplinary design actors to explore the 'feeling of a city'	Several times during the elaboration of building designs	A workshop to translate the urban vision into architectural concept of building designs; urban design atelier to develop the urban plan and masterplan as well as to monitor the suitability of building designs to the plans

Table 3.2 The characteristics of multi-architect building projects regarding collaborative design

Furthermore, in the cases of multi-architect building project, this research observes the difficulties of collaborative design in the conceptual architecture design phase. These difficulties are due to the technical and social complexity. The technical complexity is caused by complex requirements of an integrated multifunctional project. The social complexity is due to the involvement of a large number of stakeholders. These stakeholders often have conflicting goals. Besides, the decision-making processes involving these stakeholders often become complicated when there is only limited information to get the insight of the design process and there is uncertainty regarding the long-term consequences of the decisions. Particularly in the design team, there is another social complexity, which is the result of the need for closer and more intensive interactions between the design actors in collective designing. The result of multiple case analysis on this issue is summarised in Table 3.3.

Difficulties of collaborative design in the conceptual architecture design phase observed in the case studies of multi-architect building projects in the Netherlands				
Difficulties	De Resident, The Hague	Nieuw Stadshart, Almere	Oosterdokseiland, Amsterdam	Mahler4, Amsterdam
Complex requirements of an integrated multi-functional urban project	Urban renewal at city centre location; importance of the municipality and the state to build office accommodations for ministries	Completely new and vast city centre built on a large site essential for promoting Almere as a new and modern metropolitan	Very strategic location next to the central station of Amsterdam with high density of mixed use and high intensity of daily urban activities	One of the key projects related to the realisation of high-speed rail link; occupying the most expensive business location in the Netherlands
Social complexity due to the involvement of a large number of stakeholders	The public clients include the municipality and the state; the real estate developer that was involved at a later stage required a new review of the masterplan from a commercial economic perspective for some design adjustments	The public client is the municipality represented by a special corporation; the private clients include two real estate developers; the project is very large and divided into many blocks and phases under supervision of different project leaders	The municipality and the real estate developer often had different requirements that were not yet fully solved during the initial phase because the masterplan and the choice of developer was the result of a competition	The private clients include three real estate developers joined in a consortium to work in partnership with the municipality; the development of Zuidas area is dependent to the complicated process of realising an integral urban infrastructure
Social complexity in the design team	One of the first experiences in the Netherlands in collaborative design through workshops	A large number of architects are involved, each with different proposals to adjust the masterplan	Some architects withdrew from the design team and were replaced by new architects who had to start over the design process	Different design approaches by the Dutch, Japanese, and American architects working on connected building blocks

Table 3.3 The difficulties of collaborative design in multi-architect building projects

Now knowing the characteristics and difficulties of collaborative design in the conceptual architecture design phase, this research concludes that the biggest challenge to manage collaborative design is to deal with the human factor and social complexity in collective designing. In a less complex project in which a single designer (architect) is in charge, the designer manages his own creative design process. When a project becomes complex and various design actors are involved, there is a need for collaborative design since the total problem cannot be solved by an individual. In the beginning of this dissertation (see subchapter 1.1), it has been identified that through collaborative design it is expected to integrate competencies of different people to tackle a complex design problem. By integrating, it is not meant simply combining individual outputs, but rather creating a synergy through the interactions of design processes by different design actors. The challenge for design management is to stimulate and guide the interactions between the creative design processes of individual design actors in such a way that collective designing can take place.

In the case studies, it can be observed that there were attempts to bring more interactions between the individual design processes. Many times these attempts were carried out based on practical experience without being really based on fundamental knowledge of managing creative teamwork. Social complexity in collaborative design may not be really new, but its importance has not been adequately addressed and dealt with by design management.

Referring to the illustration in Figure 3.10, this research presents the main elements of collaborative design in which collective designing takes place. Thus, from the case studies, it can be concluded that managing collaborative design deals with three main aspects:

- the design process including the cognitive process of different design actors;
- the interaction between these individual design processes, in principle through social contacts and interpersonal communication;
- the way a real building project is organised in its context, which includes the design programme, the design products, and all information, tasks, procedures, organisations, and processes that take place in a real building project.

Managing Collaborative Design

Chapter 4

Learning from other theories

CHAPTER SUMMARY

One of the conclusions from the empirical study in Chapter 3 is that managing collaborative design in the conceptual design phase needs to deal with three main aspects in collective designing, namely: the creative design processes by the design actors, the interaction of these processes through social contacts and interpersonal communication, and the way a building project is organised in its real context. The first two aspects have not yet been adequately dealt with by design management. Many attempts are based on practical experience without fundamental knowledge of managing the human factor and social complexity in collaborative design. The literature study in Chapter 2 concludes that in design management in architecture there is much knowledge in managing the way a building project or a design firm is organised through the management of tasks, information, organisation structure, and 'hard' design products. However, the current approaches of design management do not directly address the creative design processes by the design actors and the social interactions between them.

The knowledge about the design actors as human individuals and groups with their cognitive processes and behavioural styles is important for managing collaborative design. However, looking at the preceding chapters, it is clear that both in practice and literature, there is a lack of knowledge of a social-psychological approach in design management in architecture. Therefore, this research conducts literature studies into relevant knowledge and theories in other disciplines. Social psychology is the branch of psychology that studies persons and their relationships with others and with groups and with society as a whole. It deals with the behaviour of groups and the influence of social factors on the individual. The literature studies presented in this chapter discuss the emerging theories of management complexity as well as the social-psychological theories regarding cognition and behaviour of people in workgroups.

Managing collaborative design should recognise the designers' cognitive processes in order to channel the cognitive patterns in collaborative design. Managing collaborative design needs to embrace both the explicit knowledge which can be transferred to the design team through documents and protocols, as well as the tacit knowledge which can only be shared through social interactions and coaching. Concerning group creativity, design management can employ the deliberate insight model in which the creativity in a group is seen as an insight shift. An insight shift is often triggered by the idea of the other group members towards a better understanding of the problem and the solution. In practice, reflections on the design actors, processes and products are important to guide the action.

4.1 Introduction

One of the conclusions from the empirical study in Chapter 3 is that managing collaborative design in the conceptual design phase needs to deal with three main aspects in collective designing, namely: the creative design processes by the design actors, the interaction of these processes through social contacts and interpersonal communication, and the way a building project is organised in its real context. However, the first two aspects have not yet been adequately dealt with by design management. Many attempts are based on practical experience without a fundamental knowledge of managing the human factor and social complexity in collaborative design.

The literature study in Chapter 2 concludes that in design management in architecture there is much knowledge in managing the way a building project or a design firm is organised through the management of tasks, information, organisation structure, and 'hard' design products. However, the current approaches of design management do not directly address the creative design processes by the design actors and the social interactions between them. Most recent literature on design management in architecture does not adequately address the issue of collective designing.

The knowledge about design actors as human individuals and groups with their own cognitive processes and behavioural styles is important for managing collaborative design. However, referring to the conclusions of the preceding chapters, there is a lack of knowledge of a social-psychological approach in design management in architecture.

To obtain adequate knowledge for managing collaborative design in the conceptual architecture design phase of a building project, this research looked for relevant theories in other disciplines, especially in social psychology. Social psychology is the branch of psychology that studies persons and their relationships with others and with groups and with society as a whole. It deals with the behaviour of groups and the influence of social factors on the individual. The literature studies in this research discuss the emerging theories of management complexity and the social-psychological theories regarding cognition and behaviour of people in design teams.

Relevant theories were sought to provide the knowledge especially needed to manage the first two main aspects of collective designing which have not adequately been dealt with by the current attempts for managing collaborative design and the literature in design management in architecture. The aspect of creative design processes by the design actors is discussed in the theories related to human thinking and knowledge. The aspect of interactions in designing through social contacts and interpersonal communication is discussed in the theories related to group dynamics. In reviewing the relevant theories, this chapter discusses how these theories apply to individuals and respectively to design teams. At the same time, it discusses how these theories apply to the thinking process and subsequently the implementation in working process or actions.

Next to the review of management complexity theories, which provide ideas how to tackle the complexity of the building project and collaborative design, the literature study of social-psychological theories presented in this chapter is elaborated in four sections (see Figure 4.1). On the subject of "architect's thinking", this research describes the cognitive processes of an experienced designer. On the subject of "personal and organisational knowledge" it discusses the personal knowledge built up from explicit knowledge and professional experience, and then it goes further from individual thinking and knowledge to the subject

of how to create the organisational knowledge. On the subject of “group dynamics in design teams”, it shows how to promote the collective creativity by managing the group dynamics. Finally, on the subject of “reflective practice”, this research connects the knowledge with concrete actions referring to the principles of reflective practice in design.

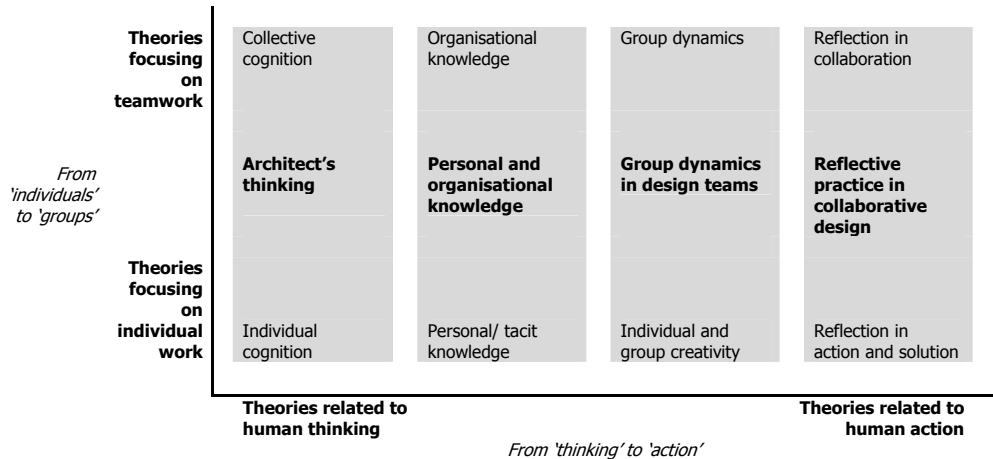


Figure 4.1 A selection of relevant theories from other disciplines

4.2 Management complexity

Complexity is a critical challenge for many areas of science and technology. Rosenhead (2001) writes that complexity theories are generally concerned with the behaviour over time of certain kinds of complex systems. The systems of interest to complexity theory under certain conditions perform in regular, predictable ways; under other conditions, they exhibit behaviour in which regularity and predictability is lost. The systems of interest are dynamic systems – systems capable of changing over time – and the concern is with the predictability of their behaviour. Before the emergence of complexity theory, the unpredictability of such systems was attributed to randomness. Addressing this as randomness is not quite right, for although these systems are infinitely variable, the variation stays within a pattern.

To consider the arguments which have been advanced for the extension of the complexity theories to the role of management, this research learns from the work of Ralph Stacey (1996). Stacey suggests that a group of people and the groups of people that constitute organisations are all complex adaptive systems. They consist of agents, in the form of autonomous individual human beings, who interact with each other, thus forming a network system that produces patterns of individual, group and organisational behaviour.

Stacey continues by saying that there is an emerging acceptance that the ‘reductionist’ approach (which at the extreme assumes that an organisation works in entirely predictable circumstances) has its limits. Discoveries by the theories of complexity show that organisations are not entirely predictable, and this revelation of the role of creative disorder

needs to be taken to the heart by managers. The key finding claimed by complexity theory is the effective uncertainty of the future and that complex systems have to be understood as networks of agents, evolving networks, and even networks of networks.

Progressing from Rosenhead and Stacey, a question relevant for this research is: What lessons, it is claimed, does complexity theory teach managers of collaborative design in architecture? The first lesson may be that it is not enough for managers to adjust their behaviour in response to feedback on the success of their actions relative to pre-established targets; they also need to reflect on the appropriateness, in the light of unfolding events, of the assumptions (the mental models) used to set up those actions and targets. Second, the dynamics of group thinking, which means the agility of thought based on the fostering of diversity, is a prerequisite for the organisation's longer-term success. Third, management complexity theorists emphasise, the importance of openness to accident, coincidence, and serendipity. Strategy is the emerging resultant. Rather than trying to consolidate a stable equilibrium, the organisation should aim to position itself in a region of bounded instability.

Rosenhead (2001) and Stacey (1993) state that some managers, afflicted by increasing complexity and information overload, can react by becoming quite intolerant of ambiguity. All factors, targets and organisational structures need to be nailed down. Stability is sought as the ultimate bulwark against anxiety; uncertainty is ignored or denied. The management task is seen as the enunciation of mission, the determination of strategy, and the elimination of deviation. All of these managerial reflexes, many of them seeming unassailably commonsensical, do not always give enough room for design creativity, especially in this research context of the conceptual architecture design phase. Contrary to the existing management belief, in which stability is sought as the ultimate bulwark against anxiety, there is potential in the effective uncertainty of the future. Complexity cannot and should not be isolated, but should be explored for innovation.

Stacey explains two management approaches, one that is required in order to carry out day-to-day problem solving to achieve the organisation's established objectives and is necessary if the organisation is to deliver cost-effective performance, and the other that is required of the organisation to be able to transform itself in situations of open-ended change. The latter requires the activation of the tacit knowledge and creativity available within the organisation. This necessitates the encouragement of informal structures – for example, workshops round particular issues or processes, with membership drawn from different business units, functions, and levels. Stacey proposes that these two management approaches are needed in viable organisations, and they must be enabled to coexist. In line with this, this research emphasises that for managing collaborative design, the technical-rational approach, which is widely used in project management methods and instruments must be integrated in the social-psychological approach, which can be drawn from the knowledge field of social psychology.

The exploratory case studies show the significance of social complexity in collaborative design. Advances in molecular biology, neuroscience and genetics, have opened new perspectives for cognitive science and the associated fields. The questions of "what makes humans different?" and "how and why are human cognitive facilities unique?", which were once a matter of philosophical speculation, have now become central to science, perhaps also in architectural design management. The answers may have profound implications. Most obviously, they could provide understanding and underpin the design and technological development for society and economy.

Greater insight into the origins of human motivation, social behaviour and co-operation will lead to design that better accommodates complex human needs in terms of function and perception or spatial experience. Learning from the complexity theories, design management can incorporate new perspectives from cognitive and behavioural sciences to respond to the social complexity. The cognitive facilities that human minds exhibit in complex and uncertain situations are believed to have the potential to tackle the complexity of dynamic activities in collaborative design.

4.3 Architect's thinking

Hamel (1990) discusses the cognitive process at the core of designing. Cognition is the psychological result of perception, learning, and reasoning. It is generally understood as the process of thinking. It is the mental process of knowing, including the aspects such as awareness, perception, reasoning, intuition, and judgement. Based on the observation of experienced architects at work, a cognitive-psychological model that describes the thinking of an experienced architect is developed (Figure 4.2).

Designing and managing involve cognitive processes, which contain the heuristic nature of human thinking in parallel lines. Heuristic thinking is a common sense set of rules intended to increase the probability of solving a problem by trying to look at the problem from many angles instead of tackling it head-on. It may relate to a usually speculative formulation serving as a guide in the investigation or solution of a problem. Designing and managing, thus, involve means-ends analysis, goal seeking experiments, and problem solving by self-learning (Simon, 1960).

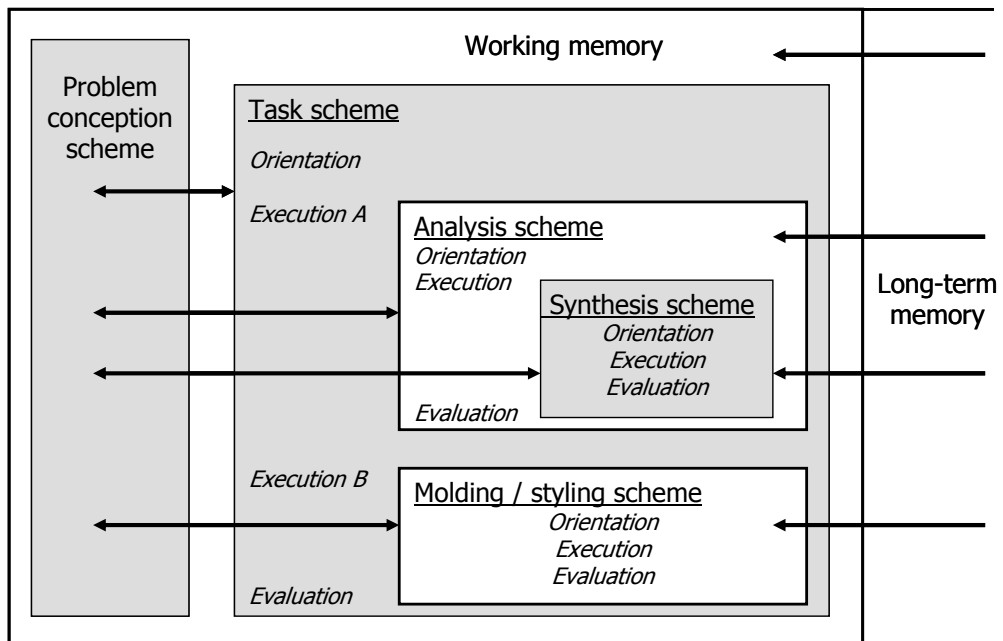


Figure 4.2 Cognitive-psychological model of the architect's thinking (Hamel, 1990)

Hamel (1990) reports that the work of an architect seems to consist of two interwoven activities: problem solving at its broadest scope (including the iterative ways of problem recognition and conception throughout the design process) and form creation. In the product that an architect delivers, the solutions for diverse 'hard' problems (construction, installation, etc.) are integrated in the 'soft' and visual character of the design.

The design thinking alters between the long-term memory and the problem conception scheme. The long-term memory stores crystallised professional experience including tacit knowledge. The design thinking moves through a cycle and there is a great deal of overlap of the following levels of activity: task, analysis, synthesis, and moulding. The activities are conducted by gathering information, decomposing the assignment, analysing the current problems, proposing sub-solutions, implementing sub-solutions, synthesising the overall solution, and moulding the solutions into a design outcome. Within each level of activity, orientation, execution, and evaluation occur recurrently. The synthesis produces the solution for all dimensions, in such a way that a solution to a particular requirement is never in conflict with any other. The synthesis of a set of dependent sub-solutions is best characterised as a choice, a skilfully made decision. When moulding the solution into a design, the architect seeks to transform the results of the synthesis to satisfy the client's brief as well as the architectural values.

The lesson that can be learned from Hamel's theory for managing collaborative design in the conceptual architecture design phase of a building project concerns recognising and facilitating the creative thinking of various architects.

Hamel's model of the architect's thinking is descriptive; thus, it is not meant to be a prescription of how one should design. So far, there is no consensus between different research on the sequence and thinking phases in designing. People often present the common sequence of analysis–synthesis–evaluation, but the real design process strongly depends on the project circumstances and the designer's frame of mind. Nevertheless, Hamel's model confirms that architectural designing is not conceived as a process of problem solving based on objective criteria only, but rather associated with subjective judgement in perceiving, reframing, and solving the problems in the cyclical process.

Hamel's model shows that what seems to be a creative "Aha!" during the design process is not necessarily a sign of randomness or chaos. Some architects may feel that they do not have full and conscious control of the creative process, but this does not mean that the process itself is a series of unstructured coincidences. Hamel's model describes that the components of such creative process actually relate and interact with each other in certain ways. For the experienced architects, the creative processes occur under the influence of the structural characteristics of their memories derived from their rich design experience.

4.4 Personal and organisational knowledge

Nonaka et al (1995) begin their book by clarifying the main difference between information and knowledge. Information is the basic material that forms the development of new knowledge. Knowledge, in contrast to information, is always bound to a certain conviction, involvement, and objective of the people or organisation. Since people always develop and acquire knowledge from a certain perspective or belief, knowledge is not neutral or objective. Knowledge can be recognised as justified belief. People develop knowledge for a purpose; in other words, knowledge always has a certain function related to the action. Thus, knowledge is a subjective, value-attached, and action-oriented derivative of information.

Knowledge is not a static notion since it is continuously subjected to the review of its value and purpose. Nonaka et al describe the process of review and the building up of knowledge in the dynamic interaction between individuals as knowledge creation. Knowledge creation has two dimensions: the epistemological dimension (from tacit to explicit knowledge) and the ontological dimension (from individual to organisational knowledge).

The first dimension of knowledge creation is derived from the theory introduced by Polanyi (1958), which is primarily an inquiry into the nature and justification of scientific knowledge. Polanyi draws on the domain of Gestalt psychology as his first clues to the conceptual reform of the conception of knowing. Yet he prefers not to directly refer to the Gestalt theory since his evaluation of the subject is so different from the theory. Gestalt psychology is the school or theory in psychology holding that psychological, physiological, and behavioural phenomena are irreducible experiential configurations that are not derivable from a simple summation of perceptual elements such as sensation and response.

Explicit knowledge is the 'coded' knowledge that can be transferred from one individual to the others verbally or in writing. Explicit knowledge can be stored in facts, procedures, formulas, theories, or models. Tacit knowledge as defined by Polanyi (1958), on the other hand, is very personal and context-specific, and therefore, difficult to put into words. It is the personal awareness that makes one able to do something without being able to describe the procedure explicitly. Tacit knowledge is only stored in humans, both in their intelligence ('brains') as well as in their skills ('bodies'). This is why tacit knowledge is often known as person-attached knowledge. It can be understood in its being-in-use, and it can be learned by its being-performed. Tacit knowledge has both cognitive aspects (i.e. mental maps, ideals, beliefs) as well as technical aspects (i.e. know-how, professional skills).

The second dimension of knowledge creation indicates the scale of knowledge creation, from the individual, group, and internal organisation, to the external relationship between various organisations. This dimension is important because knowledge is always created by individuals, not by organisations. The organisational knowledge can only be created through facilitating individual knowledge creation and planting the knowledge in the organisation respectively. With respect to this, Nonaka et al (1995) distinguish a knowledge creating company as an organisation which develops new knowledge, spreads it in the whole organisation, and establishes it in the organisation's services, products, and systems.

Some scholars have attempted to translate tacit knowledge into explicit knowledge. Some others, instead, deny the importance of tacit knowledge for organisations, given that it cannot be translated into formal knowledge. Yet, the people in the same school of thinking

as Nonaka et al stress the organisational value of tacit knowledge despite its untranslatability (Strati, 2003).

Nonaka et al (1995) report that explicit knowledge is only a small part of the whole knowledge; it can be compared to the top of an iceberg. The largest part of all knowledge that exists in humanity consists of tacit knowledge. There is growing acknowledgement that much knowledge is tacit in nature. Both explicit and tacit knowledge are indispensable in the process of knowledge creation.

It is the interaction between different sorts of knowledge, which is called the knowledge conversion that forms the basis for the development of new knowledge. The ways for knowledge conversion are: socialisation, externalisation, internalisation, and combination.

The first way for knowledge conversion is socialisation, which is the transfer of the tacit knowledge between two persons through sharing personal experience in practice. A classical example of knowledge creation through socialisation is how an apprentice learns the know-how from the master by directly observing what the master does and trying to imitate the actions.

The second, externalisation, is the conversion of tacit knowledge into explicit knowledge. Since it is hardly possible to describe tacit knowledge in words, externalisation uses metaphors, analogies, or models. Externalisation is the starting point for bringing the individual's tacit knowledge to a larger scale in the organisation.

The third, internalisation, is the process in which someone adopts the explicit knowledge into his own tacit knowledge, for instance, when someone learns to understand a procedure by doing it himself.

The fourth way for knowledge conversion is combination, which is the process of joining together explicit knowledge from various sources and organising it in a new way. For instance, through exchanging documents and re-organising information in a database with a new categorisation.

Learning about personal and organisational knowledge enabling gives a new awareness and a strategy that are important for managing collaborative design in the conceptual architecture design phase of a building project.

Polanyi (1958) uses an analogy to explain about two kinds of human awareness: "When we use a hammer to drive in a nail, we attend to both nail and hammer, but in a different way. We watch the effect of our strokes on the nail and try to wield the hammer so as to hit the nail most effectively. When we bring down the hammer, we do not feel that its handle has struck our palm, but its head has struck the nail. Yet in a sense we are certainly alert to the feelings in our palm and the fingers that hold the hammer. These feelings guide us in handling it effectively, and the degree of attention that we give to the nail is given in the same extent, but in a different way to these feelings. I have a subsidiary awareness of the feeling in the palm of my hand which is merged into my focal awareness of my driving in the nail."

Similar to this, in designing, although the focal awareness is given to the explicit knowledge or ideas ('the nail'), it is the subsidiary awareness of the tacit knowledge ('the feelings in our palm and fingers') that often handles the thinking process to produce the outstanding ideas ('the most effective hit on the nail'). The recognition of these two kinds of awareness is the

starting point for design management to give sufficient attention to tacit knowledge in designing. Design management should learn from a 'knowledge creating company' analysed by Nonaka et al (1995) where the project leaders and managers have the capacity to put the individual's tacit knowledge into metaphors and concepts for the organisation.

Nonaka et al (1995) notice that innovation demands the development of new information and the creation of new knowledge. The view of the organisation as an information processing system is, thus, not sufficient to generate innovation. A new approach is needed to manage the process of knowledge creation. There are five organisational conditions for an optimal knowledge creation process, i.e. intention, autonomy, fluctuation and creative chaos, redundancy, and variation.

Intention means the aspiration of the organisation to realise concrete goals. This sense of purpose motivates the individuals to develop new knowledge to be used. Autonomy means that the individuals are granted sufficient freedom. This increases the chance of being confronted with new ideas since everyone is stimulated to use their own creative manner to fulfil the task. Fluctuation means temporarily breaking the organisational routines or stimulating creative chaos. This is to stimulate individuals to get into a dialogue with others to figure out new solutions for existing problems, new working manners, and new ideas for organisational structure. It is crucial to note that such creative chaos will only have a positive influence on knowledge creation if the individuals have sufficient time and freedom for reflections and constructive dialogues. Redundancy means providing the individuals with extra information beyond their tasks. In the beginning it may seem inefficient, but actually the extra information creates overlapping areas between different tasks upon which the individuals have common issues for dialogues. When people feel comfortable to share personal experience within each other's 'information area', the transfer of tacit knowledge can occur more easily. Finally, variation means circulation of function or task among the individuals, so that everyone can learn about the whole organisation and various skills from each other.

4.5 Group dynamics in design teams

Group dynamics is the branch of social psychology that studies the dynamics of interaction in social groups. By interaction, this research means to study the group behaviour in collaborative design. It aims to understand how to effectively form, develop, and lead a creative design team. A great deal of work has been done on the dynamics and creativity of groups. Within this, there are some subjects that emerge or become very important for managing collaborative design.

Andriessen (2003) summarises the central points of attention of group dynamics as follows:

- The difference between the group effectiveness criteria: product quality, group viability, and individual remarks.
- The importance of organisational characteristics and the interaction of teams with their environment.
- The specification of group composition, and of characteristics of culture and structure.
- The role of new tools in supporting or hindering group cohesion and group identification.
- The stages in the life cycle of a group and the role of new tools in supporting or hindering the rites of passage.
- Group dynamics in various ways: changing tasks, changing stages, and changing membership.

According to Mullins (1996) and Buchanan et al (1997), group behaviour is concerned with the study of the behaviour of people within an organisational setting. It involves the understanding, prediction, and control of human behaviour, and the factors, which influence the performance of people as members of a group. The behaviour of people cannot be studied in isolation, but in the interrelationships with other variables that together comprise the total organisation. Group behaviour is influenced by group objectives and group cohesion.

Conducive group behaviour results in group effectiveness. Group effectiveness refers to the adequacy of a group in performing its functions as an organised system and achieving its purpose. The group effectiveness includes the managerial effectiveness. Effectiveness must be distinguished from efficiency. Efficiency is concerned with “doing things right” and relates to inputs and what the manager does, while effectiveness is concerned with “doing the right things” and relates to outputs and what the manager actually achieves. In terms of effectiveness, the manner in which the manager achieves results and affects the people is important.

To become effective, the personal objectives should be compatible with the group objectives. The group objective is a future expectation or some desired future state. It is something the organisation is striving to accomplish. The meaning of the objective is, however, subject to a number of interpretations. More strictly, groups have no objective; only people do. Group objectives are established by people. If the group objectives and personal objectives are pulling in different directions, performance is likely to suffer.

To become effective and innovative, a group also needs to be cohesive to a certain extent. Without cohesiveness there will be no teamwork. However, too much cohesiveness in the group will not make a group more effective and innovative since personal relationships rather than the work will become the most important. Moreover, when the cohesiveness is too much, people will begin to think in the same line and the group will lose the

opportunities of having new ideas as different views are confronted with each other. The first and most important dimension of any group development is trust building, which includes the acceptance of self and others. Cohesiveness and trust are built as a group progress through four successive stages of maturity: forming, storming, norming, and performing (Tuckman, 1965).

Forming is the bringing together of a number of individuals, who tentatively identify the purpose of the group, its composition, and terms of reference. Storming is when members of the group present their views more openly and forcefully as they get to know each other better. Disagreements will be expressed and challenges will be offered on the nature of the task and arrangements made in the earlier stage of maturity. Storming is important because if this stage is successful, there will be discussions on reforming arrangements for the working and operation of the group, and the agreement on more meaningful structures and procedures. Norming is when members of the group establish their own norms or acceptable behaviour as conflict and hostility start to be controlled. Finally, performing is when the group has created structure and cohesiveness to work effectively. With the successful development of the group, more complexities – both cognitive and emotional – and more difficult tasks can be handled.

The group cohesiveness and effectiveness are also influenced by the compatibility of the group members. Belbin (1996) suggests that all members of groups have dual roles. The first and most obvious is the functional role, which refers to their specialist professional contribution as, for example, an accountant, designer, engineer or marketing executive. The second role is less obvious but every bit as important. This is the team role, which is the contribution by individuals in terms of behaviour, style, temperament, relationships and leadership. Belbin's research has shown that the most successful teams are those that have the right blend of team roles. Belbin identifies nine Team Role characteristics, which the ideal team should encompass. They are: coordinator, planner, resource, investigator, shaper, team worker, specialist, monitor-evaluator, implementer, and completer-finisher.

Although most members of a design team are from the same profession as architects, the different team roles described by Belbin can be found in the different core personality traits, intellectual styles and behaviours, as well as in the working approach of each architect. The next important issue is to understand how these team roles are drafted in the structure and leadership of creative groups.

According to Andriessen (2003), in a simple way, cooperative work settings can be distinguished into three types: collection, community, and team. A collection consists of loosely coupled individuals that exchange information on an ad hoc basis. Membership and commonality of interests may be rather vague. Vast numbers of people can be involved, such as thousands of users of an intranet in a large company. A community consists of a group of people that have a common interest and therefore interact over a period of time. Many newsgroups on the internet are formed around common hobbies or other interests. Some companies stimulate the creation of communities of practice, i.e. distributed groups of professionals belonging to separate departments that have a common field of work for which they exchange and/or develop knowledge. A team includes a group of people with a common goal, formality and interdependence that cooperate during a clearly delineated time period.

Mintzberg (1979) sees the importance of a good structure since it affects not only productivity and effectiveness, but also the morale and job satisfaction of the workforce. Group structure should be designed, therefore, to encourage the willing participation of the

team members, as well as to maintain the balance between the socio-technical system and effective team performance. According to Mintzberg, designing group structure means turning those knobs that influence the division of labour and the coordination mechanism, thereby affecting how the organisation functions in its environment. There is no one best structure in particular. There is a good structure if the design parameters are internally consistent, and together with the situational factors they form a coherent configuration.

In the conceptual architecture design phase of a building project, people often seek innovation. Innovation may mean breaking away from the standardised skills of the experts and established group patterns. Such group often finds itself operating in a dynamic working environment. Its responsibilities shift from routine tasks to more non-routine tasks and improvisations (Wijnen et al, 1993). Mintzberg (1979) suggests that to cope with a more dynamic (unpredictable) environment, the organisational structure needs to be more organic. The structure should decentralise to managers and specialists, who can comprehend the issues, yet allow members to interact flexibly to respond to unpredictable changes and to solve complex problems. In such structure, group members should be able to communicate through an all-channel decentralised network involving full discussion and participation (Mullins, 1996).

Determining the suitable structure is also influenced by the ad hoc nature of the design team. An ad hoc design team consist of various experts that come together briefly to undertake a project. Such group requires a structure that is able to fuse experts drawn from different disciplines into smoothly functioning teamwork. Mintzberg (1979) calls this an operating adhocracy. In an operating adhocracy, the operating and supporting work tends to blend into a single effort. The distinction between the line and staff becomes blurred as an organic mass of line managers and staffs work together with the operating experts in ever-shifting relationships on ad hoc projects. In such a group, the coordination of work is achieved mostly by informal communication called a mutual adjustment mechanism.

Hohn (1999) and Cheung et al (2001) present research on the leadership of creative and innovative groups, which leads towards the participatory and supportive leadership style. Hohn gives evidence that good group dynamics and cohesiveness allow the group members to bear the tension when switching from the generative to focusing leadership modes and vice versa.

The generative mode is the leadership behaviour that encourages divergence and fosters exploration and originality that leads to new ideas. In the generative mode, supportive group dynamics in terms of openness and good communication are needed. The pace is adjusted to the creative process of the group and the outcome is not strictly defined yet. Challenge and risk taking belong to this path, as well as the exploration of conflicts within the group. The leader creates conditions to maintain intrinsic motivation and high commitment of individual members by giving them freedom and autonomy to develop and use their expertise.

The focusing mode is the leadership behaviour that encourages convergence and directs the process to perform the tasks within the given constraints. High divergence is needed to allow creative process while high convergence is needed to obtain effectiveness and efficiency. The leaders or facilitators of collaborative design should be able to combine these two modes if the design team is to be successful. In the focusing mode, supportive group dynamics in terms of honesty and clarity are needed. The goal in this path is clearly established and determined by plans, which are monitored and adjusted if necessary. The group focuses on business performance, work within the given budget and resources, and it

is sometimes triggered by market competition. The leader boosts the motivation of the individual members by providing material and immaterial awards if they reach the targets. When crisis or conflict arises, the leader acts with his authority.

The leadership in the design team can function as a catalyst that stimulates sharing of ideas through which one's creativity can be triggered by others' ideas. Barlow (2000) presents a deliberate insight model, which may serve to understand and facilitate group creativity. As an alternative of many views that focus only on the ideas as outputs, this model focuses on the people. In this model, creativity is understood as the insight shift to a new perspective which is closer to understand the problem and solution.

In Barlow's model, the 'real' problem, which is the complex interaction of wants, wishes, and reality, is only approximated by one's viewpoint and problem statement. Based on their perception of the problem, people illuminate certain aspects of the problem and define their own problem statements. Then they signify the set of ideas that fit the problem statement and all the things anyone could ever do.

In a creative group, one's perception of the problem and one's idea to solve it is positively affected by other members of the group. A creative group deliberately seeks for new viewpoints. The shift from the initial perception of the problem and the new formulation of the problem which includes a more complete set of ideas to solve the problem is called insight shift. With the new viewpoint one's recognition of the 'real' problem is deeper and more comprehensive. In a successful insight shift, some of the ideas illuminated by the new viewpoint are better than the best ideas made obvious by the old viewpoint.

4.6 Reflective practice in collaborative design

Schön (1983) explores the relationship between the kind of knowledge honoured in academia and the kind of competence valued in professional practice. He reviews the model of technical rationality and proposes a shift to the concept of reflective practice. According to Schön, technical rationality is the view of professional knowledge which has most powerfully shaped both the thinking about professions and the institutional relations of research, education, and practice. In the technical rationality model, the professional activity consists of instrumental problem solving made rigorous by the application of scientific theory and technique.

Schön stresses that technical rationality depends on the agreement about the ends. When the ends are fixed and clear, then the decision to act can present itself as an instrumental problem. But when the ends, like design solutions, are confused and conflicting, there is as yet no 'problem' to solve. A conflict of ends cannot be resolved by the use of techniques derived from technical rationality. In the real-world practice, especially in uncertain, instable, unique, complex, ill-defined, and value-conflicting problem situations, it is rather through the non-technical process of framing the problematic situation that one may organise and clarify both the ends to be achieved and the possible means of achieving them. Such situation calls for the 'artistry' of the professional. Here is where the reflective practice comes into play.

Schön (1983) continues to explain that when one goes about the spontaneous, intuitive performance of actions of everyday life, he shows himself to be knowledgeable in a special way. Often he cannot say what it is that he knows. When he tries to describe it, he finds

himself at a loss, or he produces descriptions that are obviously inappropriate. His knowing is ordinarily tacit, implicit in the patterns of action and in the feel for the matter with which he is dealing. It seems right to say that his knowing is inherent in his intelligent action. This is called: knowing-in-action.

If common sense recognises knowing-in-action, it also recognises that one sometimes thinks about what he is doing while he is doing it. This is called: reflective practice. Although reflective practice is not a rare event, it is not generally accepted – even by those who do it – as a legitimate form of professional knowing because professionalism is still mainly identified with technical expertise. Those who are more inclined and adept at reflective practice feel profoundly uneasy because they cannot say what they know how to do, cannot justify its quality or rigor. For these reasons, the study of reflective practice is critically important. Schön suggests that the dilemma of rigor or relevance may be dissolved if people can develop an epistemology of practice which places technical problem solving within a broader context of reflective inquiry, shows how reflective practice may be rigorous in its own right, and links the art of practice in uncertainty and uniqueness to the scientist's art of research. The legitimacy of reflective practice can, thereby, be increased; and the broader, deeper, and more rigorous use can be encouraged.

In studying reflective practice for collaborative design, this research analyses the relevance and implications of reflective practice to the design actors, design processes, and design products. In this sense, reflective practice can be further classified into three types of reflection:

- reflection-in-collaboration, which in this research means reflecting on how different design actors think and act in teamwork;
- reflection-in-action, which in this research means reflecting on the design process;
- reflection-in-solution, which in this research means reflecting on how the design products are created.

In the following explanation, these three types of reflective practice are elaborated.

Designing as reflection-in-collaboration: Reflecting on the design actors in teamwork

In collaborative design, reflections are also set on the other designers' thinking and on the design activities that other members of the design team are doing. At the heart of this social activity is the development of a shared understanding among the group members.

Valkenburg (2000) further stresses that design as a reflective practice works particularly well in the conceptual design phase. Valkenburg performs experiments with some product design teams and finds that the design teams which follow reflective practice principles are able to achieve better results. Looking at the designers, she notes that design as reflective practice provides insights in the complex nature of designing, preserving the interaction between the design activity, the design task, and the designers.

Valkenburg explains that reflection is a conscious and rational activity that can lead to reframing the problem when the current frame is not satisfactory, the making of new moves, or attending to new issues when the reflection leads to a satisfactory result. In this way, the reflective process continues; it is an ongoing process. She defines four design activities of reflective practice in a design team: naming, framing, moving, and reflecting.

Naming is the activity when a practitioner sets a problem and chooses and names the things he will notice. The naming activity will be the first attempt to share thoughts between the team members.

Framing is the use of sense-making devices that establish the parameters of a problem. In order to work together, team members have to share some common understanding of how they are going to approach the situation.

Moving includes activities like generating ideas, exploring problems, or looking at the consequences of design decisions undertaken by the team.

Reflecting is the activity in which team members reflect on what they are doing and question where this is taking them within the design task.

Reflection-in-collaboration offers a new role for the design manager. The manager can act as a frame coach, reflection guard, or move helper. Although the results of Valkenburg's research do not deliver the exact know-how for direct application in practice, they are useful to expose reflective practice to the broad and actual issue of how to manage collaborative design as an extension of Schön's description of reflective practice as an individual, limited activity.

Designing as reflection-in-action: Reflecting on the design processes

Schön (1983) views design as a learning and exploration process where iteration is the interesting part. Designing is a reflective conversation when the designer shapes the situation in accordance with his initial appreciation of it, the situation 'talks back', and the designer responds to its 'back-talk'.

Akin (1986) supports this view by saying that a deterministic relationship exists between the problem description and its solution, which is dialectic. Design problems need to be iteratively framed out of the ambiguous situations and paradigms before the designers are able to organise and clarify both the ends to be achieved and the possible means of achieving them. The designers actually surface and question the phenomena they perceive with their intuitive judgement in order to come to new interpretations, in the reflection of action. Frequently, their experiments yield in surprising results that cause them to reformulate their questions, in the knowing in action.

Research that draws the reflective practice to bridge the gap between design research and practice has been carried out by Reymen (2001). To Schön, reflection-in-action is an integral part of the design process and probably not explicitly uttered. Reymen believes that this can be improved by structured reflection in the design process. Reymen suggests that the designers should reflect on the current design situation and on the performed design activities explicitly, in a systematic way, and on a regular basis (at certain intervals during the process). By doing this, designers can plan next activities and can perform these effectively given the design goal at that moment. Reflection-in-action is seen as an introspective contemplation of the designer's perception of the design situation and of the remembered design activities.

Reymen (2001) proposes five steps to stimulate designers to reflect regularly and structurally during a design session. A design session is defined as a period of time during which one or more designers are working on a subtask of a certain design task, for

example, one afternoon, a whole day, or a week. The five steps are: planning a design session, defining the subtasks of the session, reflecting at the beginning of the session, designing during the core of the session, and reflecting at the end of the design session. These steps can be supported by systematic description and analysis of the design situations and activities by means of forms and checklists, which help designers to get an overview of the design process.

Designing as reflection-in-solution: Reflecting on the design products

The solution or, in other words, the design product, is the output generated by the designers through the reflective design activities. The initial ideas are put on the primitive objects, which evolve and become more subtly tuned to meet the expectations. During the process, some products that are made by the designers to experiment with broad possibilities may seem to be 'out of the line'. If these products survive the test, they are proven to be suitable for the requirements and constraints, and they are worth the trouble to be further refined. Dorst (2003) calls this: design as evolution.

Reflection-in-solution involves any design actor who reflects on the generated design products and gains the knowledge to proceed with the creative process. In such evolution, the design problems as well as the solutions evolve during the process as the designers acquire more knowledge about the situations and possibilities. Design management could play an important role by guiding the design actors to reflect properly on the 'product under construction'. In the reflection by both the designers and the clients, no one should expect perfection of the work-in-progress. In contrary, everyone should openly discuss the strengths and weaknesses of the design products in order to determine the directions and strategies to develop the final solutions.

4.7 Conclusions

To adopt and adapt different theories from several disciplines into design management in architecture, we have to understand them in their full spectrum and in direct relationship with the practice of collaborative design. This research sees the relevance of using these theories for managing collaborative design. The awareness of the designer's cognitive process is very useful to match one's own creative process with those of the other group members. The appreciation of individual tacit knowledge is very useful to build up rich organisational knowledge over various problems and solutions. By managing group behaviour and group dynamics, design management can create a creative climate that is conducive for innovation and group performance. By using the principles of reflective practice, design management can exploit the value of personal skills, implicit know-how, and intuitive judgement of experienced architects and managers.

For managing collaborative design, the awareness of such cognitive process is very useful to channel human competencies, for instance in a design workshop. By studying design cognition in the context of design activities at the social level, design management can guide creative meetings, envisioning in enhancing the learning cycle, shared understanding, and vision within the creative design process. By 'matching' the cognitive patterns of various designers, design management can help them to build on each other while generating design ideas during collaborative design.

This research sees an additional challenge in managing collaborative design since a design team is ad hoc, existing for a relatively short time, and usually design management does not have full (contractual) authority over the members. In applying the theory of Nonaka et al. (1995) for instance, design management should consider how to facilitate the knowledge creation in more dynamic circumstances and more organic organisational structures. Nonaka et al. prompt that the knowledge creation requires a certain time and is not without obstacle, even for already established organisations.

In an ad hoc project group, like a design team in a building project in contrast to a more permanent organisation, the time is much shorter. The members do not have many opportunities to build personal relationships. Within a working period of a few months to a few years, the members of the design team operate from their own organisations and only meet with each other during project meetings or workshops. The purpose of the project is to create something for the client; not to focus on how the group is organised, how the group interacts, or if they ever see each other. Everyone stays focused on the outcome, not on each other (Larbi et al, 2003). Therefore, to develop the group cohesiveness, it is important that design management uses an innovative approach to teamwork to compensate the lack of time and resources for social processes.

Concerning the management of group behaviour, one significant aspect of the relationship between the individual and the organisation is the concept of psychological contract or social contract, as explained by Mullins (1996) and Heintz (2000). A psychological or social contract is not a written document, but implies a series of mutual expectations and satisfaction of need arising from the people-organisation relationship. It involves a process of giving and receiving by the individual and by the organisation. The psychological contract covers a range of expectations of rights and privileges, duties and obligations, which do not form part of a formal agreement, but still have an important influence on people's behaviour. It is an implicit contract that binds the members of a society together and governs, or ought to govern, their conduct. It consists of a number of implicit situations about mutual conduct, respect, and the teaching of compromise, sharing of information, performance of commitments, and a notion of fairness in one's conduct with collaborators.

Heintz (2000) states that the principle of the psychological or social contract can be important for design management in a number of interesting ways. First, design management can encourage the presence of such an implicit contract and attempt to determine what it must consist of. Second, it can inquire whether collaborative design can be improved by making elements of the implicit social contract explicit.

After forming and developing the design team, design management is to bring the team to perform creative tasks. According to the insight model by Barlow (2000), a way to improve the group creativity is by increasing the probability of an individual insight shift triggered by the other group members. The probability that this occurs is higher if as many as possible parts of the complex problem are included in the discussions.

In addition to this, Hohn (1999) suggests to include playing as an important factor in a creative process. Aligned with this, Dorst (2003) compares design to a game. In the 'game', a design problem is a challenge that motivates the ambitious designers to pursue the highest result. While playing, the designers become personally attached and dedicated to the project. Playing gives opportunities to have 'destructive' thoughts and to take risks. It involves excitement, vision, winning spirit, and positive competition among team members to aim high and to be satisfied only by the best result. It steps out of standard patterns and turns a team into a more creative work unit. Through playing, the team members can work

together in relative disagreement, seeking out all the clarifications and simplifications possible, but accepting that consensual clarity is impossible (Barlow, 2000).

When the knowledge about cognitive processes, personal and organisational knowledge, and group dynamics are to be put into practice, design management can adopt reflective practice. Reflective practice is essential; it provides a way to integrate the holistic skills of the design actors into the design and management strategies. Knowing that design is a reflective learning process, design management is to give the appropriate space for designers to propose-experiment-and-learn while they gradually gather the knowledge about the design problem and the best routes towards the solution. Schön (1987) calls in reflective practicum as a way to educate reflective practitioners through coaching. In the same line, Reymen (2001) suggests a design session and Valkenburg (2000) suggests reflective design teamwork. These can be recognised as the first proposals to apply reflective practice to improve collective designing.

When applying reflective practice for managing collaborative design in the conceptual architecture design phase of a building project, the following aspects must be taken into account. The first aspect is that reflective practice concerns an intuitive artistry and a craftsmanship strongly influenced by the organisational learning system. For this, design management needs to relate to and employ the principles of organisational knowledge enabling. The second aspect emerges from the question about the form of reflective practicum or design session. In the exploratory case studies in this research, such a session is known as a design workshop, in which design management is expected to elaborate and guide the programme of activities in the series of events within and in-between the design workshops.

Managing Collaborative Design

Chapter 5

Understanding the heart of managing collaborative design

CHAPTER SUMMARY

In Chapter 3, this research describes that one of the main challenges of design management is managing the human factors and social complexity in collective designing. The recent literature on design management in architecture, as reviewed in Chapter 2, does not provide adequate knowledge to cope with this challenge. Therefore, in Chapter 4, this research reviews relevant theories in other disciplines to complement the current design management knowledge in architecture.

Based on the understanding of the practice and the theories, this research aims to present a design management concept for managing collaborative design. However, as indicated in Chapter 1, design management is considered a rather new knowledge field in architecture. The people's interpretations of design management are still at variance.

To develop the knowledge of design management, an unambiguous perspective of design, management, and design management is essential. Therefore, in this chapter this research carries out an investigation to find an interface between design and management, to acknowledge a common ground on which design management can be built, and to present the scientific reference. In this chapter, this research also clarifies the role and focus of design management in the conceptual design phase.

This research analyses certain aspects of the views of design and management of Buchanan (2001, 2004), Bucciarelli (1994, 2003), Drucker (1999), Simon (1960, 1969, 1970), Jones (1970), Kuhn (1962), and Vitruvius (transl. 1999). Design and management are not completely two poles apart. There are certain similarities between design and management since both are practiced as knowledge intensive human activities that work with and within uncertain situations, to deliberately initiate and devise creative processes for shaping a more desirable reality. In the light of this, the focus of design management in managing collaborative design in the conceptual architecture design phase is not only problem-solving, but also problem-finding. Design management in this context is not the steering of activities and resources towards static and pre-defined goals or requirements, but the critical examination and reformulation of both the requirements and solutions in an iterative process. It is not merely the effort to find a single best solution, but a reflection action during the search process.

5.1 Introduction

In Chapter 3, using exploratory case studies, this research described the practice of collaborative design in the conceptual architecture design phase of multi-architect building projects and the challenges that should be dealt with by design management. One of the main challenges is to deal with human factors and social complexity in collective designing. The recent literature on design management in architecture, as reviewed in Chapter 2, does not provide adequate knowledge to cope with this challenge. Therefore, in Chapter 4, this research reviews relevant theories in other disciplines to complement the current design management knowledge in architecture.

Based on the understanding of the practice and the theories, this research aims to present a design management concept for managing collaborative design. However, as indicated in Chapter 1, design management is considered a rather new knowledge field in architecture. The people's interpretations of design management are still at variance. Besides this, many people still consider design and management as two poles apart. This perception holds back the attempt to progress with design management.

In order to develop the knowledge of design management, an unambiguous perspective of design, management, and design management is essential. Scientific reference that supports this perspective and a common ground between design and management are required. Therefore, in this chapter this research carries out an investigation to find an interface or certain similarities between design and management in the way of thinking and working relevant to the activities in the conceptual architectural design phase of a building project.

In Subchapter 5.2, the research describes that designers and managers need each others' competencies for achieving excellent project results and realising breakthroughs rather than replicating ordinary design solutions.

In Subchapter 5.3, the research clarifies the role and focus of managing collaborative design, by investigating the way design management is exercised as a participative role in designing by using a social-psychological approach.

In Subchapter 5.4, this research discusses how design management should embrace social sciences, next to architecture and engineering, in order to be able to cope with the social complexities in collaborative design during the conceptual architecture design phase of a building project.

5.2 Interface between design and management

While seeking to find the term of reference that reflects the interface between design and management, this research does not intend to present a (new) universal and complete definition. Lawson (1990) argues that an attempt to define design might lead either to a narrow and restricted view from a particular design discipline, or to a too general and abstract definition which is not very useful in helping us to understand design. Similarly, Drucker (1999) states that management has no existence in itself, but it is an organ dependent on the institution. The question of “what is management” comes second after we can define management in and through its tasks. Therefore, instead of debating on the abstract definition, this research aims to obtain a reliable term of reference, according to the purpose and context of the research regarding managing collaborative design in the conceptual architecture design phase of a building project.

Many people in the building industry still perceive that design and management are two poles apart, as noticed by Allinson (1997). Allinson begins his book by illustrating this common misunderstanding in a simplified way. Many designers assume that management is dominated by strictly formulated techniques, methods, and instruments of thinking; and thus, hardly compatible to the open, free, and holistic ways through which design handles the uncountable amount of variables they assume that management has its roots in technical rationality, systems theory, and analytical techniques. Its paradigm is the sophisticated mechanical control device. Its twin gods are economy and effectiveness. This may be the main reason why many architects are reluctant to the idea that their design activities are to be managed. Architects are typically thought to enjoy a tolerance for ambiguity that is an antipathy to what they often perceive as management: rigid project planning and its anxious pursuit of certainties and fixed outcomes.

Conversely, Allinson (1997) continues, many managers still assume that design has an irreducible core that is concerned with issues outside the boundaries of instrumentality. Many managers think that design’s agenda is only cultural and aesthetic. Its values are poorly understood and its methods are difficult to explain. Design is therefore considered as a ‘wild card’ in the project management pack. Many people try to avoid these conflicting mind-sets by placing the managers as those responsible for managing information, communication, and tasks during the design phase while leaving the creative design activities to the architects themselves. This, however, does not answer the need for design management at the core of idea generation by the architects.

Designers and managers have their own tasks and responsibilities in a building project, but to a certain extent there are similarities between design and management in the way of thinking and working. This research intends to show these similarities especially in the conceptual design phase. Understanding these similarities is important for people who manage collaborative design in which they are expected to deal with and be directly involved in the design activities by the design actors.

To be able to understand the similarities between design and management, on the conceptual level, the misinterpretation that puts design against management needs to be corrected. This research seeks to acknowledge that there is a common ground between design and management as designers and managers need each others’ competencies for achieving excellent project results and realising breakthroughs rather than replicating ordinary design solutions.

The research discusses management beyond the functions according to the classic viewpoint of management introduced by Fayol (1949) and Taylor (1947), which are planning, organising, commanding, coordinating, and controlling. This research also intends to look beyond the analytical techniques and tools which have subsequently been developed to support these functions. In the same way, this research looks at design beyond the activity which is mainly based on aesthetic considerations to produce drawings, models, and artefacts (buildings). The research also intends to look at design beyond the largely systematic work as presented by Ferguson (1975) and Handler (1970). This research examines design and management through experienced designers and managers in their daily complex practices.

Simon (1969) and Jones (1970) have both written about the philosophical term of reference of "design" that applies to what the designers do. Simon states: "Design is a process by which we devise course of action aimed at changing existing situations into preferred ones." Jones writes: "Design is the process by which we initiate change in man-made things." If design and management as practice have a shared nature, this term of reference must also be able to address management. To examine this, this research analyses design and management through the aspects of the actors, processes, and products. This can be explained as follows.

Concerning the products, it can be recognised that both design and management deliver something, which is applicable in real situations or in practical settings.

In architecture, for instance, design is commonly seen to hold a responsibility for a real contribution to the environment – in contrast to pure art that is centred around the artist. Grant (2004) illustrates this by saying that an artist faces a blank canvas, an uncarved block of marble, or some other fresh medium that awaits the creative process. The artist's design process starts with unformed raw materials. Architects and managers do not have the same luxury. While, they must still select an arena for action, comparable to the selection of the medium for the artist, that arena is not raw material, nor is it blank. The potential within the architectural and management context is rarely so pristine because an architect or a manager is usually working within a context that already has form, e.g. there is an organisation in existence. Thus, at a minimum, existing structures must be redesigned simultaneously with the creation of a new design.

At the outset, architecture seems to deal with the physical environment only, but actually this will affect the social environment when it fulfils the human needs for space and aesthetics (Popov, 2002). While an architect or a manager, like an artist, may also be hampered in his efforts by imagination and ability, he bears the additional burden of the pre-existing or simultaneous creative efforts of others (Grant, 2004). Management, too, cannot restrict itself from the environment. Management's environment is the society, the organisation, and the business enterprise (Drucker, 1999). At the outset, management seems to only deal with the social environment, but actually this will also affect the physical environment as it organises people who decide on buildings, accommodations, mobility, facilities, etc.

Both design and management are associated with people's environment, and united in the mission to improve the quality of life by satisfying the physical and social needs through the environment. Thus, the environment is not only the context, but also the result. As the result, the final destination of design and management is not the natural environment, but the man-made one. The goal of design and management is not only to understand the natural environment for the knowledge collection, but also rather to find the ways to adjust

it into a more desired one. In architectural design, the intervention is intended to improve the built environment (e.g. comfortable, healthy, and safe) while in management, it is to improve the people (e.g. motivated, self-esteemed, and productive).

The environment or the situation that design and management deal with is definitely not an isolated one – like a laboratory or an art studio – which can be fully controlled. Either physical or social, the situation is severely influenced by external forces, making it very unpredictable. Not only the existing situation is uncertain, but the targeted one too, since it is very dependent on continuously changing people's preferences. Thus, design and management have a shared nature regarding the setting since both are activities that work with and within uncertain situations.

Regarding the processes, design and management can stand on the same line if they are interpreted as verbs rather than as nouns. This means the focus should not be on the drawings, models, rules, procedures, schemes, plans, or anything that is observed only as an object. Instead, design and management must be primarily considered as activity or practice.

Drucker (1999) explains that even though certain components of management can be analysed and organised systematically, the ultimate value of management is in its practice that leads to achievements. The distinctive criterion and the organising principle of management is not its power to command over people and the work of other people, but rather its responsibility for contribution as an active function.

Design and management as activities occur in a certain process, which at the first sight seems to be a change process: changing the existing situations into the preferred ones. However, the process does not simply mean a shift between two existences, but rather a transformation from the existing reality into a new one that does not exist yet. In other words, from the present state to the future state that must be created and shaped. Therefore, design and management are more than just 'the changing', but also 'the making'. In order to do this, design and management activities need specific knowledge to recognise the present situation, the expectation, and the transformation. Design and management are knowledge-intensive activities that occur in a set of creation processes.

The process is not a ready-made system to run, but it must firstly be initiated and devised. Referring to Simon's vision, Boland (2004) explains this by saying that management begins with the activity that alerts us to the need for intervention in order to change the current state of affairs. It includes sensing and predicting the conditions that require action. Following the initiation, there are goals, courses, and alternatives to be selected and followed. It now becomes clear that both design and management –in contrast to some kind of art– are not spontaneous and expressive, but purposive actions (Allinson, 1997). Thus, design and management have similarities regarding the process since both are creative activities with accountable goals and knowledge about ways to achieve the goals through a deliberately initiated process.

By the actors, design and management resemble each other since their fundamental principles can only be practiced by people and their ultimate goal is to serve people.

Buchanan (2004) challenges the popular understanding of design that tends to reduce it to a self-expressive artistic activity associated with the appearance of graphic communications, industrial products, interior spaces, and buildings. He states that such popular understanding of design is not the understanding held by many leading designers. They

regard design not merely as an artistic activity, but as a deeply humanistic and intellectual activity that focuses on the creation of practical, effective products that serve human beings in all aspects of their lives. It is humanistic because it focuses on the human experience of products. It is intellectual because it requires direct or indirect knowledge of all factors that must be integrated in a successful product, whether the product is a communication, an artefact, a service or management activity, or an environment.

Design is directly attached to people – the design actors and the users. As we look to the design actors, we will certainly learn that a design firm is appreciated because of the qualification and the reputation of the designer. Design embraces the combination of four personal competencies, namely: implementational, improvisational, creative, and intellectual (Allinson, 1997). Design takes a complex and sophisticated skill, which is very difficult to be entirely replaced by ‘machines’. Even if it were possible to assign ‘machine’ to any of those competencies, only people can sense and proportionally balance the competencies for endless incomparable cases. Management can neither be taken apart from the people – the managers. Although what a manager has to be able to do can be learned, those are the vision, the dedication, the experience, the personal integrity, and the character of managers that determine the success. People manage, rather than ‘forces’ or ‘facts’. Every achievement or failure of management is that of the manager (Drucker, 1999).

In relation to the people, it has to be realised that the aims and the resources of design and management are the people. Design and management originally depart from the people’s need. In architecture, design is needed to provide shelter for mankind, which depends on three basic aspects: the fitness, the form, and the structure (Vitruvius, 1999). Management is needed to hold the society of organisations together and to make them work. In practice, design and management work with people in order to develop something for them, or to develop them. Moreover, design and management involve interpersonal relationships. Professional designers earn their living by designing for others, and often work in teams, hammering out rather than easily conceiving their ideas. In the same way, managers have to integrate ‘downwards’ with the subordinates, as well as ‘sideways’ with people in other areas and functions who have to put their work to use. Thus, design and management have a shared nature regarding the people since both are centred around the people as the performers (the leading roles), and the resources (the main contributors), and the ultimate aims (the final destinations).

Buchanan’s (2001) description of design can also apply to management, and it can summarise the discussion so far. He describes that design is the human power of conceiving, planning, and making products that serve human beings in the accomplishment of their individual and collective purposes. ‘Power’ is the efficient cause or agency of action that concerns creativity. ‘Conceiving, planning, and making’ are activities executed with adequate knowledge and careful consideration. ‘Product’ represents the changed environment, which can either be physical or social.

Thus, design and management can be addressed by a term of reference as knowledge-intensive human activities, which work with and within uncertain situations, to deliberately initiate and devise creative processes for shaping a more desirable reality. This term of reference of design and management underlines the common ground between design and management. It is the bottom line of the interface between the two domains. It provides a way to connect a wide array of people’s interpretations about the core issues of design and management that are essential for design management.

5.3 Role of design management in the conceptual design phase

In building practice, many people understand design management as project management during the design phase (Doeksen, 2002). Consequently, people try to carry out design management by applying the project management techniques and instruments (e.g. systematic decision-making, planning, monitoring, controlling, evaluation) on the design process (Allinson, 1997; Tunstall, 2000). Wijnen et al (1993) define project management as: Decision-making about the available alternatives in phases, and the integral steering of time, cost, quality, information, and organisational aspects of the project.

This research argues that such understanding is too limited to accommodate the core issues of design and management as described in the term of reference defined in this research. For the purpose of managing collaborative design, this research understands design management as: enabling the creative human competencies to explore the edges of the dynamic conditions for innovation – thus, discovering new alternatives rather than only selecting from the best available ones – while guiding design through the constraints and risks towards the project realisation.

In this term of reference, one should understand that design management is not only problem solving, but also problem-finding. It is not the steering of activities and resources towards the static, pre-defined goals or requirements, but the critical examination and reformulation of both the requirements and solutions. It is not the one-way journey of making decisions to narrow down the possibilities on the course of the project, but the iterative process to continuously review and refine the possibilities. It is not the endeavour to find a single best solution – since there is probably no single best solution in the design –, but the searching itself is very important. A relevant citation from Picasso (taken from the citations of Pablo Picasso (1881-1973) as edited and translated by Fons Heijnsbroek [in Dutch]) says: “I do not seek. I find.” In other words, “I paint to show what I have found [while searching] and not what I have searched for.”

A contrasting comparison between ‘classic’ project management and managing collaborative design in the conceptual architecture design phase of a building project is as follows. The ‘classic’ project management narrows down the decision-making possibilities and steers the project to achieve the pre-defined goals. Classic decision-making starts with a clear consensus about the problem, the facts, and the criteria. But real design problems are ill structured, with constraints and criteria in so many conflicting domains that a clear decision is impossible. The research goes a step further from that by suggesting that for managing collaborative design, design should not be limited by known alternatives, but should be stimulated to find innovation, often beyond the known solution space.

In this sense, the highest contribution of design management should be found in its direct involvement and active participation in the creative processes by the design team. Hence, it is important that managing collaborative design is exercised as a participative role in designing, rather than by giving orders and enforcing rules. In this capacity, it acts more as a peer rather than as a superior leader. It provides consultations to the design actors, rather than giving instructions or commands. Design management is needed as a catalyst that opens, stimulates, and guides the mutual interactions between the ‘black boxes’.

Design management as a participative role can be taken up by any leader of the design team, whether he is a design project leader, a manager, a representative of the client, or an

architectural supervisor. Viewing design management as a participative role may somehow be in contrast with some people's view of management as a cadre of people. Management as a cadre are those members of an organisation who carry the formal title of manager and who commonly share similar beliefs about their status and right to manage. Usually, the title "manager" is given to people in the organisation hierarchy who are at one or more levels above first-line supervision (Easterby-Smith et al, 1991).

In architectural practice, there is an ongoing debate whether design management should be formalised as a function in the project team. This research argues that design management as a participative role is to be customised according to the project setting, scale, complexity and organisation; design management can operate informally or more formally. Prins et al (2001) give the example how design management can operate more formally. At a higher scale in the project, design management can be understood to encompass management activities in the design phase of a building project. This means that design management is a part of integral project management. At a lower scale, design management can be defined as the management function of design processes, which corresponds to the traditional coordination responsibilities of the architect. Within a design office, design management can be seen as the internal management of the organisation. Heintz (1999) shows how design management can operate more informally and assume the leadership in the design team based on trust, respect, dialogs, and social contract (which is an implicit contract that binds the members of the design group and governs their conduct).

In this sense, project managers and design managers can coexist in a building project, and their roles and competencies can complement each other. The conclusions are supported by the fact that in many ways, experienced architects and managers can find the essence of their thinking and action in each other's practice. Stevens (2006) acknowledges that he has experienced many projects in which the architects admit that they are more satisfied with the results than if they had to do the project without project managers. Stevens continues by saying that many architects appreciate the presence of project managers in the design team to support architects in their design tasks. An experienced designer is fully aware of the project requirements and constraints, and uses his creativity to explore the edges of the possibilities and propose inventions. An experienced manager never limits himself to standard solutions and protocols. He uses his analytical skills to get to a higher level of comprehensive understanding of the situation to seek innovative decisions. Managing does not only mean steering and regulating, but also creating and inventing.

5.4 Scientific reference of managing collaborative design

Can design management be considered scientific?

Kuhn (1962) describes a paradigm as a collection of beliefs shared by scientists, a set of agreements about how problems are to be understood. A paradigm is essential because it guides the research efforts of scientific communities, and it is the criterion that most clearly identifies a field as a science. Kuhn envisions a science as having, at any one time, a worldview or 'paradigm' of its environment. This scientific paradigm describes everything that the science holds, all of its laws, beliefs, procedures, methods, and everything upon which it bases its life. He describes a paradigm as a set of inherited preconceptions, the 'glass darkly' through which even the most scrupulous inquirer habitually views the world. When someone shatters the glass – as Einstein did with his theory of relativity, for instance–

everyone is forced to ask questions differently, and to view the challenges of science and philosophy in a new way. This is called a paradigm shift.

A scientific paradigm is the starting point to establish a body of knowledge for design management. However, finding a scientific paradigm for design and management has to face the opposition that says neither design nor management is rock-hard science. On the one hand, design and management are often questioned in terms of their legitimacy of being sufficiently fundamental as fields of science. Many concepts are based on personal success stories of the gurus, who invent the ideas, travel around, and gather a group of followers. Theoretical models are not empirically validated, while terminologies are often weak against critics of rules and formal logics (Prins, 2004). On the other hand, the attempt to define design and management as autonomous art or science can lead them into isolation.

Jong et al (2002) and Whitman (2003) examine the question whether design can be acknowledged as a form of science or research. Jong et al reveal that design cannot fully comply with the general criteria of scientific activity, such as reliability, validity, and evaluative potential. To comply with reliability, design must demonstrate consistent behaviour under circumstances determined beforehand. Regarding this characteristic, the reliability of design is restricted due to the fact that there is a range of possibilities to use a design product and there is much freedom to choose between them. To comply with validity and evaluative potential, the design must be able to be generalised in different situations or contexts. In fact, design thinking is less focused on causality for generalisation reasons, but more on conditionality since designers are hired particularly for solving problems in a unique way. For this reason, classic empirical science, which strives towards design that can be generalised, may be frustrated. This has become even more complicated since design features elements which are incomparable to each other, like usefulness, beauty, and sturdiness. The way design unifies these elements within a specific context is difficult to evaluate before a product is made and used. In architecture, even if a building as a design product proves its value this way, this does not ensure that the same way of designing will generate the same result somewhere else.

Whitman (2003) writes that if design is to be categorized as a form of research, it is essential that it can meet certain criteria, included in the definition of research. In natural sciences, the definition sets three conditions that research must satisfy – that a research question is clearly stated, that appropriate methods of investigation are clearly articulated, and that results are presented coherently and distributed widely. If these conditions are met, then the activity in question may indeed be considered to be research.

According to Whitman, if tested based on the definition in natural sciences, architectural design might not be considered to be a form of research inquiry. Research in natural sciences is distinguished in its commitment to general inquiry and generalisable findings, while design commonly seeks to solve specific problems relevant to specific situations. Research seeks to make generalisable statements that extract reliable knowledge from the world and articulating it so that others may reuse it in some new way. Research lays bare the bones of processes of investigation, and discusses the strengths and weaknesses of the results, disseminating the conclusions unambiguously. The individual case or cases, which may be the focus of the research, are not important. The outcome of the research activity is only of lasting use if it can be, as it were, abstracted and generalized to other situations. In contrast to the impulse of research to generalise, architectural design seeks to uncover, in most cases, a specific solution to meet a set of demands pertinent to the individual case. Design is characterised by 'specificity and finitude', while research concerns itself with

investigations of broad concern. Design is concerned with 'what ought to be': in contrast, research in natural sciences is concerned with what it is. The researcher, seeking to understand the universal properties of what it is, is undertaking a different task to that of the designer, who is concerned with conceiving and planning a particular idea that does not yet exist out of the problems and issues of specific circumstances.

Just like design, management too, is difficult to be acknowledged as rock-hard science. Drucker (1999) says that believing that management can ever fully be a science could be harmful. Management is a practice rather than a science although it contains elements of both. There are aspects and requirements that can be analysed, organised systematically, and learned by anyone with normal intelligence. This stresses that management is not just a matter of experience, hunch, intuition, or native ability. And yet, achievement, rather than knowledge, is both the aim and the proof. Moreover, management as well as design – unlike hard science – are not value-free.

Having learned those opinions, one should probably question whether a scientific paradigm for design and management could ever be found. However, in a 'scientific assessment' like above, people usually use the characteristics of natural or engineering sciences as starting points. The word 'applied sciences' conceals, but it does not change this fact. It simply means that in the professional schools those topics are selected from mathematics and natural sciences for emphasis that are thought to be most closely relevant to professional practice (Simon, 1969). Prins (2004) states that technology and management are mainly based on the early development of empirical and systems thinking, but architecture nowadays relies more on the postmodernist sociological tradition, in which there is no absolute truth, and in which meaning is strongly bound to context and tradition.

It may appear that design and management do not completely belong to those natural or empirical sciences, but this does not mean that they are non-science. There is another kind of science, which Herbert Simon (1969) calls 'the sciences of the artificial'. The term of reference generated in this chapter also reflects the association between design and management to this kind of science. 'Artificial' is used here in a very specific sense: to denote systems that have a given form and behaviour only because they adapt (or are adapted), in reference to goals or purposes, to their environment. Simon characterises an artificial system as an interface between two aspects (e.g. a person and a building). These aspects lie in the province of natural science (e.g. a biological man or woman and a physical space or material), but the interface that links them is the realm of artificial science (e.g. the way an architect designs a building or the way an inhabitant lives in the building). Simon indicates how the sciences of the artificial are relevant to architecture, management, and to all fields that create designs to perform tasks or to fulfil goals and functions.

Simon describes that both man-made artefacts and man himself, in terms of this behaviour, are artificial. He continues by saying that the complexity in human behaviour is largely a reflection of the complexity of the environment in which he finds himself. The analysis in this paper fleshes out these abstract connections by emphasising that design and management are activities by and through human beings to intervene in the environment. Within this understanding, the aspect of human behaviour manifests itself in the social process within and between the individuals involved in designing or managing.

Dorst (1997) summarises that there are two main paradigms in design: the one that sees design as a rational problem solving process related to engineering sciences, and the other that describes design as an activity involving reflective practice related to social sciences. The second one is as important as the first one for managing collaborative design in the

conceptual design phase, but it is often neglected (as found in this research after the literature studies on design management in architecture and the exploratory case studies). The deeper exploration of the nature of design as a social process has been carried out by Bucciarelli (1994, 2003). He examines the consequences of the fact that design is both an instrumental process and an activity that always takes place in social context. He compares design with language, as a human construction embedded in and co-terminus with a range of social activities. Design is a process which engages individuals, each with different ways of seeing the subject, but yet individuals who are in collaboration with one another, must work together to create, imagine, conjecture, propose, deduce, analyse, test and develop a new product in accordance to certain requirements and goals. Bucciarelli proves that social interaction and communication of group members to be a significant determinant of success of collective designing.

Management, too, is a social process. Management is a social function, embedded in a tradition of values, customs, and beliefs, and in governmental and political systems (Drucker, 1974). Management is culture-conditioned, and in turn, management and managers shape culture and society. Even though the management function, the work of management, its tasks, and its dimensions are universal and do not vary from country to country, the way the work is done is strongly influenced by national traits, national traditions, national history; and sometimes determined by them. Thus, although management is an organised body of knowledge and as such applicable everywhere, it is also 'culture'.

This research finds that design and management can be included in the sciences of the artificial. Design management intensely involves social processes and it needs to embrace social sciences, next to architecture and engineering if design management is applied in a building project.

The need for a social-psychological perspective

Related to design management, there is an early tendency both in practice and science to complement the technical-rational perspective with a social-psychological perspective. In practice, all cases in this research show the significance of the social interaction, respect, trust, commitment in the design team, and how the managers are trying to apply a more personal rather than a rule-based approach to manage the collaboration. People realise that managing collaborative design should incorporate social-psychological approaches, not only to complement the current technical-rational approaches, but also because the primary attention should be given to the human players, the design actors. The need for a social-psychological perspective also seems to appear in science. In science philosophy, the 'evolution' from a systematic, technical-rational thinking to a social-reflective paradigm can be noticed. There is a revival of the human factor, with its unique cognitive facilities, as the focal point in design and management.

Buchanan (2001, 2004) illustrates this as a fundamental shift in the intellectual arts that we employ to explore design in practice and research. The early theories of design found expression in the grammars and logics of design thinking, but new design finds expression in rhetoric and dialectic. His idea of interaction design suggests the shift of perspective from the massive totality of systems to the pathways of human experience.

Behind the recent effort to develop the technical methods, most researchers in the field of design management in architecture have actually become conscious about the importance

of a social-psychological perspective. Prins et al (2001) have distinguished design management from regular project management by emphasising team building, leadership, the creation of commitment and shared values, and steering of outputs above the specification of activities and the steering of administrative factors as time, cost, quality, and risk. Design management has to maintain the balance between an open, informal, and stimulating sphere within the design team and a more formal management mechanism to control the progress. Allinson (1997) has brought up the purposive thinking and the heuristics as the ancient art of simplified problem solving in designing related to personal perspectives. He has also paid much attention to the professionalism, ethics, and cultural factors of architectural design teams. Gray et al (2001) have addressed the effective communication and team building. Unfortunately while the methods to reflect on the systematic process are currently available, the considerations about the human aspects in architectural design management still remain silently as conceptual thoughts.

5.5 Conclusions

In architecture, many people still consider design and management as two poles apart. This holds back the attempt to build the body of knowledge of design management. Moreover, to date there has been no consensus on the definition of design management. As a result, design management in architecture is fragmented into experimental approaches in small application fields.

This research finds that design and management have a common ground if they are acknowledged as social process. Design is a social process. Design is attached to people – the designers and the users. Design is an activity that takes a combination of competencies that are exhibited by human. Design affects the social environment as it fulfils the human needs for space and aesthetics. Management is a social process, too. Management cannot be taken apart from people –the managers and the people in the organisation. Although what a manager has to be able to do can be learned, those are the vision, dedication, experience, personal integrity, and character of the managers that determine the success. People manage, rather than forces or facts. Management works with people. Management is needed to hold the society of organisations together and make them work.

Design and management share a common ground in practice as knowledge-intensive human activities, which work with and within uncertain situations, to deliberately initiate and devise creative processes for shaping more desirable reality. Design and management share a paradigm in science as sciences of the artificial that embrace social sciences, next to architecture and engineering if design management is applied in a building project.

Furthermore, this research identifies an importance of managing collaborative design in the conceptual design phase in enabling creative human competencies to explore the edges of the dynamic conditions for innovation while guiding design through the constraints and risks towards the project's realisation. In this context, design management becomes a catalyst that stimulates and guides the mutual interaction between individual creative processes. Design management takes a participative role in designing. It acts more as a peer, rather than as a superior leader. It provides coaching and consultations to the design actors, rather than giving instructions and commands.

Knowing that the interface between design and management can be found in the social processes of the two activities, this research urges design management in architecture to

integrate the social-psychological approach to complement the technical-rational approach. The social-psychological approach for managing collaborative design could find its scientific basis in social psychology. Sufficient recognition of the human dimension in architectural design is undoubtedly important. It is also important that design approaches evolve to keep pace with technological as well as with human capacities and needs. The social-psychological approach in design management may set a new frontier by reviving the human dimension as the focal point of building design. It contains much potential since it raises the sensitivity of designers to complex societal realities during and after the design process. It also contributes in creating better design through creative and reflective collaboration, progressive learning-in-action, and high performance team working.

Managing Collaborative Design

Chapter 6

A concept for managing collaborative design

CHAPTER SUMMARY

Based on the results of empirical and theoretical studies in the preceding chapters, a concept for managing collaborative design in the conceptual architecture design phase of a building project is presented in this chapter. The concept focuses on the participative role of design management in idea generation through creative teamwork. It adopts a social-psychological approach to complement the technical-rational approach. The concept comprises a model describing that collaborative design is an interplay of cognitive, social and project frames, and several principles to manage collaborative design by designing these frames. The concept is called managing-by-designing.

The empirical study in Chapter 3 shows three main aspects of collective designing that need to be dealt with by design management. The theoretical study in Chapter 4 reviews the theories that address these aspects. In this chapter, a model is presented to describe these aspects and their interrelationship. The model shows that collaborative design is an interplay of cognitive, social and project frames. In practice, while working within a real project frame, the design actors are engaged in the creation of design solutions through dynamic cognitive processes of problem framing and solving, and at the same time, in the social processes in which group behaviour and teamwork climate play an important role to achieve the desired synergy effect.

The cognitive, social, and project frames do not pre-exist and cannot be standardised. Managing collaborative design is expected to creatively create and shape them in different situations and to meet the project content and the characteristics of the design actors and organisations. In other words, design management is expected to design these frames. Therefore, managing collaborative design works through designing; and therefore, it can be called managing-by-designing.

In this chapter, several principles of managing-by-designing are described. Managing collaborative design by designing the cognitive frame implies that design management is to develop and configure heuristic devices to stimulate and facilitate the generation of creative ideas by individual and group. Managing collaborative design by designing the social frame implies that the managers can create the environment that fosters positive group behaviour for collaborative design. Managing collaborative design by designing the project frame deals with the real goals, visions, constraints, resources, and outcomes of an architectural project on which the design actors are working.

6.1 Introduction

Based on the results of empirical and theoretical studies in Chapter 3 and 4, a concept for managing collaborative design in the conceptual architecture design phase of a building project is presented in this chapter. The concept also reflects an understanding of the heart of managing collaborative design that has been discussed in Chapter 5.

The concept for managing collaborative design in this research focuses on the participative role of design management in idea generation through creative teamwork. In such a design process, the design actors are of key importance. In the participative role, design management becomes a social catalyst in the design team to stimulate and guide creative design interactions between the design actors. Therefore, the concept addresses the design actors, their design processes and creative ideas by adopting a social-psychological approach. A social-psychological approach is needed next to complement the technical-rational approach that mainly works through systematic processes to facilitate the achievement of tangible design products.

In this research, the concept is not meant as a guideline, a tool, a protocol or a blue print for managing collaborative design. The concept does not draw the boundaries of action. It is unlike a guideline, which is more like a statement or other indication of policy or procedure by which to determine a course of action. It is also different from a tool, which is more like a set of instruments that are prepared to help the people in their course of action into practical effect. The concept will be useful for the professionals to reflect on their current practice and to improve the way of managing collaborative design.

It should be possible to customise the concept for different project types and the dynamic characteristics of the project actors and organisations, to a certain extent within the context of managing collaborative design in the conceptual design phase. Each design project is unique and so it needs a tailor-made design management approach. Furthermore, the concept should not become a standardised protocol since it should be able to accommodate an endless variety of personal knowledge, skills, and experience of the people that use it for managing collaborative design.

Managing collaborative design becomes significant in a complex project in which many different design actors are involved. Therefore, the concept should be applicable for large and complex building projects, which are fundamentally different from the small and simple ones. Gunsteren et al (2001), Koskela et al (2002), and Gray et al (2001) argue that conventional project management techniques are not automatically applicable, and even the most experienced manager can fail to manage a complex design project. The complexity should not be avoided because it is a necessary part of a flexible and responsive industry. It is not the presence of complexity that is a problem, but the inability of the management to deal with it.

6.2 Managing-by-designing concept

Based on the results of empirical and theoretical studies in the preceding chapters, a concept for managing collaborative design in the conceptual architecture design phase of a building project is presented in this chapter. The concept comprises a model describing that collaborative design is an interplay of cognitive, social and project frames, and several principles to manage collaborative design by designing these frames. The concept is called managing-by-designing.

A model describing the cognitive, social and project frames in collaborative design

One of the conclusions of the empirical study in Chapter 3, which is illustrated in Figure 3.10, is that managing collaborative design in the conceptual design phase deals with three main aspects in collective designing, namely: the creative design processes by the design actors, the interaction of these processes through social contacts and interpersonal communication, and the way a building project is organised in its real context. The design actors deal with the activities of idea generation to invent design solutions (e.g. in masterplan and building design), establishing and developing effective teamwork (e.g. through interactive workshop and the role of informal design leadership), and delivering design products that can meet the client requirements, political agenda, and budget and market constraints (e.g. according to the design brief and project scope).

The theoretical study in Chapter 4 reviews the theories that address these aspects, namely: theories related to thinking and knowledge, theories related to group dynamics, and theories of management complexity. The considerations used in the selection of these theories are shown in Figure 4.1.

In this chapter, a model is presented to describe these aspects and their interrelationship. The model distinguishes these aspects into cognitive, social, and project frames. The model shows that collaborative design is an interplay of cognitive, social and project frames. In practice, while working within a real project frame, the design actors are engaged in the creation of design solutions through dynamic cognitive processes of problem framing and solving, and at the same time, in the social processes in which group behaviour and teamwork climate play an important role to achieve the desired synergy effect.

Regarding the description of the cognitive, social, and project frames and the interrelationship between these frames, the model builds further on the view of Badke-Schaub (2004) and Frankenberger et al. (1998). Badke-Schaub et al. focus on human-centred design methodology. In their research, three interrelated groups of factors influencing the design process and its results are defined, namely: the individual factors (e.g. style of problem solving, open-mindedness, knowledge, and experience), the group factors (e.g. style of communication, cohesiveness, hierarchy, and group climate), and the external conditions (e.g. management style, company situation, and restrictions).

Some other writers present a similar view. Bucciarelli (2003) writes that design comprises a balance of two aspects. The first one involves the analysis of situation and the creation of design artefacts. The second one involves the purposes and roles in social circumstances. This is crucial because what makes the situation complex and makes designing a challenge of the highest order is the fact that each participant sees the object of design differently. Bucciarelli writes that design and many of the descriptions in the process of design are

expressions in the various languages of 'object worlds'. This is aligned with what Buchanan (2001) calls as 'interaction design' that focuses on how human beings relate to other human beings through the mediating influence of products. Here, products are not only physical objects, but also experiences, activities or services.

The model as a part of the concept for managing collaborative design in the conceptual architecture design phase of a building project describes that while working in real project circumstances, design actors are engaged in the creation of design solutions through dynamic cognitive processes of problem framing and solving, and at the same time, in the social processes in which group behaviour and climate play an important role to achieve the desired synergy effect. These three interrelated frames are shown in Figure 6.1.

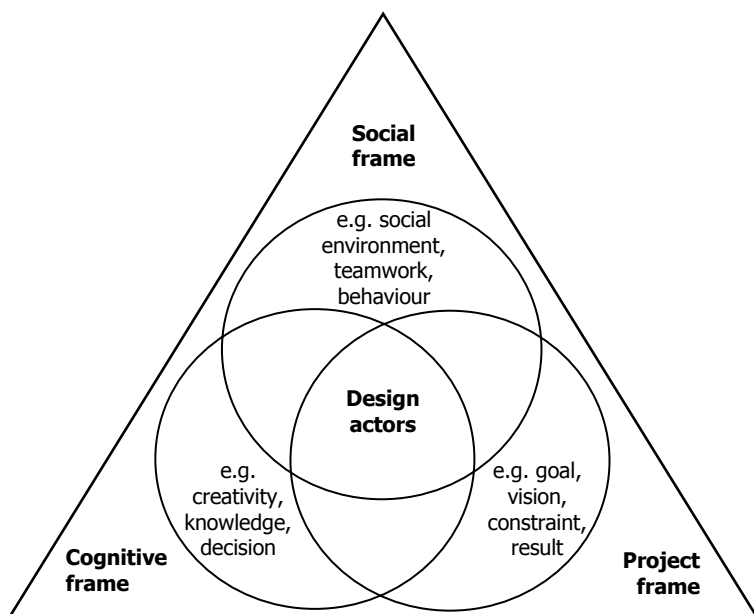


Figure 6.1 A model describing the cognitive, social, and project frames in collaborative design

The cognitive frame comprises problem framing and problem solving processes using methods of enlarging and limiting the search area. It involves the analysis of the situation and the creation of a solution. It implies the analytical and synthesising ability of the design actors, including human perception and insight.

The social frame comprises cooperative behaviour, which might take account of the relationship between conscious and unconscious aspects of behaviour in the design team. It involves the purposes and roles in social circumstances. It implies group leadership integrity and the ability of the design actors to interact with each other.

The project frame comprises actual project goals, constraints, operations, and targeted results. It involves the awareness of project resources, challenges, and circumstances. It implies multidisciplinary and multilevel linkages in the project process.

To deal with these aspects, certain abilities are needed by design management. As written by Drucker (1999), management must balance two kinds of abilities in undertaking its main tasks. One involves the analytical and synthesising ability, including human perception and insight; and the other involves integrity and the ability to interact with other people. The first ability is more dominant in tasks related to measuring, while the second one in tasks related to communicating, motivating, and developing people. Both abilities are of the same importance when management must set objectives and organise.

Several principles of managing collaborative design by designing the cognitive, social and project frames

The cognitive, social, and project frames do not pre-exist and cannot be standardised. Hence, managing collaborative design means creatively creating, shaping and customising these frames to apply in different projects and to different design actors and organisations. In other words, managing collaborative design works through designing these frames. Therefore, the concept for managing collaborative design can be called managing-by-designing.

The interface between design and management in the context of managing collaborative design has been broadly and deeply explored in Chapter 5. Designing is not merely an artistic activity associated with drawings and models. Design can be seen much wider than creating forms and spaces. Design can be about anything: organisations, processes, communications, policies, etc. Managing is broader than steering and regulating using rule-based systems, procedures, and protocols. Management should be seen openly to include re-exploration of situation and re-creation of possibilities. Viewing managing as designing provides the energy and the direction to move forward by comparing the two activities to emphasise their resemblance and mutual potential. It shares a view of managing and designing as specialised, purposeful activities that structure the interaction of parts (people, resources, things) to create some envisioned whole (Eickman, 2004; Orlikowski, 2004).

Allinson (1997) intends to make designers re-apprehend the significance of management. He tries to bring management into the architects' practice by introducing project management methods. His effort is thus to promote the awareness of the importance of project management for designers. The managing-by-designing concept builds further on Allinson's effort by looking from the other perspective to promote the awareness of the significance of design (and the way designers think) for managers. The concept shows that management can learn from design competence. It underlines how the innovative power of the habits of thought of designers can be transferred and incorporated in management.

Bringing the art of design into the practice of management has been the focal discussion point during the international workshop held in June 2002 in Cleveland, USA. The workshop involved scholars and practitioners from a wide range of disciplines, i.e. architecture, sociology, industrial design, history, choreography, strategy, economics, music, accounting, product development, and management of for-profit and not-for-profit organisations. They discussed how to bring the art of design to the practice of management. The premise of this workshop was that the disciplines of management and design should be newly conceived – reborn in a symbiotic relationship in which management draws on the principles of design (Boland and Collopy, 2004; Eickman et al, 2004).

The international workshop was inspired by the experience of close collaboration between Weatherhead School of Management and Frank O. Gehry & Partners for the design and construction of Peter B. Lewis faculty building. The management experts were intrigued by the unique design competence exercised by Gehry and its potential for management.

Many people believe that design is a core capability of the people who manage today's complex situations. Tzonis (2004) notices that there is something extremely engaging and fundamental about design that prompts it to work as robust metaphors to be applied in other domains of practice such as management. Buchanan (2004) discusses how designing and managing are inescapably intertwined and as a result, design principles should permeate and inform management practice at all levels and stages of an organisation. Coughlan and Prokopoff (2004) add that while design continues to be seen as a specialised expertise, the tools of design are found learnable and applicable to challenges that managers face every day. When designers are coupled with managers, a capacity to envision and realise futures that are both desirable for the people and viable for the organisations can be created.

Herbert Simon (1969) argues that design attitude should also be found in management. His book *The Sciences of the Artificial* is one of the finest examples of a well-developed theory of design attitude for managers. Simon states that the essence of the man-made sciences – including management – is design.

The contrast between the design attitude and the conventional management attitude (called decision attitude) can be explained as follows.

During the 1960s, a view was developed that the key to an effective management was the ability to take decisions, particularly under conditions of uncertainty. This decision attitude therefore emphasised the importance of techniques that could be used to analyse the environment within which decisions must be made, and ways of reaching decisions which will work as well as possible, even if they are not completely ideal (Easterby-Smith et al, 1991). Such decision attitude towards problem solving is used extensively in management education. It portrays the manager as facing a set of alternatives courses of action from which a choice must be made. It solves problems by making rational choices among alternatives and uses tools such as economic analysis, risk assessment, multiple criteria decision-making, simulation, and the time value for money. But for all the power of analytic approaches to problem solving, they share a central weakness in that they take as given the alternative courses of action from which the manager is to choose.

In contrast to this, the design attitude towards problem solving prioritises the effort to create good new alternatives. Although this often is difficult, the design attitude appreciates the 'cost' of conceiving an innovative course of action much higher than the 'safe' choice among 'wrong' available alternatives. A design attitude views each project as an opportunity for invention that includes a questioning of basic assumptions and a resolution 'to leave the world a better place than we found it' (Boland, 2004).

Next to design attitude, the managers of collaborative design need to employ design thinking that is characterised by innovative and creative explorations. Design thinking is believed to be very useful if it is applied to a widening circle of human problems that are no longer adequately addressed by traditional methods and practices (Buchanan, 2004). Design thinking could bring significant contribution to effective strategy development, organisational change, and constraint-sensitive problem solving. Design thinking is, thus, crucially important for managers, but remains overlooked in management practice and

education (Boland et al, 2004). Therefore, it is important to raise more widespread design thinking among managers of collaborative design in the conceptual architecture design phase of a building project.

The managing-by-designing concept introduced in this chapter is based on the view that, managers needs to take a designer's approach in managing collaborative design in the conceptual architecture design phases of a building project. Simon (1969) sees a manager as a form-giver who shapes organisations and economic processes. Grant (2004) adds by saying that the truly enlightened manager will understand that this responsibility means that his own old designs may require modification or destruction to facilitate new ones. Those with the power to enable new creative spaces within the management context must be the ones who embrace design. Schön (1983) writes that in a certain situation, a manager is like a technician whose practice consists of applying principles and methods derived from management science to solve organisational problems. In another situation, a manager is expected to be like a craftsman, a designer, and a practitioner of an art-of-managing that cannot be reduced only to explicit rules.

The managing-by-designing concept enriches the view of the actual management by blending the two competencies. Simon (1960) sees this blend and calls design as one of the three major components – intelligence, design, and choice – which a manager engages in. Intelligence is that activity which alerts us to the need for an intervention in order to change the current state of affairs. Design is the formulation of possible courses of action that can respond to the current situation in a way that makes it better able to serve desired human ends and achieve our goals (this has been discussed more detailed in Chapter 5). Choice is the process of selecting that design alternative which is most efficient and effective in achieving our goals. These three take place in a way that finds them intertwined. In investigating the implications of the way that managers punctuate the sequences of their intelligence, design, and choice actions, Boland (2004) draws on Karl Weick's formulation that an individual engages in sense-making of the 'blooming, buzzing confusion' of their ongoing stream of action by punctuating it into a sequential pattern in order to generate a plausible and coherent understanding.

This research outlines several principles of managing collaborative design by designing the cognitive, social, and project frames (Table 6.1). In the following sections of this chapter, these principles are explained using real examples from the case studies and supporting theories that can be made practical in these examples. These principles are non-exhaustive. They are not meant to be generic and complete, but rather to be used to clarify and demonstrate the practical implication of managing-by-designing.

The cognitive frame comprises the creation and problem solving process. Managing collaborative design by designing the cognitive frame means that design management is to develop and configure heuristic devices to stimulate and facilitate the generation of creative ideas by individual and group. The heuristic comprises ways, especially the human cognitive formulations, serving as a guide in investigating problems and finding solutions. They accommodate rapid processes of intuitive judgement and implicit knowledge to be combined with rational and systematic analysis. They help to make the thinking process (thus not only the developed product) to be understood by different design actors through different perspectives. Heuristic devices for collaborative design can be models, tools, activities, events, organisations, situations or other means to support collective designing; whether they are visual, verbal, or spatial.

The social frame comprises social interactions and behaviour in the design team. As idea generation in collaborative design occurs through social interactions between the people, managing collaborative design by designing the social frame means that the managers can create the environment that fosters positive group behaviour for collaborative design. It may concern physical environment or structural elements of an organisation, but more importantly the teamwork settings and culture.

The project frame contains actual project goals, constraints, operations, and targeted deliverables. Managing collaborative design by designing the project frame deals with the real goals, visions, constraints, resources, and outcomes of an architectural project on which the design actors are working.

Several aspects within the cognitive frame - Idea generation, creativity, problem framing and solving - Personal and organisational knowledge - Design decision-making	Several principles for managing collaborative design by designing the cognitive frame - Diagramming and sketching to enhance design and management cognition - Developing and composing meta-models, metaphors, and analogies to engage shared understanding - Activating expert intuitive judgement to support design decision-making
Several aspects within the social frame - Teamwork environment and culture - Social interactions, trust, and teamwork - Motivation and commitment	Several principles for managing collaborative design by designing the social frame - Setting up a design studio-like working environment - Team building for designers - Assuring dedicated and highly motivated effort
Several aspects within the project frame - Goals and vision - Constraints - Targeted results	Several principles for managing collaborative design by designing the project frame - Reinventing goals and vision - Reframing constraints - Shaping and synthesising solutions

Table 6.1 Several principles for managing collaborative design by designing the cognitive, social, and project frames

6.3 Managing collaborative design by designing the cognitive frame

The concept of managing by designing the cognitive frame as introduced in this research builds on the view of Karl Weick (2004a). As a social psychologist, Weick points out that if managers need to understand and coordinate variability, complexity, and effectiveness, then they need to create design that mixes together perceptual and conceptual modes of action, or move back and forth between these modes, or rely on multiple compounds of abstraction.

Weick refers to another social psychologist, Ruben Baron (1999), when explaining the distinction between perceptual and conceptual processing. Baron argues that in the mode of direct perception, people develop knowledge by acquaintance through active exploration. Cognitive processing involves bottom-up stimulus-driven processing in order to take action. Direct perception consists of online automatic processing. As a result of continued direct perception, people tend to know more and more about less and less, which makes it easier for them to 'forget the name of the thing seen'. By contrast, when people work in the conceptual epistemic mode, they develop knowledge by description rather than acquaintance, their cognitive processing is now scheme-driven rather than stimulus-driven, and they go beyond the information given and elaborate their direct perceptions into types, categories, stereotypes, and schemas. Thus, continued conceptual processing means that people know less and less about more and more.

This research describes several principles to design the cognitive frame of the design actors in collaborative design in the conceptual architecture design phase of a building project. The principles comprise: diagramming and sketching to enhance design and management cognition; developing meta models, metaphors, and analogies to enable shared understanding; and activating expert intuitive judgement to support design decision making.

Diagramming and sketching to enhance design and management cognition

Sketching may serve management purposes next to being a means of communication between designers. Sketches can be used by designers to describe his interpretation of the client's requirement, as well as by the managers to design the programme of requirements –to explore, set-up, and elaborate the references and expectations. It can also be used by the managers to design and clarify organisational linkages, division of tasks and responsibilities, and project procedures.

In the exploratory case studies in this research, the following examples were found. In De Resident, the clients, managers, and architectural supervisors used sketching to discover the possibilities and draw the strategic plan for project development when neither detailed programme of requirements nor guidelines were yet available. In Oosterdokseiland, the project managers used sketching to figure out, make visible, and map the complex conditions and circumstances of the building site. An example can be drawn from the researcher's professional experience. He was assigned to assist the project managers of the client organisation to visualise the project situation and sketch alternative strategies for project realisation, and to prepare the design programme for the architects. More examples were given by an architect and architectural supervisor, Jo Coenen (interview in DELTA, vol. 18, 2005), who described that by sketching together with the client, both parties tried to better understand the expectations and possibilities.

Sketching can be used to explain the extraordinary design ambition. For instance, by sketching the design actors can elaborate their interpretation and imagination of an 'architecture sandwich' resulted from the horizontal and vertical combinations of different buildings or building sections by different designers. Sketching as a universal language to formulate and communicate the management's requirements is easier to comprehend by the designers, and therefore, very useful to complement the textual design brief. To improve this, design managers could train to use the cognitive power of sketching to conceive meta-schemes that comprise multiple frames of formal-functional interrelationships, multilevel processes and information.

Sketching can also be used to guide a design workshop. The architectural supervisor can directly participate in real-time sketching to present his idea and guidance can complement the managerial advice, instructions, and protocols. To enhance this, the design manager could learn from group sketching approach.

These practical examples can be supported by a theoretical explanation about the use of diagramming and sketching to enhance design and management cognition as a principle of managing collaborative design by designing the cognitive frame.

Collopy (2004) argues that experienced designers are not more imaginative than novice designers. Their cognitive aids help them to think of things they would not normally imagine. Being able to control the shape of one's design environment facilitates the mind stretching, which is associated with creative activity.

This research discusses several cognitive aids suitable for designers and managers in collaborative design. Throughout the design process, there is an emphasis on visualisation. Designers employ a wide variety of visualisation techniques to facilitate individual and collective understanding of ongoing work, ranging from concept mapping and sketching to visual collage and other forms of imaging (Buchanan, 2004). Heuristic devices applied by designers to conceive schemes, such as diagramming and sketching, can be interesting from the point of view of management.

First, it is important to define what a diagram means and what it is in its relevance in architectural design and management. A diagram is a pictorial representation of arrangements and relations. It is the containment of ideas, relationships, arrangements, and interactions. Spuybroek (2002; and additional information of the concept of diagramming on <http://wiki.sial.rmit.edu.au/theHive/FinalEssay>) states that the diagram is employed as the intermediate between "the world as imagined" and "the world as experienced". It does not exist as a unique component, but rather functions as the in-between, the bridge between the incorporeal and the corporeal. The diagram is a self-contained entity, which should be credited for its infinite potentials in forming or revealing relationships, rather than the graphic from which architecture merely imitates. In the beginning of the process, the diagram has the capacity to be perceived, experienced, interpreted, and translated differently. Its essence remains intact during the translation process. This leads to a question of what it is exactly that could lie beyond architecture's physicality and its reign of solidity. Perhaps the diagram is best accepted for what it can achieve, ceasing to try and be what it cannot and may never be less its essence is lost when it is physically challenged architecture. Architectural form, rather than be directed by the diagram, should capitalise the diagram in allowing it to reveal potentials and possibilities and that in turn affect the built in some way. A diagram reveals relationships and interactions and it is which constitutes form, not dictates it.

Architectural sketches are a kind of diagram, used by architects as means for reflection enhancing the design process, or for communication aiding design collaboration. Architectural design, language, diagrams, drawings, plans, and numeric representations are used in the design process, both for the communication between those involved in the process and as design tools for the individual designer. These languages are not simply instruments for the description of facts, but they play an active role in the design process. Using these languages as a tool for exploration requires an understanding of their role in the process of design. Architectural sketches mix different modes of representation (pictorial, iconic, topological, and algebraic) as well as superimpose concurrently multiple frames of formal-functional interrelationships. The sketches are capable of compressing vast amounts of information. They are powerful tools that help architects to abstract attributes of hypothetical provisional design solutions and summarise their complex patterns; thus, enhancing the design process. The principle of sketching is useful not only for designers, but also for managers. A similar mechanism can be used at the early stages of a management inquiry. The mechanism, which is used originally by architects to construct diagrams and to map design situations and problems, can be adapted and developed for the setting and conception of non-spatial organisational schemes and processes (Tzonis, 2004).

Managing collaborative design can utilise or produce heuristic devices with similar capacity of architectural sketches to be used in collective designing, for instance by using mental arithmetic and shared images operating at multiple levels as techniques for architectural brainstorming and as means for design communication in aiding collaborative design (Tzonis, 2004). Tzonis further reminds us that when using sketches to support design cognition, we must keep in mind that there is neither an explicit protocol nor an official list of rules for describing forms or functions in architectural sketches. Another problem associated with the use of sketches is that they are fuzzy. Sketches can lead, smoothly and unconsciously, to illusions, deceptions, and biases. Thus uncritical trust in sketches can have a negative impact on rational design thinking.

Diagramming and sketching can be used in combination with visual and verbal methods. Lugt (2001) demonstrates that graphic techniques can be applied in a design project start-up meeting to provide a quick simulation of the design process to come. Each participant can sketch his idea individually on a large sheet of paper pasted on the wall, and after a few minutes, briefly and verbally presents his ideas to another participant. Then, these two switch places and continue sketching using the ideas drawn on the sheet by the other group member as a source of inspiration. Subsequently, each participant seeks another 'partner' to repeat the 'visual-verbal' sketching process. Such simulation allows the designers in a team to gain a shared understanding of the design task by discussing possible pathways towards solutions that came up when generating ideas. Graphic techniques may be more suitable when, instead of a large number of ideas, a smaller but more refined collection of novel design ideas are desired. Lugt further proposes a combination between ideas sketching, which is entirely non-verbal, with brief verbal explanation the ideas.

One of the verbal reporting processes to be combined with diagramming sketching is thinking aloud. The think aloud during problem-solving means that the subject keeps on talking, speaks out loud whatever thoughts come to mind, while performing the task at hand (Someren et al, 1994). Thinking aloud is a method which, in principle, does not lead to much disturbance of the thought process. In general, talking aloud does not interfere with the task performance. The talking may simply be talking to oneself, or as a conversation between members of the team who act in a similar way. In either case, the project gains solidity and momentum just through this magic of description. The verbal way combined with the visual way is also very suitable for managers who often construct visions by

debating with their colleagues, with their consultants, and with themselves (Engeström, 2004).

Developing and composing metamodels, metaphors, and analogies to engage shared understanding

From several examples found in the exploratory case studies in this research, we can learn that unexpected “aha!” by someone can be triggered by ideas from any other people in the design team. For instance, there were times when the supporting staff, which were looking at the problems from different, yet complimentary, perspectives, happened to spark the ingenuity of the designers. Therefore, acquiring multilevel and multidisciplinary creativity by addressing and engaging wider participants is important. For this purpose, broad vocabulary and means of representations are needed to encourage all participants to understand the design ideas, and to allow them to actively contribute to the creative discussions. Multimedia representations, scale models, 3D drawings, and virtual reality can be used in the design workshop to help the design participants to recognise the design on global and detailed level. In all studied cases, the use of scale models in design workshops was proven significant to examine the integration between different building blocks and the articulations at the integral context.

Each design actor or project participant may have different interpretations of certain design issues. In Nieuw Stadshart Almere, the architects, civil servants, and real estate developers had their own interpretations of how the urban spaces should be designed and characterised. The individual interpretation remained implicit and was never confronted with those of the others. In an attempt to bring out these interpretations, a workshop was organised. The participants were joined in groups consisting of participants from different backgrounds and roles. An artist presented the photo series over Almere while the participants were asked to take an imaginary walk through the to-be-designed urban spaces, and then to express their “feeling of the city” –the meanings and perceptions of the urban spaces. They were also asked to give themes to the spaces using reference images, stories, and arguments.

Thematic workshop series can be organised over building architecture, open spaces, as well as colour and material selections. In a workshop, metaphors about similar and contrasting urban situations can be used to clarify design ideas. For example, some participants in the workshop in Almere compared the future urban space of Almere to La Ramblas in Barcelona.

In addition to this, sounds, movements, and art performance could provide unique ways to portray sense and emotion which should be realised in a lively built environment. Group site visits and journeys through the city, like that organised in Oosterdokseiland project, can give the participants the personal experience of the spatial and social atmosphere of the project.

These practical examples can be supported by a theoretical explanation about developing and composing meta-models, metaphors, and analogies to engage shared understanding, as a principle of managing collaborative design by designing the cognitive frame.

In collaborative design, design idea generation is not the work of a single heroic maestro. In collaborative design, good dialogue and persuasive arguments, along with the physical

handling of artefacts, contribute to the quality of design ideas (Boland et al, 2004). Therefore, multiple perspectives are essential for the constant framing and reframing of the design problems and solutions. Looking through different perspectives is like in film and photography, what is put into a frame and what is left outside decides much of the meaning in a picture of the world thus produced. With time, a habitual framing develops, which may in the end stop providing the picture of the world needed for successful action (Czarniawska, 2004).

For working with multiple perspectives, members of the design team need to use multiple models on multiple scales simultaneously. Boland et al (2004) take an example of the distinctive approach by Frank Gehry when designing a faculty building at Weatherhead School of Management, Case Western Reserve University. Gehry used multiple models of a design problem and the working ideas for its solutions can bring out different aspects of the design problems, different difficulties to be overcome, and a different sense of what a good solution might be – all of which contribute to a higher quality solution. Gehry used different models in several meetings with the clients during the conceptual architecture design phase to show what he was thinking and to get reactions. Each model was different from the following one. This process continued several rounds before the architect and the clients could say that the underlying form was stabilised. Then they could work with the models that were indeed becoming refined with each iteration. While the managers thought that the first models will be refined to eventually become the final solution based on the client's suggestions, Gehry and his senior partner, Jim Glymph, would say things like, "This is just a place to start", or "It's the beginning and it will change."

For many architects, including Gehry, a model is a tool for thinking, not only a representation of the building he is designing. It is a working model of the creative process. They see a model as a kind of three-dimensional sketch to stimulate thinking and explore ideas about possible ways that the project could go. The managers, in contrast, tend to use the concept of model as theory of a situation and its solution, the abstract essence of what the completed building would be like. Actually, the first model by the architects may not contain an essence of the building because their search for a solution is still ongoing in fundamental sense.

Sketching, mapping, and storytelling as well as metaphors and analogies are potential complements to models in keeping an evolving understanding of a design problem in a more liquid state. Designers often use a series of concepts and metaphors for capturing the oscillating between precision and fuzziness, which is the essence of good design practice. These concepts and metaphors have their origin in a diversity of disciplines and they transcend these disciplines (Wagner, 2004).

The distinction and use of metaphors and analogies are made clear by Rosenhead (2001). A metaphor is a figure of speech in which a name or descriptive term is transferred to some object to which it is not properly applicable. It can be a way of illuminating certain phenomena in a novel way, so that routine understandings of their significance may be enriched or replaced by interpretations based on the quite different field to which they are juxtaposed. An analogy carries rather more clout. An analogy consists of some assertions of similarity or difference between corresponding elements in two different systems, and about the sets of causal relations operating within each system. Analogies are widely used to suggest scientific hypotheses worth investigating, to the extent that 'analogy' and 'model' can be treated as virtual synonyms. Generally, analogy is used to connect a well-understood domain to one in which understanding is less developed.

Architects are usually more daring in their analogies than most other disciplines (Tzonis, 2004). They recruit sources from more distant domains. Architects also recall precedent cases to extract from them only parts of an entire scheme, which they proceed to recombine in novel wholes in surprising ways. The managers can see systematic procedures developed, employing architectural metaphors as heuristic devices at the early stages of a management inquiry. In addition, they can see them applied as communication vehicles in an inquiry that requires multi-agent collaborative problem solving. Using metaphors and analogies, the implicit skills and tacit knowledge can be shared with other people (Nonaka et al, 1995).

Activating expert intuitive judgement to support design decision making

To be able to utilise the expert intuitive judgement to support rational analysis in designing, the complementary expertise and experience of different designers in the design team is important. From the exploratory case studies in this research, we have learned that architects work through different ways for conceiving design ideas. Some architects were quick in presenting generic design alternatives out of their project portfolio, e.g. the American architects like Graves and Pelli in De Resident with their vast experience in office buildings. Some other architects, including many Dutch architects, were excellent in critically reviewing the programme and local situation.

Therefore, encouraging the foreign and local architects to work together may shorten the analytical and learning process to fit the solutions to specific problems. Moreover, the expert intuitive judgement can support bright innovative thinking when 'more experienced' architects are paired with 'less experienced' architects. In Mahler4, this was done by assigning a 'less experienced' architect to design the low-rise building (the podium) and a 'more experienced' architect to design the high-rise building (the tower) of the same building block.

For design management, the art of composing the design team itself is an endeavour of expert intuitive judgement. An architectural supervisor of De Resident mentioned that when he and the real estate developer, MAB, decided on the architect selection for De Resident, they did not only look at the design portfolio and track records of the candidate architects, but also assessed the candidate architects –using their professional intuition– whether they would be able to fit in the teamwork with the other architects (Kees Rijnboutt, interview).

The presence of all persons who have the mandate for taking the final decision representing the design parties is crucial for an effective decision making in a design workshop. This also appears to be important at the strategic level. For instance, the strategic decision making for a complex project like De Resident took place in a compact top management team (Ton Meijer, in Langenhuizen et al, 2001). The monthly meeting, so-called "herenoverleg", involving Peter Noordanus (the alderman of the Municipality of The Hague), Ton Meijer (representing the real estate developer, MAB), and Kees Rijnboutt (architectural supervisor and chief government architect), was organised with the aim of eliminating long bureaucracy in decision making by large organisations. People who did not consider expert intuitive judgement essential might think that the "herenoverleg" some erratic decisions. Actually, these decisions, which have later been proven to be successful, were based on serious consideration and were accepted with great responsibilities by all parties.

At the strategic level, every critical decision to develop a large project involving high risks is always a matter of balancing comprehensive analysis and expert intuitive judgement

(Gehner, 2003). In De Resident, the clients believed in Rob Krier to realise successful urban architectural despite Krier's unusual approach to Dutch urban design; since Krier's 'organic design style' is rather uncommon to the Dutch grid pattern. In Almere, the decision to experiment with the "curved ground level" and a mix of irregular urban blocks was, to a certain extent, based on the expert intuitive judgement that such innovative approach would not only promote a breakthrough, but would also sustain the daily urban operation.

These practical examples can be supported by a theoretical explanation about activating expert intuitive judgement to support design decision making as a principle of managing collaborative design by designing the cognitive frame.

Herbert Simon in his later article "Making Management Decisions: The Role of Intuition and Emotion" (1987) reports that over the past 40 years, the technique of decision making has been greatly advanced by the development of a wide range of tools –in particular, the tools of operations research and management science, and the technology of expert systems. But these advances have not applied to the entire domain of decision-making. They have had their greatest impact on decision-making that is well structured, deliberative, and quantitative, but they have had less impact on decision making that is loosely structured, intuitive, and qualitative.

Therefore, Simon (1987) explicitly endorses the use of expert's intuitive judgement to complement the other approach for decision-making. Intuitive decision-making involves interpersonal interaction. Experts often arrive at problem diagnoses and solutions rapidly and intuitively without being able to report how they attained the result. This ability is best explained by postulating a recognition and retrieval process that employs a large number of patterns stored in long-term memory.

In logical decision-making, goals and alternatives are made explicit, the consequences of pursuing different alternatives are calculated, and these consequences are evaluated in terms of how close they are to the goals. In judgemental decision-making, the response to the need for a decision is usually rapid, too rapid to allow for an orderly sequential analysis of the situation, and the decision maker cannot usually give a veridical account of either the process by which the decision was reached or the grounds for judging it correct. Nevertheless, decision makers may have great confidence in the correctness of their intuitive decisions and are likely to attribute their ability to make them rapidly to their experience.

Simon compares this to a chess game. The difference between a grandmaster and a novice can be found in the grandmaster's knowledge, acquired by long experience, of the kinds of patterns and clusters of pieces that occur on the chessboard in the course of games. Previous learning that has stored the patterns and the information associated with them in memory makes this performance possible. When the grandmaster is solving a difficult problem or making a complex decision, much conscious deliberation may be involved. But each conscious step may itself constitute a considerable leap, with a whole sequence of automated productions building the bridge from the premises to the conclusions. Hence the expert appears to take giant intuitive steps in reasoning, as compared with the tiny steps of the novice. This, then, is the secret of the grandmaster's intuition or judgement. Simon notices that there is nothing 'irrational' or 'magical' about intuitive or judgemental reasoning based on productions. It is grounded in knowledge and experience. Its sources lie in physiological conditions or factors, or in the physical and social environment, mostly impressed upon us unconsciously or without conscious effort on our part.

The next question is how the expert's intuitive judgement can support decision making, especially for managing collaborative design. Simon underlines that it is a fallacy to contrast 'analytic' and 'intuitive' styles of management. Intuition is not a process that operates independently of analysis; rather, the two processes are essential complementary components of effective decision-making systems. Every manager needs to be able to analyse problems systematically as well as to be able to respond to situations rapidly, a skill that requires the cultivation of intuition and judgement over many years of experience and training. Being an effective manager means having command of the whole range of management skills and applying them as they become appropriate. When the problems to be solved are more than trivial, the recognition processes have to be organised in a coherent way and they must be applied with reasoning capabilities that allow inferences to be drawn from the information retrieved, and numerous information to be combined.

6.4 Managing collaborative design by designing the social frame

In collaborative design, there is a need to interact and share individual creativity and tacit knowledge. The process of sharing creativity and knowledge is bound to circumstances – both physical and social. Managing collaborative design by designing the social frame of the designers is, therefore, oriented to creating the working environment that inspires creativity through social interaction in designing, as well as the personal motivation of the designers to strive to accomplish the design tasks through complex situations where they are thrown into. Several design activities by the managers are setting-up design studio-like working environment; team building for designers; and assuring dedicated and highly motivated effort.

Setting-up a design studio-like working environment

A design studio is a 'natural' working environment for designers. In a design studio, the exchange of inspirations, questions, comments, and clarifications among the design actors (architects, supervisors, managers, etc.) can take place immediately and informally while the design ideas are being worked out and sketched down. A design studio is an organic working environment suitable for a design team. In the organic working environment, the design team decentralises to specialists who can comprehend the issues, yet it allows members to interact flexibly to respond to unpredictable changes and to solve complex problems.

A design workshop can be seen as a temporary design studio. It is an opportunity for open and interactive design activities. One of the most important intentions of the design workshop is to get co-creators into one's creativity as those at the workshop make the proposed ideas obvious and implementation immediate. An effective design workshop provides the opportunities for design studio-like working besides the plenary meetings or discussion sessions involving all design actors.

In the exploratory case studies in this research, an example of studio-like working environment can be seen in the urban design atelier of the Zuidas/Mahler4 project that accommodated urban designers, architects, and managers to work together. In the atelier, the informal social atmosphere stimulated mutual dialogue and exchange of ideas between

different designers and between the manager and the designer. An urban architect and architectural supervisor, Pi de Bruijn, was appointed in 1998 to lead the atelier. The design workshops involved the urban designers of the Municipality of Amsterdam and the other participants (members of city council, real estate developers, project managers, architects, advisors, etc.) who were invited to attend special design sessions related to their responsibilities. The main task of the urban design atelier was to develop the urban plan, and subsequently to monitor the urban design implementation for assuring the integral urban design quality. The work of the atelier included various disciplines and activity levels, e.g. from policy making to landscape design. The atelier was not a decision-making body, but rather a think-tank. The atelier reported to the city council that takes the final decisions.

These practical examples can be supported by a theoretical explanation about setting-up design studio-like working environment as a principle of managing collaborative design by designing the social frame.

To design the social frame, one ought to rethink the entire organisational ecology of the design team. Collaborative design in the conceptual architecture design phase of a building project needs, among other things, a 'creative density' (Wagner, 2004). A creative density is an environment rich in resources that may help open up an unfruitful venue; a placeholder, which facilitate working with something that has not yet been specified in detail and allow temporary 'fixations'; and a diversity of representations of a design, and in particular, persuasive artefacts that invite others into a dialogue, enlisting their cooperation.

The dialogues between designers need the right working environment to take place. For this purpose, collaborative design can benefit from moving into a working environment similar to a design studio. It is a working environment that is conducive to exploration, experimentation, design, interaction and dialog. Design studio allows for maximum creativity by providing for a natural physical environment and free interaction by all group members. Such working environment can support design management to remove as many roadblocks to creativity as possible, providing an open environment to innovation. In such creative environment, the managers should not be quick to punish failure, since creating something really new often involves several failures before achieving success (Eickman et al, 2004).

Thus, design studio sessions and design meetings are parts of a design workshop. In the design studio, all designers elaborate their designs in real-time, responding to the general remarks during the presentation session. In the design studio, the designers can immediately and informally interact and discuss the design problems with each other. In the design studio session, the managers can directly involve in design activities by exchanging ideas while the designers are designing.

Team building for designers

Architectural designing is a long iterative process of refinement which takes many years of intensive consultations with a large number of parties. Being asked how it then possible to realise the high-quality design, Jo Coenen, the former Chief Government Architect, explained (interview in DELTA, vol. 18, 2005) that an architectural supervisor must be able to play a series of simultaneous chess games, which could be exhausting. One must be flexible and smart in using the other people's knowledge and understand their problems. He must not become subservient or like a chameleon. He should retain his position deriving from his knowledge of design.

In collaborative design, the designers often find themselves in a situation of endless discussions and negotiations that require mutual give and take to reach a consensus. The social interactions in designing lead to the social power which effectively shapes individual and overall designs.

One of the real examples of this was the way in-depth discussions with the other members of the design team, rather than top-down management's instruction, drove Sjoerd Soeters to change and improve the design of Helicon Building in De Resident several times to achieve the most satisfactory end result (Figure 6.2).

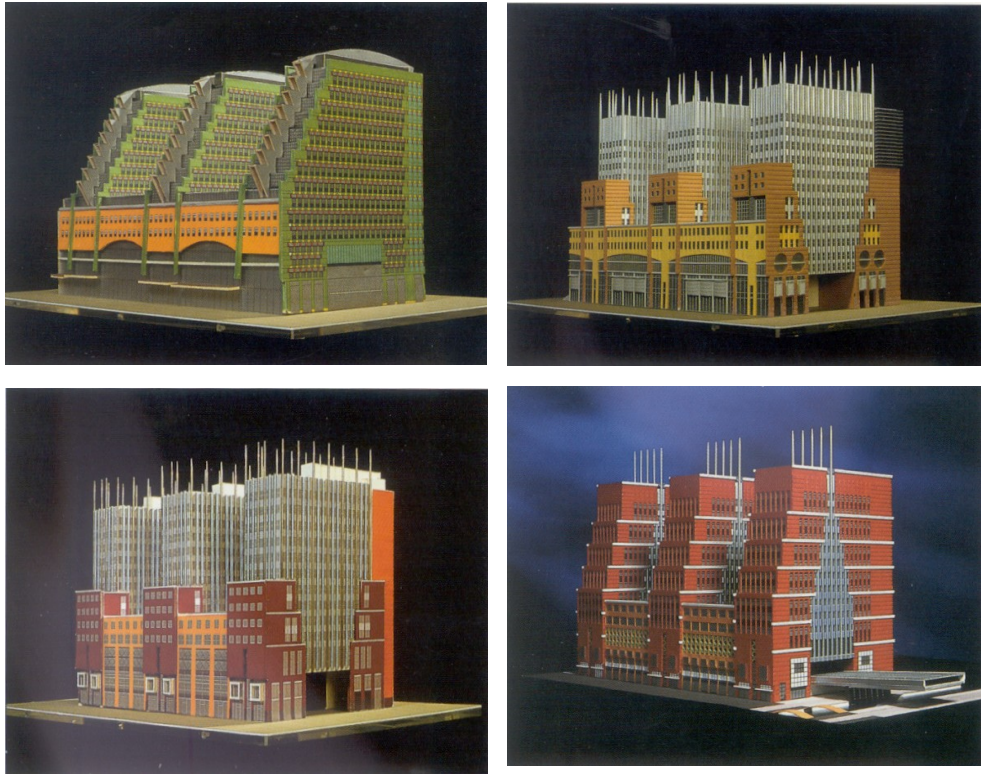


Figure 6.2 Design changes of Helicon Building by Sjoerd Soeters (source: Rossem, 1996)

It has become clear that when a close collaboration in the design team is sought, it is moral rather than contractual argument that turns the actors. Heintz (2002) supports this by stating that social power is the potential influence that one person exerts over another. The moral arguments made between designers, their decisions, and their commitments should be based on appeals to fair play, professional pride, and collegial courtesy.

For team building, a design manager can initiate social activities during the project kick-off session to create conducive social interactions and social power. The exploratory case studies show that this is dependent to the personal quality of the architectural supervisors. The charisma and reliability of the supervisors, beside their outstanding knowledge and

experience, help them to foster respect for one another in the design team. The design managers' role is not limited in harmonising the expertise, but also harmonising the behaviour of the design team.

These practical examples can be supported by a more theoretical explanation about team building for designers as a principle of managing collaborative design by designing the social frame.

Teams are a cluster of two or more people usually of differing roles and skill levels who interact adaptively, interdependently, and dynamically towards a common and valued goal. Teams which assemble for a specific project are defined as project teams. They often comprise members from different backgrounds who bring specialised skills to a project (Bellamy 2005).

Team building comprises several group factors, i.e. recruitment and selection, group configuration, group maturity and cohesiveness, and group effectiveness. Designing the social frame starts by composing the design team. During the recruitment and selection of members of the design team, design management needs to consider personal characteristics and attitudes towards collaboration beside design and technical competencies. There is nothing to be gained by appointing someone who although competent and technically efficient is unlikely to work in harmonious relations with other members. Consideration of sociability is also important because design management must cast each team member into one of the team roles as explained by Belbin (1996).

The understanding of organisational design does not only refer to the structural features such as alignment with formal authority, the organisation as a material entity, details and constraints, the prescribed rather than the emergent, and choices rather than construction (Weick, 2004a). To reanimate the topic of designing the social frame, the attention should be broadened to dynamic elements such as social interactions in design team. In managing collaborative design, the managers realise that what counts most in creating a successful group is not how compatible its members are, but how its members manage to deal with incompatibility.

Subsequently, management intervention is required to assure an effective group maturity process in the relatively short time wherein the members of the ad hoc design team come together to perform the design tasks. To compensate the short time for achieving group cohesiveness, the managers can organise social events related to the design tasks, for instance, on-project-site gathering or thematic kick-off meeting. All members of the design team should realise that trust, openness, respect among the members and dedication towards the overall project quality are as crucial as the quality of individual ideas.

The group cohesiveness is also affected by what motivates the members. Mullins (1996) describes that extrinsic motivation is the result of tangible rewards such as fair payments and bonuses as defined in the contracts. Such factors are those which, if absent, can cause dissatisfaction. In other words, they are hygiene or maintenance factors to prevent dissatisfaction. Intrinsic motivation, more importantly, is related to psychological rewards such as the opportunity to use one's ability, a sense of challenge and achievement, appreciation, recognition, and being treated in a considerate manner with trust and openness. These factors are the motivator or growth factors, which if present, serve to motivate the individual to superior effort and performance. This is the point where the social-psychological approach for managing collaborative design in the conceptual architecture design phase can bring a significant contribution.

Furthermore, effective work groups actively look for the points on which they disagree, and consequently, encourage conflicts among participants in the early stages of the discussion. In contrast, the ineffective groups feel the need to establish a common view quickly, use simple decision-making methods such as averaging, and focus on just completing the task rather than on finding a solution they could agree on (Buchanan et al, 1997). Mintzberg (1983), Roeloffs (2001), and Boer (2001) write that a dynamic condition may breed aggressiveness and conflict, which in fact are necessary elements to generate innovation. Design management is not supposed to bottle up that aggressiveness, but it can channel a conflict to productive ends. For doing this, design management does not operate in the authoritative sense (give orders by direct supervision), but instead, it can spend a good deal of its time acting in a liaison and negotiating capacity, coordinating the work laterally among the different teams and functional units.

In certain situations and cultures, consensus may be most important. Kitao (2005), after observing a number of building projects in Japan, came to the conclusion that the collaborative design process relied on consensus between all parties involved. At a time when the leading architect had no formal authority vested on him to command the block architects, social approaches such as mutual understanding, professional respect, and consensus were the ways to proceed with the collaboration. However, consensus should aim at synthesis (i.e. choices aimed at satisfaction of all stakeholders) and not at compromise for lower qualities (Gunsteren et al, 2001).

One of the most important results of successful team building is the social contract. When the members of the design team successfully blend in collaboration, new social contract and ethics are born (Heintz, 2001). Heintz asserts that formal conventions provided by professional associations, which bind the contractual relationship between design actors, are always partial and sometimes even at odds with observable behaviour. In fact, the actors' conducts are informal conventions that define the practice. Almost all coordination between members of the design team who do not have explicit contracts with each other (thus the majority of bilateral relations) is governed by the social contract. Social contract is an implicit contract that binds the members of a society together and governs, or ought to govern, their conduct. It consists of a number of implicit situations about mutual conduct, respect, and the teaching of compromise, sharing of information, performance of commitments, and a notion of fairness in one's conduct with collaborators. Such informal conventions also include many suppositions about other professions participating in building design, and how best to work with or often around them. As such informal conventions have been established, the social frame for collaborative design is operational and sustainable.

Ronco (2005) discusses how teamwork fits into the practice of architecture and explores the nature of effective team. He observes that team building is an essential competence for designers, yet many designers struggle to build teams effectively. Successful teamwork aims to achieve synergy and to avoid performance slippage. By synergy, teamwork directs a design team to the potential of producing at a greater level than the sum of their individual parts. In sports, the team with synergy has a strong winning record in spite of average individual player statistics. In architecture, project teams with synergy produce projects beyond the abilities of the sum of the individual project team members. However, despite strong individual resources and the potential for synergy, a design team should become aware so that they will not suffer from a kind of performance slippage. Performance slippage means that the sum of their individual efforts falls short of what it could be. Following the sports analogy, they are like all-star teams that showcase strong individuals but fail to deliver a strong team product.

Ronco (2005) also illustrates the five myths and facts about team building. He writes that although the field of group dynamics and the practice of team building have existed for several decades, a number of myths about the nature of team building prevail. The first myth is that team building should never be needed; just select good people and teamwork will follow. The fact is that team building is necessary because, especially in the practice of architecture, strong individual performers are often ineffective when working in teams. Conflict and miscommunication are inevitable; team building helps groups understand and manage conflict and miscommunication effectively. The second myth is that team building is a one-time event like bowling or paintball. The fact is that one-time events can help build a team, but effective team building is usually more of an ongoing process. The third myth is that team building depends upon chemistry; people either get along or they do not. The fact is that for professional teams, team building is a form of practice. Like sports teams, professional teams perform at higher levels when they practice. The fourth myth is that the goal of most team building is to get team members to like each other. The fact is that in effective teams, members may or may not like each other. Team building can (and often should) be more focused on bottom-line team performance and productivity. The fifth is that most team building aims to eliminate conflict and disagreement from groups. The fact is that conflict and disagreement can help make groups more effective at problem solving. Team building usually aims to help groups manage conflict more effectively, not to eliminate it.

Assuring dedicated and highly motivated effort

In the case study of De Resident, we can find an example of the design actors' motivation which resulted from the personal bindings between each designer and his design, and between the project success and the achievement of individual goals. In the right setting, it was possible to stimulate a high degree of loyalty to the design project and respect for each other's views from a group of very talented architects (Ton Meijer, in Langenhuizen et al, 2001). The level of ambition and commitment of the design actors in De Resident continuously raised throughout the project. The dedication of the architects to their job was remarkable as they strived for an unprecedented degree of urban, architectural, and functional quality.

From the exploratory case studies in this research, we can learn that all designers are enthusiastic and feel appreciated for being appointed for a prestigious and challenging project. All designers in the interviews expressed to have been looking forward to the unique opportunities and valuable experience of design collaboration with the other designers. For instance, as an architect, Peter Drijver (interview) admitted that he respected Rob Krier's designs and that he was delighted to be able to work with Krier in the project of De Resident.

Within its capacity, design management can maintain the designers' dedication and motivation, and prevent management inconsistency that may break the positive dedication and motivation. In the attempt to do so, there are many challenges beyond the capacity of design management to control, for instance the influence of market and economy situation. An example of this can be found in the beginning of Oosterdokseiland project when the architects were stimulated to realise high quality urban design and architecture. However, under the circumstance of the declining economy, the client trimmed down the design proposals by the architects. As there was inconsistency between the proclaimed ambition and the actual decision, without rigorous explanation or collective discussion to adjust the ambition level and the vision, the motivation of the architects was negatively affected.

Design management might contribute to limit the negative effect to the design actors' motivation by facilitating clear consultations between the architects and the clients.

These practical examples can be supported by a theoretical explanation about assuring dedicated and highly motivated effort as a principle way of managing collaborative design by designing the social frame.

Designers are not just working on design problems; they are thrown into a design situation (Dorst, 2003). They are inside a situation that already has interested actors, cultural forms, path-dependencies, policies, laws, and expectations related to it that will shape the problem space being addressed (Boland et al, 2004). A design activity by the manager is to create the opportunity and attitude for highly motivated effort through the difficulties.

The notion 'thrownness' was unpacked by a philosopher, Martin Heidegger, as quoted by Weick (2004b). Referring to Heidegger, Weick defines 'thrownness' as the pre-reflective experience of being thrown into a situation of action without the opportunity or need to disengage and function as detached observers. The condition of 'thrownness' characterises the manager's design situation. It shapes the possibilities for the manager as being a designer and helps him to understand how design emerges in a social context. In designing the social frame, design management encourages the mood of 'thrownness' and enriches the aspiration by rendering design activities stronger and more appropriate through many complexities. Design management supports the designers to cope with daily problems, which require dedication, highly motivated effort, and stubborn muddling through obstacles and challenges.

To enhance motivated effort through the difficulties in the collaborative design, design management can introduce playing. Playing is a means to stimulate group creativity. Design as a game can become a challenge that motivates the designers to pursue the highest result. In the game, the designers become personally attached and dedicated to the project. A game involves excitement, vision, winning spirit, and positive competition among team members to aim high and be satisfied only by the best result. It steps out of standard patterns and turn a team into a more creative work unit (Dorst, 2003; Hohn, 1999).

6.5 Managing collaborative design by designing the project frame

A team may suffer from sub-optimal team performance because they never fully clarify and articulate their shared vision, mission, and goals in direct relation to the project. Therefore, the social processes and cognitive activities by the design actors need to be placed in the real project content and context. Managing collaborative design by designing the project frame comprises several 'design activities' by the design managers, among others: reinventing and reformulating goals; instilling, picturing, and sharing visions; reframing constraints; and shaping and synthesising solutions.

Reinventing goals and vision

The design process of a building project is affected by collective, group, and individual goals, which cannot always be made explicit or anticipated beforehand. The client is usually made up of partnership between the (local) authorities and private building developers. Consequently, the project carries government and business agenda's, and design is always influenced by an accumulation of political-economical decision making processes, made by many, over a long period of time. The design processes and requirements are often subjected to modifications and delays, for instance when a new stakeholder joins-in or replaces another. In managing collaborative design, one needs to consider the external factors that influence the design process. The following examples show how managing collaborative design can cope with changing goals in a real building project and take necessary decisions or actions.

From the exploratory case studies in this research, we can learn that reinventing goals is crucial. In the project of De Resident, one of the investors, quitted while the design process was ongoing. This has resulted in the changing roles of the stakeholders. In Nieuw Stadshart Almere, the design of certain blocks was delayed because the need for adjustments following the requirements of new building tenants. In Oosterdokseiland, the project had to 'wait' for the completion of the European tendering procedure for certain buildings. Design may be affected by the political changes, but may also affect the politics to gain the support for the project. For example, the design ideas for De Resident drew the interest of the alderman of Municipality of The Hague, who then gathered political support to realise the project. Furthermore, the case studies show that the development phases needed to be adjusted to accommodate 'newly' discovered problems or solutions. The originally development phases in De Resident, Nieuw Stadshart Almere, and Oosterdokseiland were adjusted several times because of infrastructure and construction problems as well as financial limitations.

Next to having a dynamic goal, a visionary perspective is essential. The project of Nieuw Stadshart in Almere is an example of this. Jan Nieuwenhuizen, the director of Dienst Stadscentrum (interview in Stadscentrum Nieuwsbrief, vol.15, 1999) said that the visionary thinking of the masterplan was presented by OMA, but it came into reality as the City Council of Almere decided on the design (in 1995) as they had 'good feeling' that the selected design was promising for the future of the city. The urban vision was elaborated through close discussions between the masterplan architects (OMA, represented by Rem Koolhaas and Floris Alkemade) and the real estate developers. The real estate developers critically examined the architects' visions through technical-social-economical considerations of project realisation. After the masterplan has been established, a Q-Team was set-up to develop and translate the vision together with the project architects through direct briefing and discussion.

Instilling the design vision of an integrated project is crucial, especially when multiple designers working on a project. However, this is not always simple since the clients' design visions are often unclear and it requires collective effort to interpret them. Managing-by-designing can be understood as production of vision and decisions and bringing these two into fruitful interplay with one another, so that envisioning and decision making are dialectically intertwined. Once the vision is clarified, the challenge would be to picture and share this to be understood by all project participants. To generate and transpose the vision, people can use many different ways and media. Architects and urban designers may prefer to use visual representations as shown in the following examples.

The project vision of Mahler4 was a part of the comprehensive urban development vision of Zuidas. The Municipality of Amsterdam in collaboration with multidisciplinary experts presented a thorough description of the vision in the document titled "Visie Zuidas". Besides explaining the development schemes, this document included various urban issues, e.g. environment, infrastructure, mobility, economy, labour opportunity, leisure and culture, housing, public facilities. This document was periodically updated to link the vision and ambition with the current progress state. Based on the urban vision of Zuidas, the masterplan and urban plan of Mahler4 were developed. Subsequently, to translate these into architectural design concept, a workshop involving all design actors and stakeholders was organised.

In De Resident, the urban design vision was included in the "Design Guidelines LAVI-kavel", which was presented in more architectural way. The guidelines were actually meant to share the architectural vision –such as block and building forms, spatial philosophy, and material and colour impression– rather than to impose strict rules for designing.

In Oosterdokseiland, the presentation of the design vision became urgent after the design process has been going for some time. There were difficulties to integrate different design ideas from various designers due to the lack of an integrative vision. Responding to this, the masterplan architect, Erick van Egeraat, was assigned to present the architectural vision of the project. Van Egeraat presented this in scenes and videos which displayed the expected 'atmosphere' to be created in the urban environment.

From the abovementioned examples, it can be seen that design vision may come from the local authorities or the clients, but may also be developed together with the designers and other project participants. It is important, however, that the vision is introduced as early as possible in the design process to be comprehended by all participants. It is also important to invite all participants to critically appraise the vision during the progress of the design or realisation.

These practical examples can be supported by a theoretical explanation about reinventing goals and vision as a principle of managing collaborative design by designing the project frame.

Designing as a process and an accomplishment can be considered as an ongoing activity; it is always on the move. The goals and ways to achieve them cannot be frozen and statically formulated just at the beginning of the project. In a creative and complex design process, people are not able to anticipate everything (if all answers are known beforehand, it is more likely standardisation rather than innovation). Knowing this, design management ought to leave room for exploration to locate a possible range of solutions. It implies openness and dynamics. Design management can incorporate a proper degree of flexibility to continuously reflect on the goals and activities in the dynamic process rather than rigidly operate within the original preset. At the same time, design management can make the design participants aware of the "(acceptable) price" for arriving at real innovation.

Formulating goals as a part of designing the project frame for managing collaborative design is to be done while the design process is ongoing, like the classic saying, "We are designing the bicycles that we are riding". One cannot stop riding while the design is reinventing itself. Through the project frame, design management can produce a clear path through the well-crafted design process towards the transition from the current goals to the newly conceived goals, as the designers are reframing the problems and revealing new

possibilities. The manager also guides the stakeholders to understand the fullest ramifications of the openness of the goals.

Designers may play a subtle game in which they pit their individual interests against their understanding of how they are obliged to act within the design team (Dorst, 2003). An architect may have individual ambitions to create 'the most important' building in the urban complex. It is the manager's role to remind the architects that the real success is determined by the realisation of an overall harmony out of diverse architectural shapes and styles. An architect can only gain the reputation or credit upon the success of the whole project. The manager then needs to clarify the team objectives and create a way for the architects to achieve their objectives by directing their effort towards the success of the project.

Designing the project frame does not actually portray management as a science of rational decision making within a known and stable world, but instead, as an art of generating visions and the pathways for reaching the visions within an uncertain and dynamic world. Engeström (2004) describes this as the reconfigurative production of visions and articulate production of decisions. Thus, one of the manager's important roles is instilling visions. Instilling vision is introducing a mental image about the ultimate goals of the architectural project and the insight into the current situation and requirements. A classic saying by Antoine de Saint-Exupery sounds, "A rock pile ceases to be a rock pile the moment a single man contemplates it, bearing within him the image of a cathedral." The role of design management is to assure that the design participants can always see the cathedral –the bigger vision– just outside their window.

The manager can tell stories and conveys images that allow the design participants to feel and envision a purpose beyond the immediate task at hand. Stacey (1993) writes that senior managers should not only espouse a unique vision or long-term plan, but should rather promote the conditions for the emergence of an evolving agenda of strategic issues. It should intervene only selectively, and then at sensitive points. To do so effectively it needs to have an understanding of the qualitative patterns of behaviour, which such intervention could produce, without wishing to control it to a preconceived path or believing that it could. The strategic role of senior management is largely to facilitate processes of dialogue, which can lead to innovation, rather than to preside as final arbiters over an elaborate analytic process.

To instil visions to the members of the design team, the managers ought to speak the designers' 'language'. Design as a social process acknowledges that different participants speak different 'languages' with different kinds of heuristics, metaphors, norms, and knowledge as codified, tacit, and know-how (Bucciarelli, 2003). What needs to be done is to bridge those proposals, preferences, claims, and requirements of participants from different 'worlds' into a coherence by constructing a certain interface to draw the lines between and surrounding different domains. Designing the project frame may need to include the reformulation of new management vocabulary in design. This which includes not just the words, but the strategies of problem solving the designers and managers are drawing upon, the kinds of imagery they are being inspired by, and the materials, shapes, and textures of the design elements that formed a kind of language for the project (Boland, 2004). This can be used to resolve the difficulties when the client's vision of the project is not yet complete or clear. By sharing the 'language', the managers do not only transfer the vision to the designers, but also invite the designers to develop and present the vision together.

Reframing constraints

Design constraints can be used to stimulate innovation if the constraints are creatively re-construed and reframed. The case studies in this research show that even the constraints on budget, realisation time, resources, etc. can be turned into a creative frame to generate a high-quality design that fits in its market context. In the project of De Resident, the architects were expected to research the design constraints and possibilities to contribute to the detailed spatial and functional programme which was simultaneously developed with the architectural design. Designing could, thus, be considered as a research process to recognise and identify the frame. Design investigated and defined the constraints while proposing the best solutions. In Nieuw Stadshart Almere, new spatial and design solutions came to light where architecture had to deal with technical innovations of integrated utility, mobility, and transport systems. In Mahler4, the high and low-rise skyline pattern of Zuidas urban area reflected in the building shapes, leading to the blend between building towers and building podiums by different architects. In Oosterdokseiland, the high density inspired design solutions which allowed views as well as sunlight and fresh air to penetrate the places where the distance between the adjacent buildings was very limited.

In dealing with constraints in the design process, managing-by-designing differs from the 'conventional' project management since it suggests that design management does not only use the existing process components and arrange them into another variant of the system, but also generate new process components and systems. In this sense, the design manager is to give the opportunity and to encourage all design actors and the other stakeholders to actively address constraints and explore the meaning of constraints.

These practical examples can be supported by a theoretical explanation about reframing constraints as a principle of managing collaborative design by designing the project frame.

Constraints are limitations on action. They set boundaries on solutions. Yet, those boundaries have the potential to inspire. Identifying and exploring constraints offer the opportunities for learning about them and reinterpreting their meanings. This provides a starting point for negotiating new possibilities. Constraints can be accepted or challenged, adopted or explored (Vandenbosch, 2004). Many designers acknowledge constraints as fundamental to their processes. While designers may work very hard to circumvent local planning laws, they recognise that a key component of their skills is their ability to provide creative solutions for their clients' programs taking many limitations into consideration. This responds to the designers' need to expand the solution space of their work, on the one hand, and to cope with the impossibility of 'controlling users' detailed implementation and appropriation of a design on the other hand (Wagner, 2004).

While designers often begin their work by questioning the basic assumptions, many managers prefer to work around or eliminate constraints rather than taking time to 'confront the box' (Vandenbosch, 2004). By investigating how other disciplines understand and work with constraints, we may be able to provide insight into how managers might become more attentive to them and learn how to work with them. Therefore, by designing the project frame, design management can learn from the ways designers identify and negotiate the meanings of constraints and how they decide to challenge them, accept them, or leverage them in the design process. By this, the manager may develop a new mechanism to work with the designers in designing around and through the constraints they inevitably face.

Design managers need to take into account that design and management constraints are a dynamic unfolding discovery. One cannot always know at the outset of a project about the

constraints that will be the project's undoing. Sometimes, constraints develop as a project progresses. Moreover, many design and management constraints are socially constructed. While these are probably more negotiable than the law of gravity, it is an understanding of the degree to which their meanings are negotiable and what options there are for dealing with them that determines the constraint space. Therefore, it takes a manager with personal competence of professional insight and patience to recognise and accommodate or assimilate constraints dynamically.

Another competence required to re-interpret constraints is improvisation. In cognitive terms, improvisations are usually linked to the exploitation of tacit knowledge. Improvisation is currently treated in the management and organisation literature as a form of situated action where the emphasis is placed on its temporal dimension and its description is largely based on a cognitive perspective. Thus, improvisation is an activity where composition and execution, thinking and doing converge in time or occur simultaneously (Ciborra, 1999). Ciborra explains that improvisation has to do with the actor's emotions –moods, which he characterises as “so ephemeral, sometimes superficial and unexplained, but they precede, or better ground, any mental representation of the situation and the action strategy.” The designers' experience of inspiration and of contexts and moments that help them re-programme and generate a 'different view', are good examples of the role of mood in improvisation, which is at the core of innovation. Therefore, improvisation is important for managing collaborative design.

Shaping and synthesising solutions

Every designer wants, of course, to make the 'best' design. This may create a tension of ego in collaborative design. Shaping and synthesising design solutions address the way for design management to deal with this tension field to achieve the highest possible design quality and the harmony in diversity. Shaping and synthesising design solutions also address the synthesis of multidisciplinary aspects of urban, architecture, installation, operation and maintenance, building regulations, etc. during the conceptual architecture design phase.

The synthesis includes social integration, which deals with the fact that the stakeholders often have widely divergent definitions of the project. They 'begin' and 'finish' the project at different times, produce different sorts of products, and reckon success in different ways. They are imbedded in a social process and possessed of their individual goals, motivations, and procedures (Heintz, 2000).

An example of synthesis of multidisciplinary technical aspects in design can be found in one of the major strategies in the project of De Resident. For the project, the working drawings and detailing were not undertaken by the individual architects within their own practices, but assigned to a technical coordinator: a building engineering firm, ARCADIS. In Mahler4, the similar role of technical coordinator was taken by Ove Arup. The technical coordinator received the work of the architects some time before a design workshop in order to have the opportunity to optimise the design processes, improve the technical solutions, materials and details, and assess logistic possibilities. By doing this, the clients and advisors could update the cost estimates and construction programme to be presented in the workshop. In the workshop, the architects were briefed on comprehensive technical and economical factors related to the project realisation.

Synthesising design solutions is not to be done by merging or combining partial solutions, but rather by designing (developing a new integral design). Meta-drawings are generated to synchronise multiple layers of information.

These practical examples can be supported by a theoretical explanation about shaping and synthesising solutions as a principle of managing collaborative design by designing the project frame.

Design problems are something like moving targets (Dorst, 2003). They are usually very vague at the beginning of the project, and as the designer acquires more knowledge about the problem and about the possibilities for solving it, they evolve and become clearer. Therefore, designing is not a matter of first fixing the problem and then performing a leap to a solution, but more a matter of developing and evolving both the formulation of a problem and ideas for a solution while constantly shuttling between them in order to generate a matching problem-solution pair at the end. Such process produces prototypes, which evolve from the initial ideas, and the first primitive objects to become more subtly tuned over the generation. This is called iteration, which can be understood as moving through the design process again after an initial solution has been proposed.

Designing the project frame realises that design solutions are usually achieved through an iterative process including experiments and reflections. All stakeholders should positively and critically regard the evolving prototypes and work together towards the refinement. A design solution is only truly functional if it meets the design criteria of all who are affected by it, including customers, employees, neighbours, publics, and future generations (Boland, 2004).

In this sense, designing the project frame means bridging the designers and the other parties to synthesise all requirements and design outcomes respectively. Each of those parties concentrates on their area of specialisation and creates a 'partial design' according to specific criteria. The more complex the project, the more parties and the more specialisations involve, e.g. urban designers, architects, interior designers, structural engineers, mechanical and installation engineers, municipality planning agency, fire safety department, energy company, general and sub-contractors, building material producers and suppliers, site supervisors, real estate agencies, and user organisations. However, it is not possible to simply merge all partial designs into the overall design. The only way to achieve the multidisciplinary integration is by designing: creating a new overall design that is both comprehensive and detailed.

6.6 From provocative ideas towards the implementation

Through some examples from the exploratory case studies in this research, it can be seen that, in fact, some parts of the concept for managing collaborative design have been applied in practice by a few experienced design actors. However, so far the application has occurred rather unconsciously, irregularly, and incompletely.

In order to be able to get the most of managing-by-designing, the idea needs to be applied rigorously. If the idea of managing-by-designing is to be extended to practical implementation, it should get beyond interesting concepts and turn the connection into concrete actions. It has to be confronted with the real-world practice. Therefore, the attempt to implement managing-by-designing has to consider the practical implications of the idea, the practitioners, and their preferred personal skills to exercise the proposed management principles.

We are reminded by Orlikowski (2004) who notes that in the process of learning from design, one should not succumb to the temptation to idealise it. Like every human undertaking, the field of design brings with it possibilities and pitfalls, inventions and conventions, potentials and constraints. People are just as capable of ineffective designing as they are of ineffective managing. Therefore, one should be attentive to these as he explores the connections between designing and managing. Furthermore as designing and managing include the meaning of creating and shaping artefacts and events that create more desirable futures, this begs the question: Desirable to whom? However inventive, intuitive, brilliant, or beautiful these designs may be, their ultimate value is dependent on the engagement of others. They are incomplete until realised in action, until integrated into the everyday practices of human actors for whom the designs are means to an end.

Orlikowski (2004) sees the importance for the designers and managers to come to understand the critical role that actors other than themselves play in realising their designs. Good designers and managers are inspired to create artefacts that both exhibit an enduring aesthetic quality and generate outcomes in use that people care about. For that, they must engage the people who will be left with the design when the designer walks away, the people who will need to interact with it day in and day out to get their work done. And it is these people and the outcomes they care about that are too often overlooked in the discourses and practices of designing and managing.

The concept for managing collaborative design in the conceptual architecture design phase of a building project may be mostly useful for the principal architects, architectural supervisors, and project managers.

The principal architects play an important role in the design team. While they are leading experts in their fields and principals in their own organisations, many leading architects may not have much experience in collective designing with other architects of the same calibre from other firms. The concept can encourage them to be able to enhance their creativity through group processes. Informal dialogue and exchange of ideas can build social power in the group, which result in improvement of the individual and integral design quality.

Architectural supervisors are experienced architects who have been commissioned to assure the achievement of high design quality by monitoring and improving the overall design. Usually, they do not hold the mandate to take final decisions, but rather to become the advisors to the clients and the authorities in evaluating the design proposals from an

architectural viewpoint. They also advise the clients in architect selection, and subsequently guide the architects in the design process through consultations and workshops. The architectural supervisors possess rich knowledge and experience in urban and building design, and the personal quality as respected and credible senior professionals. However, the role of supervisor is new to many of them. Therefore, the concept can be used to help them to turn their design know-how to create and instil vision, give inspirations and guidelines to the design team. The concept also describes the role of the architectural supervisor in preparing and leading workshop sessions.

The project managers usually represent the client. In the mind of senior project leaders and managers there are numerous patterns of decision acquired from long experience in various complex situations. Supported by their charisma, they should be capable of practising a 'soft' human approach to complement the 'hard' technical approach. However, the 'craftsmanship' of the human approach is often concealed behind a more common demand to perform 'hard' logical reasoning. To revive this art of managing and bring it into play in the management of collaborative design, these experts can reflect on the concept. For instance, for decision making under uncertainties and a lack of facts, the concept can point to the experts' intuitive judgement to fill the gap in systematic analysis. Designer's cognitive tools like sketching and diagramming may also be useful to explore and conceive management strategies.

Subsequently, the preferred personal skills of those with the role of design manager to exercise managing-by-designing should be considered. It is preferable that a design manager possesses rich knowledge about urban and architectural design, large and complex project development and realisation, and everything else related to the professional field. The design manager should be an expert, too, who takes his place alongside others in the team, and becomes a functioning member of the team with the special responsibility to effect coordination between the members. The knowledge about the design and functional issues is needed if the design manager is to preserve the effective working relationship with designers, engineers, advisors, clients, contractors, etc.

At the same degree of importance, a design manager needs to master human relationship to fuse the individuals into a smoothly functioning design team; in other words, having excellent skills of creative management and leadership over the people. He needs to be a person directly involved in the team, a good team player, respected by the other team members, and able to influence the behaviour of the team. The preferred personal quality of a design manager includes being open, clear, integer, and consistent. The balanced combination between knowledge of the design content and personal quality, supported by a long track record of relevant project experience, helps the design manager to hold his professional integrity. It is important that the design manager's influence derives from his expertise and interpersonal skills rather than from his formal position.

Especially for multi-architect building projects involving top architects, which are examined in the exploratory case studies in this research, the preferred personal skills of a design manager can be clarified using the following analogies. A 'top' design team needs a 'top' design manager with respectable knowledge, experience, and charisma, just like a top football team needs a top coach. In football, the team leading, coordination, training, and consultation are to be conducted through personal and direct interactions between the coach and the players in the playing field. Similar to this, design management is supposed to become directly involved in the creative activities of designing, rather than just supporting design by channelling the information and structuring the tasks.

Bellamy (2005) outlines several generic skills that are necessary for managing design teams, such as: leadership skills, communication skills, conflict resolution skills, negotiation skills, listening skills, team building skills, relationship management skills, planning skills, contract management skills, and problem solving skills.

This research draws upon some aspects of the studies by Thiel et al (1998) and Friedl (2002) that compare the personal skills of a design manager to that of a dance choreographer. A design manager needs to combine rationality and passion. Design management is like dance choreographing, which translates the passionate design talents into a more choreographed and staged process. The design manager should be able to turn complex problems into challenges that stimulate the natural drive of the designers to explore original solutions. In teamwork, there should be fun and enthusiasm, and therefore, design management should also concern with the personal motivation and satisfaction.

Finally, this research presents an analogy of a design manager as an orchestra conductor, whose role is to orchestrate various individual features and abilities to create a lively harmony. Conductors cannot play the instruments better than the orchestra members. Their value lies in their ability to compose the players with different talents and instruments into a great performance. In the same way, a modern manager succeeds by guiding an 'orchestra' of diverse experts in a process that outputs the beautiful music of a realistic and economic design. A design manager's task is somewhat more difficult than an orchestra conductor. In the design process there might not be a totally accepted and followed melody sheet. Consequently, a design manager likely holds less control or authority over the individual activities than a conductor does over the orchestra (Kees Rijnbouts, in an interview in *BladNA*, vol. 10, 2001).

6.7 Conclusions

Based on the results of empirical and theoretical studies in the preceding chapters, a concept for managing collaborative design in the conceptual architecture design phase of a building project is presented in this chapter. The concept is called managing-by-designing.

The concept comprises a model describing that collaborative design is an interplay of cognitive, social and project frames, and several principles to manage collaborative design by designing these frames. These principles are not meant to be generic and complete, but rather to be used to clarify and demonstrate the practical implication of managing-by-designing. In current practice, some of the principles in the concept may have actually been applied to a certain extent. However, the attempts have been done rather spontaneously, unconsciously, irregularly, and incompletely. The concept will be useful for the professionals to improve the way of managing collaborative design.

Managing-by-designing concept is somewhat provocative. Some of the ideas are in line with the emerging discussions among the academics and professionals about the significance of applying design competencies for management, as reported by Boland and Collopy (2004).

Regarding the practical implication of the concept, design management should consider the practitioner, and the preferred personal skills to exercise the proposed management principles. Applying different management approaches in coherence needs to take into account the project objectives, scopes, phases, and the characteristics of players and stakeholders. Since these are always changing and unique for every situation, the

components and linkages of a coherent framework are not to be generalised. Especially in design, the main aspects of design actors, processes, and products often overlap; or as Bucciarelli (2003) writes, it is often difficult to draw a sharp line demarcating where hard object ends and soft social process begins.

The social-psychological approach, which is central in the concept, is not to be applied exclusively from the other management approaches. The approach focusing on the design actors is complementary to the design management approaches focusing on the design processes and products. The different approaches are not alternative, competing theories of design, but rather partial and complementary to each other. Managing the design actors is essential since the core of collaborative design in the design conceptual phase is the idea generation by the designers through cognitive and social processes. However, managing the design actors cannot be separated from the technical approach for managing the processes and products.

The complementarities between the social-psychological approach for managing the people and the systematic approach, instruments, and methods for managing the processes and products are necessary to build a coherent design management framework in a further study. A coherent framework should be consistent, understandable, and cohesive. In this sense, the framework must steadily integrate various aspects without contradiction, have clarity and intelligibility to be widely accepted on different levels, and be eligible as a plan for action. Similar to what Friedl (2002) describes as a framework, which is like a nutrient medium that facilitates a collection of mono-discipline approaches to act as a coherent system, the framework must allow design and management to hold their own 'identities', but at the same time transform and improve both domains in practice through the shared nature, mutual dependency, and positive integration between them. At the same time, different methods and viewpoints must be integrated, aligned, and balanced.

Managing Collaborative Design

Chapter 7

Verification of the research outcomes

CHAPTER SUMMARY

The research outcomes are mainly descriptive. The outcomes of the empirical and theoretical research are the description of the practice and relevant theories. The concept for managing collaborative design as introduced in Chapter 6 is also descriptive to a large extent. The model in this concept describes the main aspects in collaborative design to be dealt with by design management and the interrelationship between these aspects. The principles of managing-by-designing are explained by describing real examples from the case studies and the theories that can be made practical in these examples.

None of these research outcomes is 'hard product' that can be quantitatively measured and tested. To verify the research outcomes, expert opinions and another case study were used. The case study was the collaborative design during the international design competition for Ground Zero / New World Trade Centre in New York. This case was recent and it represented a real collaborative design between multiple international architects to create the conceptual design of a building project. A number of experienced practitioners, including architects, urban designers, architectural supervisors, project managers and advisors, were selected and interviewed to obtain the expert opinions.

The description of the characteristics and difficulties of collaborative design and the challenges for managing collaborative design, which is based on the exploratory case studies using four building projects in the Netherlands, also applies to the Ground Zero case. The aspects that did not appear in the Ground Zero case were discussed with the experts. Based on the Ground Zero case and their experience, these experts found that the description adequately addressed the important issues in collaborative design in this context.

These experts also found that the concept for managing collaborative design was plausible, in terms that the concept was practically sensible and if applied it might bring a reasonable contribution to the attempt to manage collaborative design. They also indicated the wider potential and limitations of the concept.

The research outcomes are not meant to be prescriptive. They do not set a rigid guideline that should be followed to manage collaborative design. Perhaps in the following research, these research outcomes can be developed to become normative after they are rigorously tested and validated through a certain period of implementation in practice of academic simulations.

7.1 Introduction

Method for the verification of the research outcomes

The research outcomes that have been achieved and presented in the preceding chapters can be summarised as follow. Based on exploratory case studies using four multi-architect building projects in the Netherlands, this research describes the characteristics that distinguish these projects from other building projects regarding collaborative design, the difficulties of collaborative design in these projects, and the challenges in managing such a collaborative design. Based on literature studies, this research describes the theories that can provide relevant knowledge for design management in its attempt to manage collaborative design in this context. Having understood the practice and theories, this research presents a concept for managing collaborative design. The concept comprises a model describing that collaborative design is an interplay of cognitive, social and project frames, and several principles for managing collaborative design by designing these frames. The concept is called managing-by-designing.

These research outcomes are mainly descriptive. The outcomes of the empirical and theoretical research are the description of the practice and relevant theories. The concept for managing collaborative design as introduced in Chapter 6 is also descriptive to a large extent. The model in this concept describes the main aspects in collaborative design to be dealt with by design management and the interrelationship between these aspects. The principles of managing-by-designing are explained by describing real examples from the case studies and the theories that can be made practical in these examples.

None of these research outcomes is 'hard product' that can be quantitatively measured and tested. Nevertheless, the verification of these research outcomes in this chapter is required for the following reasons.

First, regarding the description of collaborative design, the verification is required to examine whether this description really addresses the core issue of collaborative design, and whether it can provide the insight into the characteristics and difficulties of collaborative design as well as the challenges for design management in building projects in which collaborative design is significant. The description is based on the findings from four case studies, and therefore, it is necessary to investigate whether this description also applies for collaborative design in other building projects.

Second, regarding the concept for managing collaborative design, the verification is required to examine whether the concept (a model showing the frames and several management principles) is plausible –in terms that the concept is practically sensible and if applied it may bring a reasonable contribution to the attempt to manage collaborative design.

Third, through the verification this research also intends to learn which parts of the concept can be applied more generally or specifically, and whether the principles of managing-by-designing can –to a certain extent– also serve as recommendations rather than only being descriptive principles.

To verify the research outcomes, expert opinions and another case study were used. A number of experienced practitioners, including architects, urban designers, architectural supervisors, and project managers, were selected and interviewed to obtain the expert opinions.

The case study used for the verification of the research outcomes is the collaborative design during the international design competition for Ground Zero / New World Trade Centre in New York. This case is recent and it represents a real collaborative design between multiple international architects to create the conceptual design of a building project. Besides that, the necessary data can be retrieved from the audio-visual documentation of several design workshops during the architectural design competition, reports and articles about the project, and lecture by some architects of the design teams about their experience of collaborative design process. The data used for Ground Zero case study contains information about the collaborative design process of two finalist teams in the design competition, namely the United Architects and the THINK Team.

The audio-visual documentation used for the verification of the research outcomes shows real situations during the design workshops, including design presentations, brainstorming session, debates, and analysis of ideas of different architects. A video documentation used is that of the collaborative design by United Architects (RAM programme dated on 10 December 2002). The documentation covers workshop scenes involving all architects, brief personal interviews with some architects, interviews with Paul Goldberger (an architecture critic of the New Yorker), and a studio interview with Caroline Bos (one of the two architect directors of UN Studio which is a one of the design firms in the United Architects). The collaborative design experience of the United Architects is also described by one of its architects, Kevin Kennon, during a lecture at Delft University of Technology (dated on 19 April 2005; recorded in video documentation). Another video documentation used is the lecture by architect Rafael Vinoly at Massachusetts Institute of Technology (dated on 6 May 2003) on his personal experience as a member of the THINK in collaborative design. The lecture discusses the chronology of the design competition, the process of gathering the architects and forming the teams, the process of idea generation by THINK, and the short review of the designs of other finalists.

Next to the Ground Zero case study, expert opinions were used for the verification of the research outcomes. Thirteen experts with much experience in building projects –including architects, urban designers, architectural supervisors, project managers, and advisors– were selected and interviewed individually.

The architects and urban designers were selected for the interviews since they were key actors in the idea generation during collaborative design in the conceptual architecture design phase of a building project. They had much experience of working in the design teams together with multidisciplinary specialists, under direct consultation and supervision of the architectural supervisors and project managers.

The architectural supervisors were selected for the interviews since they were directly in charge of instilling the vision of the architectural and urban design, ensuring the harmonious design composition, and assessing the design quality according to the larger urban plan and strategy. The architectural supervisors played a very important role in collective designing as they initiated and guided the design workshops. They also advised individual designers regarding the architectural and urban design integration. They might, in fact, be considered as the design managers in collaborative design.

The project managers were selected for the interviews because they were responsible for parts and processes of a project as a whole. They ensured the coordination between different design activities, as well as between design and other project activities. The project

managers often represented the clients and local authorities in managing the scope, resources, regulations, and outcomes of a project.

The mechanism to verify the research outcomes can be explained as follows.

The verification of the description of the characteristics and difficulties of collaborative design and the challenges in managing collaborative design was based on:

- the comparison between the characteristics, difficulties and challenges that the researcher and the interview respondents identified in the Ground Zero case and the description presented based on the exploratory case studies in this research; and
- the interview respondents' opinions –based on their own professional experience in various building projects– whether the description presented in this research adequately addressed the actual practice.

The verification of the concept for managing collaborative design was carried out through semi-structured interviews with the selected experts. The interview respondents were presented with the concept of managing collaborative design, which consisted of a model showing the interrelation of cognitive, social and project frames, and a list of principles to manage collaborative design by designing these frames. Subsequently, the respondents were asked to assess the concept whether it is practically sensible and if applied it may bring a reasonable contribution to the attempt to manage collaborative design, through reflections on the Ground Zero case study and their own practical experience in participating and/or managing collaborative design.

Each interview took 1.5 hour and consisted of two parts. The respondents were interviewed individually. The interview protocol is outlined in Table 7.1. The summary of the results of the interviews can be found in Annex 2. The first part of the interview was dedicated for the verification of the description, and the second part for the verification of the concept.

After the completion of all interviews, the interview findings were analysed. The analysis was carried out according to the goals of the verification as stated earlier in this subchapter. Next to the analysis of individual opinions, the expert opinions were analysed based on the categorisation of the expert group, namely the architects, architectural supervisors, and project managers and advisors. The analysis of the interview findings focused on answering questions of what and how did the respondents acknowledge the research outcomes (the description and the concept) through the Ground Zero case and in their own practice; as well as which limitations and wider implications of the research outcomes did the experts identify. Finally, conclusions were drawn on results of the verification of the research outcomes.

Opening: Brief introduction of the research and researcher, and introduction of the interview protocol	10 minutes
Part 1: Verification of the description of characteristics and difficulties of collaborative design and the challenges for design management While observing the video documentation of the design workshops in the Ground Zero case, the context, the design products, and the people's statements, activities, behaviour, and expression during the design process were observed, registered, and analysed. The respondents were allowed to interrupt the scenes when they wanted to give some remarks. They were free to freeze or repeat certain scenes, or they could keep their remarks until the end of all scenes. A cassette recorder was used to record the remarks. The respondents were asked to critically appraise the situations, evaluate the successes and shortcomings or bottlenecks of collaborative design, and discuss the significance of design management. For instance, in case that the video documentation showed several difficult situations in the collaborative design process, the respondents were asked to comment whether this might call for the intervention of design management. The results were a list of issues of the characteristics, difficulties, and challenges related to the collaborative design in the Ground Zero case. Additional information was obtained from written reports and articles about the project. Subsequently, a comparison was made to assess to what extent the description presented in this research addressed and clarified these issues.	35 minutes
Part 2: Verification of the concept for managing collaborative design The respondents were presented with the concept of managing collaborative design, which consisted of a model showing the interrelation of cognitive, social and project frames, and a list of principles to manage collaborative design by designing these frames. The respondents were asked to explain whether the concept is relevant to reflect on what they observed in the video documentation of the design workshop of the Ground Zero case, for instance by examining which situations showed the activities related to the cognitive frame, social frame and project frame; what management principles were applied and not applied in the design process; and what impacts did these principles bring. The use of Ground Zero case study is especially important for the interviews with the architectural supervisors. The use of a project in which these supervisors are not personally involved is important since it might be difficult to obtain the objective opinion on their own role as design manager in projects in the Netherlands. The respondents were asked to explain whether the concept is relevant to reflect on their own practical experience in collaborative design, for instance by critically discussing how the concept could help them to understand the complexity of collaborative design and which principles were most relevant for them to be applied in their practice.	35 minutes
Closing: Other questions, initial conclusions, and follow-up appointments if necessary	10 minutes

Table 7.1 Outline of interview protocol for the verification of the research outcomes

Overview of the design competition for Ground Zero / New World Trade Centre in New York

The twin towers of the World Trade Centre in New York were destroyed by terrorist attacks on September 11, 2001.

In response to the need for rebuilding the World Trade Center site, the Max Protetch Gallery in New York City opened an exhibit featuring design proposals from more than 50 architects from around the world. Subsequently, the Lower Manhattan Development Corporation (LMDC) was created in the aftermath of September 11, 2001 by Governor Pataki and then-Mayor Giuliani to help plan and coordinate the rebuilding and revitalization of Lower Manhattan, defined as everything south of Houston Street. The LMDC is a joint State-City corporation governed by a 16-member Board of Directors, half appointed by the Governor of New York and half by the Mayor of New York. LMDC is charged with ensuring Lower Manhattan recovers from the attacks and emerges even better than it was before. The centrepiece of LMDC's efforts is the creation of a permanent memorial honouring those lost, while affirming the democratic values that came under attack on September 11th. Herbert Muschamp (2002) in his article in New York Times "Don't Rebuild, Reimagine" describes the events that have led to the international design competition of the New World Trade Centre.

In June 2002, a group of New York architects met to discuss their dissatisfaction with the planning process unfolding under the auspices of the Lower Manhattan Development Corporation, the state agency created to supervise the rebuilding of Ground Zero and the financial district. The group included Richard Meier, Steven Holl, Peter Eisenman, Charles Gwathmey and Guy Nordenson, a structural engineer. It had become clear to this group that the official planning process was following a pattern conventionally used by real-estate developers and that, in this instance, it had to be broken. The pattern, a privatised version of city planning, routinely excludes architecture from the formative stages. Planners chop up the development sites into parcels, develop guidelines for each one and then hand them over to developers, who subdivide the building project among an assortment of specialists, including lawyers, interior-space planners, retail advisors, construction companies, architects and construction managers. In this way, large building projects of potentially major civic importance are delivered into the hands of competent but unimaginative firms. The assumption is: Anyone can do it. Just follow the guidelines. This system is based upon the catastrophic misconception that architectural values can be objectively quantified. From this initial mistake, erroneous ideas accumulate: architecture is the production of images; discrimination among images is entirely a matter of taste; one person's taste is as good as another's; the most popular image (or as it usually works out, the least unpopular image) must be the best building. But of course, architecture is not a matter of images. It is the relationship of visual and spatial perceptions to conceptual abstractions. Or as Frank Lloyd Wright once put it, "Architecture is the scientific art of making structure express ideas."

Having heard the heated conversations, The New York Times Magazine asked these architects if they would like to organize their frustrations into what might best be described as a study project. They readily agreed. Throughout the summer, the group, which had taken on other members, including more of the architectural world's best-known practitioners as well as some very talented, less well-known architects of the next generation, gathered at a series of loud, contentious meetings. Almost immediately, they decided to look beyond Ground Zero and re-imagine a scheme for the entirety of Lower Manhattan. They argued over core principles, lobbying one another by phone and fax. Eventually they reached something like an agreement, or at least the broad strokes of one.

Then each architect was assigned a specific site and task and asked to supply a corresponding image.

The project did not set forth a comprehensive plan. Rather, it presented an integrated set of options for the future of New York. The team began by adopting a strategy developed by Frederic Schwartz, architect of the Staten Island Ferry Terminal at the southern tip of Manhattan. Schwartz, who worked on the Westway highway project in the 1970's and 80's, had long recommended burying a segment of West Street, a six-lane state highway that divides Battery Park City from the rest of Lower Manhattan.

After 9/11, Schwartz calculated that the land created by burying this segment could easily yield 16 acres of developable land, enough to match the size of the World Trade Center site. He then figured out how the trade centre's commercial bulk could be distributed over a new West Street development corridor. In one stroke, this strategy accomplished two goals. It temporarily eliminated commercial pressures from the highly contested Ground Zero site. And it healed a gash in the cityscape that had long obstructed the integration of Battery Park City with the financial district. The plan did not prohibit building on ground zero. It simply created a space for planners to devote more time and thought to conceptualising how best to utilize the site.

In the summer of 2002, the Lower Manhattan Development Corporation (LMDC) initiated a worldwide search for design and planning professionals to propose a visionary land use plan for the World Trade Centre area. The challenge, among the greatest of our time, was to transform a 16-acre void into a place where loss is remembered and life is celebrated.

The participating design teams were presented with a revised set of priorities that was shaped by thousands of public comments received after the release of the first set of plans. They were also presented with a full accounting of all public comments received to date. Elements of the new programme include preserving the footprints of the Twin Towers for memorial-related space, restoring a powerful, tall symbol in Lower Manhattan's skyline, improving connectivity within Lower Manhattan, and creating a grand promenade along West Street. The design teams were instructed not to design the memorial, but to develop a context for the memorial that would later be determined through an international design competition.

LMDC received 406 submissions from around the globe. Seven teams were selected from among some of the world's most talented architects, planners and designers because of their bold ideas and strong beliefs; six remaining after a team led by Skidmore, Owings and Merrill (SOM) withdrew from consideration. The selected submissions were comprised of both single firms and teams of architects and designers including Lord Norman Foster; a team with Richard Meier, Peter Eisenman, Charles Gwathmey, and Steven Holl; Peterson/Littenberg; Studio Daniel Libeskind; the THINK team, led by Shigeru Ban, Frederick Schwartz, Ken Smith and Rafael Viñoly; and United Architects, led by Foreign Office Architects, Reiser+Umemoto RUR Architecture, Kevin Kennon, UN Studio, Greg Lynn FORM, and Imaginary Forces. These teams were charged with creating a soaring vision, firmly rooted in the complexities of the World Trade Center site and guided by programme that had been shaped by months of public comment. Their design proposals are shown in Figure 7.1.

Muschamp's (2002) expresses that it was remarkable to have teams of top architects working overtime and for the most part at their own expenses: "But I'm prepared to be surprised. Think how many surprises we've had so far this year. Hire Daniel Libeskind to

design a plan for Ground Zero? Impossible. Motivate Richard Meier, Peter Eisenman, Charles Gwathmey and Steven Holl to pool their talents in a powerful design that betrays no single signature style? Unreal. See a project by United Architects, a team of young designers working together for the first time, praised in newspapers and on television stations around the globe? That's crazy. Can't be done. It'll never happen. Until it does."



Figure 7.1 Design proposals for New WTC New York by the finalist teams, from upper-left clockwise: Studio Daniel Libeskind; THINK Design,, United Architects, Richard Meier - Peter Eisenman - Gwathmey Siegel - Steven Holl, Petterson/Littenberg, Foster and Partners

7.2 Verification of the description of characteristics and difficulties of collaborative design and challenges for design management

In Chapter 3, based on the exploratory case studies of four projects in the Netherlands this research concludes that in multi-architect building projects in which collaborative design is significant, the following characteristics distinguish this type of project from the other building projects:

- the masterplan as a platform for collaborative design;
- the way the design team is composed and the informal design leadership; and
- the creative design workshop for collective designing.

Having observed the collaborative design in the Ground Zero case from the researcher's and the interview respondents' (experts') perspectives, the analysis of the findings shows that the abovementioned description of the characteristics and difficulties of collaborative design and challenges for design management can also be recognised in the Ground Zero case. The findings from the Ground Zero case can be explained as follows.

- Masterplan as a platform for collaborative design

In the design process of the United Architects and THINK, each architect in the design team was given the opportunity and asked to present his design ideas on the masterplan and the buildings, rather than working separately on a building (or a block of buildings) in strict boundaries. During the conceptual architecture design phase all architects studied and discussed all parts of the project, both urban design and building design. Referring to his experience as an architect in the THINK team, Rafael Vinoly called this the overlap between architecture and masterplanning.

Almost all aspects of the masterplan as a platform for collaborative design, which are described based on the exploratory case studies, appeared in the Ground Zero case. Each design team started the collaborative design by establishing an innovative masterplan that served as the design vision for the team. The masterplan was developed together and became a starting point for collective design. The masterplan was significant to arrange how different buildings were designed in connection to each other. Since the new design solution for the Ground Zero site was of the key design requirement in the competition, the masterplan was very important to assure the integration of the building and urban design.

One aspect of the description in this research, which was not found in the Ground Zero case, was the importance of the masterplan of presenting common design elements, for instance by using similar colour, materials, or detailing for different buildings. In the Ground Zero case, this aspect did not appear since the design competition was still in a very early design stage in which choices for materials and details were yet to be made. Despite the fact that this aspect did not appear in the Ground Zero case, the interview respondents found that this aspect surely belonged with the other functions of the masterplan in collaborative design.

- The way the design team is composed and the informal design leadership

Close interactions between the design actors took place for sharing individual interpretations and enhancing individual ideas. In the Ground Zero case, it appeared many times that innovative ideas were born while the architects were sharing their understanding of the situation and their preliminary ideas. Often, other architects responded directly to one's idea, either supporting or criticizing it. All ideas and criticisms were openly discussed. This could be clearly observed, for example, when the architects of United Architects discussed the "twisty towers" concept and came to the conclusion of a design showing "united we stand" could be reflected better by intertwined of diagonal spans rather than by a vertical rise. Another example was from the design workshop involving architects like Fred Schwartz and Rafael Vinoly. At one time, Fred Schwartz passed one of his drawings to Rafael Vinoly, and when Vinoly looked at it, he revealed another excellent idea 'hidden' in the drawing (which was to leave the footprint of the previous WTC unoccupied). Vinoly then shared this in the group discussion and gave his compliments to Schwartz.

The findings from the Ground Zero case regarding the informal design leadership, dialogs and coordination in the teamwork support the description based on the exploratory case studies.

The aspect of the selection of architects in the design team did not appear in the Ground Zero case. This can be explained by the fact that the Ground Zero case was a design competition. The design teams were formed by architects instead of being formed through a selection by the client and architectural supervisor. According to the interview respondents, this aspect was essential in a real building project more than in the design competition. Even though this aspect did not appear in the Ground Zero case, a further look into the case could support the description in this research. Regarding the selection of architects, the design teams in the competition were formed by architects with very different 'design styles', backgrounds, nationalities, expertise, and age groups, but they all had own willingness to engage in collective. This was remarkable considering that all architects involved were very well-known in the architecture world and that most of them did not have previous experience of collective designing with each other. This became even more remarkable knowing that these architects gave much appreciation and had much pleasure in the collaborative design.

- Creative design workshops

During a design workshop, collective designing was performed on the most parts of the project. The architects of both United Architects and THINK worked together on the whole project. Any separation did not yet exist, at least in this particular stage of conceptual design. They worked together within an informal team work atmosphere, in office-studio space, at casual setting. One of the architects, Kevin Kennon, described his experience on how he and the other architects of the United Architects worked intensively and stayed at the same office for three months. They spent many nights in the studio. The conversations occurred spontaneously and informally, sometimes with humour. There was no formally elected leader of the design team. Somebody, not always the same person, always took the leadership in group discussions by showing initiatives, presenting ideas, or inviting other people to respond to something.

The workshops as seen in the video documentation of the Ground Zero case were essentially similar to the workshops observed in the exploratory case studies. The

workshops involved the architects, urban designers, technical designers, graphic designers, advisors, etc. In the conceptual architecture design phase both in the Ground Zero case and in the exploratory case studies, the architects held the key role in collaborative design. In the workshops, there were open discussions and the use of architectural models for the discussions.

A difference between the Ground Zero case and the exploratory case studies is that in the workshops during the Ground Zero design competition, the clients were not involved. The relation between the design team and other parties in the project was limited to the consultation between the organiser of the design competition and the design teams participating in the competition. Thus, the decision making involving the design teams and the clients during the design process was not shown in the Ground Zero case.

Next to the characteristics of collaborative design, in Chapter 3 this research also presents the difficulties of collaborative design in the conceptual architecture design phase of multi-architect building projects, namely:

- the difficulties related to the complex requirements of an integrated multi-functional urban project;
- the difficulties related to the social complexity due to the involvement of a large number of stakeholders with often conflicting goals and complicated decision-making processes; and
- the difficulties related to the social complexity resulted from the need for closer and more intensive interactions between the design actors in collective designing.

Having observed the collaborative design in the Ground Zero case from the researcher's and the interview respondents' (experts') perspectives, these difficulties can also be recognised in the Ground Zero case. The findings from the Ground Zero case can be explained as follows.

- Complex requirements of an integrated multi-functional urban project

A multi-architect building project consists of a composition of different buildings with different functions designed by different leading architects, yet closely interconnected. There is a mix of different functions, such as office, hotel, transportation node, memorial place, open public space and many more.

The architects realised that it was important to integrate and harmonise different architecture, and integrate infrastructure, building, and public space in new models of urbanism. There were many technical complexities due to the infrastructure, but mostly due to the extraordinary shape of the buildings. In the United Architects team, multidisciplinary experts engineered the 'twisty towers' (the given working name of the design) to meet structural, safety, logistic, and functional building standards in New York. Similarly, it applied for the 'cage' (the given working name of the design) by the THINK team. In THINK, the experts experimented with new joints and building materials. No matter how high the technical complexity, at the end, both teams managed to prove that their designs could be engineered and constructed.

The design team dealt with a high profile project that was expected to meet complex political, economic, and cultural importance of a large number of public and private stakeholders. In the Ground Zero case, everybody agreed that the project was not only covering a very large area of Lower Manhattan, but also of a really high profile area. All

architects and critics said that New York had always been a symbol of city and urbanism. The project was emotionally charged because at that moment, the Ground Zero site was the most famous empty land in the whole world. What came on that land would have tremendous symbolic importance.

- Social complexity resulted from the involvement of a large number of stakeholders

Despite the technical complexity, people involved in the Ground Zero project said that the most difficulties are found in dealing with different people and organisations. It was impossible to say what the people want because there were so many different groups: the port authority, Lower Manhattan Development Corporation, the State of New York, the City of New York, the city of New Jersey that shared the control with the port authority, the federal government, private real estate developers, and all different groups of people that all had a say in what would happen. All stakeholders had their own importance and were very cautious on immeasurable risks. Some architects like Kevin Kennon, Greg Lynn, and Rafael Vinoly said that the process was very confusing: nobody wanted to say to you whether you were out or in. For the design teams, lobbying, persuasion, and socialisation with the stakeholders were very important to be able to understand the unwritten questions and expectations. There was certainly an escalating social complexity regarding the involvement of multi-stakeholder, multi-architect, and multi-discipline experts.

An architectural critic interviewed in the video documentation, Paul Goldberger, stated that what was going on was enormously complicated and more about politics than architecture. The process was unbelievably complicated and difficult, almost like a mission impossible. It involved a very large amount of money attached to various public and private bodies. As architects, Greg Lynn and Kevin Kennon felt that the architects were caught in the middle of conflicting interests of different stakeholders. It was like brokering between different parties. Another architect, Rafael Vinoly, said that the architects never had a free hand.

The interview respondents supported this finding and added that collaborative design was always influenced by the external and internal social complexity. The external forces could be political, societal, or economic. The external forces were always significant in a large project that involved and affected various parties. The interview respondents found it appropriate that the research distinguished the social complexity regarding the stakeholders and the social complexity regarding the internal teamwork processes in the design team.

- Social complexity in the design team

There were various design actors in each design team. Being one of the architects in one of the design teams in the Ground Zero competition, Rafael Vinoly called the people involved as a collection of remarkable individuals with highly respected knowledge and experience in their professional areas. Sometimes, the unfamiliarity of interacting the 'black boxes' of individual creativity during the idea generation hampered the teamwork. Someone had to take the initiative and others had to react positively in order to get the collaborative design process going.

Vinoly reported a complicated process of vocalisation during the pre-competition colloquia initiated by Herbert Muschamp. Since the project had a high status and was very complex, while the goals and directions were unclear, many world architects

gathered in the colloquia in New York with no certain idea or plan of what to do. When Vinoly raised the initiative to take actions by saying: "We have to do something. Just tell me what you want me to draw. We can discuss or trash it afterwards", the responses were not very optimistic: "No, it is completely impossible. We have to go home and think carefully, review, and compare all." Only after Vinoly and others came up with some ideas and urged for the following actions, the group agreed to proceed with the idea and with the design process.

Personal motivation was very important to get on with the collaborative design, especially when a 'hard' design order was not available. An architect related to the United Architects team, Caroline Bos, explained that designing was not only a rational and analytical process. The architects felt the pride and emotion in realising the design. There was sentimental feeling of good will to make things good in the city of New York after the 9/11 disaster. This was an example of the 'soft side' of designing beyond the 'hard side' of technical aspects.

The interview respondents acknowledged this issue in the Ground Zero case and also in their own professional experience. They found that commitment and respect to each other was crucial at the start of collaborative design. Trust, interpersonal 'match', and the feeling that members of the design team could learn from each other were essential to assure the continuing effort of collaborative design. These findings supported the description based on the exploratory case studies.

Next to the characteristics and difficulties of collaborative design in the conceptual architecture design phase, in Chapter 3 this research identifies the challenges for design management. Managing collaborative design deals with three main aspects:

- the design process including the cognitive process of different design actors;
- the interaction between these individual design processes, in principle through social contacts and interpersonal communication;
- the way a real building project is organised in its context, which includes the design programme, the design products, and all information, tasks, procedures, organisations, and processes that take place in a real building project.

Managing the interaction between the cognitive processes and managing the social interactions between the design actors in collective designing are still big challenges for design management. The current attempts are often carried out based on practical experience without fundamental knowledge of managing creative teamwork.

These challenges were also present in the Ground Zero case. In such a design competition, the architects were encouraged and granted much freedom to invent new design solutions. The individual ideas resulted from the creative design processes of the various architects were very diverse. In a design team, social interactions between the design actors were therefore very important to share individual ideas and generate a design solution through collective designing. To a certain extent in the design competition it was also important for each design team to coordinate the information about the project, the procedure of the competition, and the related issues, as well as the tasks and responsibilities of the design actors.

However, in the Ground Zero case, design management was not explicitly present. The design leadership was based on the informal agreement in a design team. The interactions during the design process took place rather spontaneously and were initiated by different persons. The members of a design team divided the tasks and responsibilities among themselves following a consensus.

The interview respondents supported the described challenges of managing collaborative design. They found it was crucial to tackle these challenges if the collaborative design was to be effective. Having observed the collaborative design in the Ground Zero case, they said that even though design management was not seen as a formal function during the design competition, there was always someone who took the role of design management in each situation. There was always someone who chaired a workshop. There was always someone who provided the design team with the required information and contacts. These persons were not the same in every workshop. It could be seen that the role of design management was practised implicitly and in an informal way.

7.3 Verification of the concept for managing collaborative design

Following the evaluation of the description of characteristics and difficulties of collaborative design and the challenges for design management, expert practitioners –architects, urban designers, architectural supervisors, project managers, and advisors– were interviewed to evaluate whether the concept for managing collaborative design adequately addresses the essence of collaborative design and contributes to the attempts to improve its practice. The findings from the interviews with the expert practitioners are reported in this subchapter.

The interview respondents provided consistent remarks on the following issues. First, the research subject was timely and important. The research discussed the collaboration practice in building projects that were increasingly found around the world. Second, the model as a part of the concept for managing collaborative design was useful for clarifying the activities by the designers and design managers within the interdependent cognitive, social, and project frames. The principles of managing-by-designing described some attempts that had been done in practice and presented a more rigorous approach to manage collaborative design. Third, the potential implementation of the concept was strongly dependent to the personal skills of the design managers and the project context.

Findings from the interviews with the architects and urban designers

Regarding the model describing the cognitive, social and project frames, the respondents said that they could reflect on the model as a reminder of what was missing or neglected in the practice that weakened the collaboration. All respondents mentioned that more attention and guidance should be given to the activities related to the cognitive frame, like brainstorming and sketching together, to avoid a design workshop to turn into just an information-sharing session. All respondents agreed on the social-psychological factors of 'personal match' that made an architect could collaborate better with other architects. The awareness of such a 'match', as well as social contracts next to the written contracts, deserved more attention from design management. Finally, the balance between creative freedom and the project scope must be clear. In this sense, the project managers and the architectural supervisors must collaborate closely and have a clear understanding of the goals in order to present a clear overall vision of the project that was achievable within a feasible time frame and with available resources. This was believed to contribute to the integrity of design management in terms of decision making.

Regarding the principles for managing collaborative design by designing the cognitive frame, the interview respondents supported the principles of using diagramming, sketching, metamodels, metaphors, and analogies to enhance individual cognitive processes and shared understanding; and the decision making supported by expert judgement. They supported these principles with several examples from their experience in working with the architectural supervisors.

There were two types of architectural supervisors: the moderator, usually an urban or area supervisor, and the masterplanner, usually the architect who created the masterplan for the project and was asked to assure that the building designs fitted to the masterplan. The latter dealt more with the design outcomes and had less influence in person-to-person working between the architects. The moderator-type of architectural supervisor played a more significant role in initiating, stimulating, and guiding the collaborative design in the workshops. Some of the moderator-type architectural supervisors chose to become the catalyst or guide in the discussions to let the architects explore their ideas, for instance by introducing metaphors to allow all workshop participants to understand the problem better and to invite them to contribute their ideas. Some other architectural supervisors chose to manage collective designing by getting directly engaged in making drawings and sketches together with the architects. Sketching together could be observed in the Ground Zero case although an architectural supervisor was not present in the team. In terms of decision-making, the architectural supervisors often held an advisory role to the clients and local authorities. Much of their advice was based on their expert judgement as they were directly involved in the design process and in their role as informal leader of the design team. This expert judgement was important to complement the fact-based technical and economic analysis.

Regarding the principles of managing collaborative design by designing the social frame, the interview respondents supported the principles of setting up a design studio-like environment, encouraging team building for the design actors, and assuring dedicated and highly motivated effort of the design actors. However, these principles were not always easily applied. The interview respondents explained the reasons for this as they reflected on their experience of the design workshops and described the successes and shortcomings of the design workshops. The workshops were successful in gathering many design participants. However, the workshops also had several shortcomings. In some workshops, there were so many participants so that the workshops seemed to be more as the events for presenting individual designs and announcing the clients' message, rather than elaborating the design together. The interactive and collaborative design was not as intensive as expected. The number of workshops during the conceptual and preliminary design phase was also considered to be too few if a real collaborative design was expected. The discussions in the workshops were sometimes less effective since a collective design vision was missing. The architectural supervisors who usually chaired the workshops were highly respected as persons and in terms of their knowledge and experience. However, they were not equipped with specific managerial knowledge of teamwork. They exercised the role of design manager based on their personal skills and approaches, and sometimes, trial-and-error.

Despite the fact that organising an effective design workshop was not always successful, the teambuilding and motivation among the design actors were high. The interview respondents said that they were enthusiastic with the rather new experience of collective designing with other renowned architects. They found it remarkable to personally know and closely work with other architects as they were very keen to learn from each other. They could extend the personal and professional network and learn the different design expertise and

approaches. They considered this as a valuable enrichment to their professional career. A sustainable collegial relationship was also built between them.

Regarding the principles of managing collaborative design by designing the project frame, the interview respondents acknowledged the principles of reinventing goals, reframing constraints, and synthesising solutions during the collaborative design process, but they also mentioned that in a complex project design management should cope with other aspects of the project, especially due to the external factors like the relation between the design team and the clients, and the political, societal, and economic or market situation.

All respondents described that the multi-architect building projects were complex and unique. As major projects, they were challenging and prestigious at the same time attractive for the architects to participate in the projects. The selection of various world architects was the clients' intention to realise projects with a composition of different 'design styles'. All respondents mentioned that many technical problems were due to the strategic, yet difficult, project locations, complicated functional and spatial requirements, complex building forms, and the connections between the buildings and the urban infrastructure.

On top of this, there were difficulties in the relationship with the clients and other stakeholders. All of these took place in a very dynamic and often uncertain design process. Many technical and organisational changes and redesigns took place in a rapid pace, partly due to the fast-changing market situation. In addition to this, the members of the design team were also changing. Some key architects resigned or were replaced during the design process due to the failure to reach the agreement with the clients on design or other issues.

Regarding the project frame, the respondents distinguished the role of the project managers and that of the architectural supervisors. The project managers were responsible for the whole project, including architectural design. The project managers worked on two levels: the project managers responsible for a specific building or project part (block project managers) and the project managers responsible for the overall project. The respondents described that sometimes the coordination between the block project managers and the overall project managers was lacking. The overall project managers were at a closer position to the clients, financial advisors, etc. They set the ambition for the project. The block project managers had a direct working relationship with the architects. When the coordination between these two groups was not sufficient, the message and decisions received by the architects were inconsistent. For example, some decisions by the block project managers were altered after the architects had proceeded with their work for some time. This was also caused by the fact that sometimes the high ambition of the clients must be reduced due to market and practical limitations.

Although the interviews with different architects and urban designers were held separately, the respondents' opinions were in line with each other. The architects and urban designers as the interview respondents were positive about the concept for managing collaborative design that consists of a model and several principles. They indicated the usefulness of the concept for their own practice and the potential improvements if the concept for managing collaborative design were taken into consideration in the design process. Moreover, using real examples they also discussed that some principles, like creating an effective design studio-like setting and reinventing goals and vision, were not always easy to apply since the design process was also influenced by external factors. The interview respondents added that these external factors were broader than the issues addressed by the project frame in the model.

Findings from the interviews with the architectural supervisors

In the interviews with the architectural supervisors, the video documentation of the Ground Zero case was particularly useful for discussing the role of design management openly and objectively, considering that the Ground Zero project was not connected to the architectural supervisors' own practice in the projects in the Netherlands. All respondents said that the video documentation of the design workshops of the United Architects and THINK during the design competition was a representative example of collaborative design showing how architects actually worked using architectural language and debate to generate design ideas together. However, the involvement of the stakeholders during the design workshop could not be seen in the video since the Ground Zero case was still in the stage of a design competition.

Regarding the model describing the cognitive, social and project frames, the interview respondents agreed with the categorisation and description of these frames. For them, the knowledge about these frames made clear the particular approaches they and the other design actors could use or had used in collaborative design practice. By understanding that some people emphasised some frames or overlooked some other frames, design management would be able to keep a balance of all important factors for a successful collaborative design. In addition to this, the architectural supervisors recognised that their activities in inspiring and activating the people were done through designing –by which was meant the creating and activating the cognitive, social, and project frames. They found that the model was relevant for reflecting and evaluating their own practice.

Regarding the principles of managing collaborative design by designing the cognitive frame, the interview respondents recognised these principles in their own practice. They emphasised that collaborative design did not necessarily mean that all designs must be developed together, but rather that different architects could build up on each other's expertise to solve the overall design problems of the projects. The development of certain parts of the projects was still largely in the hands of each architect although the review of this work could take place in team meetings or design workshops.

The respondents were confident that the role of the architectural supervisors was essential in collaborative design. Although it was never thoroughly defined, the role of the architectural supervisors ranged from the morphology of design to the personal and organisational relationship of the design actors; or in other words, from the making of urban design or masterplan that was able to accommodate a variety of design, to the giving of personal advice to the clients and the architects about selection of architects and design team forming. The essence of the role was inspiring the design participants to achieve high urban design and architectural quality of the projects.

In practising this role, different architectural supervisors took different approaches: some by involving sketching and drawing and some others by initiating debates and discussions. All respondents said that the architectural supervisors exercised the authority through a persuasive approach. This was dependent on the personal talents and experience, which was very much tacit and fragmented. All respondents admitted there had been successes as well as failures or conflicts in different situations or different projects.

Regarding the principles of managing collaborative design by designing the social frame, the interview respondents found these principles applied in the Ground Zero case. They reacted in the same way when reviewing the video fragments of the design workshops of United Architects in the case of Ground Zero. The respondents found that although no formal

design manager or architectural supervisor was appointed among the architects, there was always someone who took the participative leadership of the design team. In such important projects as Ground Zero or similar, the architects from the same team were willing to compromise their ego to a certain extent for the sake of reaching a consensus so their team can win a design competition. Everybody knew that the project was so important – not only for the clients, but also for themselves and their reputation. They were willing to collaborate for the sake of the success of the projects. Although this might be a pragmatic key factor behind the commitment, it could become very important for an effective collaborative design.

Regarding the principles of managing collaborative design by designing the project frame, the interview respondents considered the relation between the design processes by the design team and the decision-making processes by or involving the stakeholders that influenced the design process. The respondents found that one of the complexities of collaborative design was the complicated mix of political, economical, and social factors, especially regarding the large number of public and private stakeholders. The projects were charged with a high ambition as well as an emotional and symbolic mission to present extraordinary architecture. The social complexity was overwhelming and more difficult to tackle than the complex technical challenges. In such circumstances, the architects must be actively approaching the clients and other stakeholders personally to understand what their real expectation was and where the real opportunities lay. In the case of Ground Zero, the respondents found Rafael Vinoly as an architect had an excellent ability in exploring and addressing the real problems and possibilities with his clients.

In the light of all the above, the architectural supervisors as interview respondents viewed the research and its findings positively. They indicated that the most important contribution of the research was to present a clear description of important issues of collaborative design that people had not explicitly stated and dealt with, such as the difficulties that resulted from the social complexity in the design team. According to them, collaborative design in architecture as an actual subject had been discussed and commented by a lot of people, but had not yet been investigated in-depth and comprehensively. For the respondents, the research was interesting as a study of building projects that did not only look at the design objects, but rather addressing the people and the processes their undertook to create and elaborate the design. The research outcomes were found useful and valuable for acknowledging the personal skills of those carrying out the role of design management as things that could not be made completely systematic and 'hard', but to be appreciated through social-psychological approach that was rather new in the architecture and project management discipline.

Three architectural supervisors, interviewed separately, provided consistent remarks that support the model and principles. They also explained that although all principles were sound and relevant, they were not necessarily exercised by the same person. For instance, some architectural supervisors preferred and were better in managing the collaborative design process by getting directly involved in making sketches and architectural models, but some others preferred to inspire the design actors by giving advice and constructive critique. Some principles should receive more attention in specific situations, for instance: assuring the motivation of the design actors was crucial when the long-running design process entered a phase in which innovative ideas faced the barriers of changing market or government policy, or when some members of the design team resigned due to an unresolved problem with the clients. The interview respondents also mentioned the importance of the project frame to understand the relation between the design processes by

the design team and the decision-making processes by the stakeholders that were often influenced by external factors.

Findings from the interviews with the project managers and advisors

Regarding the model describing the cognitive, social, and project frame, the interview respondents found the value of the categorisation of managing the people, processes, and products, and the cognitive, social, and project frames. This categorisation could remind the project managers about the specific and broad operational areas and activities of design management. The respondents agreed that in collaborative design, the social frame was an important aspect for both the project managers and the architectural supervisors to manage collaborative design. The respondents considered that project managers and architectural supervisors were the main actors in design management and they should collaborate closely. The architectural supervisors could contribute much to steering through the cognitive frame while the project managers contributed to steering through the project frame.

Regarding the principles of managing collaborative design by designing the cognitive frame, the interview respondents recognised the importance of these principles in their practice. They described that there were two management styles. First, the so-called 'square or hard' management style that was more appropriate during the detailed design and construction phase while accuracy and effectiveness were at the highest priority. And, second, the so-called 'round or soft' management style that was needed during the conceptual architecture design phase. In the conceptual architecture design phase steering should not be applied by limiting the boundary of individual design and strictly applying main design guidelines, since this could hamper creativity. The respondents realised that during the conceptual architecture design phase, the management should use guidelines and rules very carefully to avoid these to limit or narrow down innovative ideas too soon.

Although many project managers were aware of this, not all of them were skilful enough to exercise the "soft" approach. Most project managers were well-trained in logical and systematic rationality, and tend to rely on systematic procedures and measures through which they had the grip or control. There was no formula for handling social complexity. Techniques for negotiation and communication could be learned from literature, but the personal competence and human skills must be developed in the person. Thus, the principles of managing by designing the cognitive frame were relevant, but practising these principles required certain training and practical experience.

Regarding the principles of managing collaborative design by designing the social frame, the interview respondents referred to the importance of the design workshops. Closer and more intensive interactions between the design actors were crucial for a project in which different buildings were very close or dependent on each other in terms of architecture, function, and construction. There was no other way to realise the overall harmony but through collaborative design. In many situations, the design workshops were successful in achieving a consensus and establishing the trust and commitment by the architects towards the project and towards each other. However, not all design workshops were organised effectively since neither the architects nor the managers had adequate experience in managing collaborative design this way.

In the light of this, the respondents found the usefulness of the principles to design the social frame. Many experienced project managers had actually exercised the social-

psychological approach as presented in the concept, but mainly on their own intuition and practical experience. The respondents saw the use of the concept to provide clarification and reflection for these managers and to enable them to be more effective and rigorous in exercising the social-psychological approach. The social-psychological approach did not mean to substitute the project management approach and instruments, but rather to complement these at the moments when systematic and quantitative measures were not adequate.

Regarding the principles of managing collaborative design by designing the project frame, the interview respondents shared the same view on the project complexity. They considered managing a multi-architect building project as a high risk undertaking since there were no directly applied past references, especially if there were many uncertainties in terms of politics, market, and cost in the long term of development process. Often, high ambitions were set in the beginning of the projects, but this could not be achieved at the end of a project. Although the technical complexity was very high, the social complexity was obviously even more difficult to handle. The social complexity was especially the result of the fact that a project involved various public and private stakeholders of different importance. Good understanding and relationship between all parties was, therefore, crucial to hold the commitment and motivation throughout the projects despite the inevitable discrepancies about certain issues. In such a complex situation, the respondents found that the principles for designing the project frame clarified the main issues that should be taken into account by any project manager and advisor.

Thus, both the project managers and advisors, and the interview respondents found the concept for managing collaborative design very relevant to be used when dealing with design teams consisting of various design actors during the conceptual architecture design phase. They emphasised that implementing this concept required certain personal abilities that might need to be built through certain training and practical experience. They also stated that some principles, especially those for managing the project frame were as relevant for the project management as they were relevant for design management. The respondents also expressed their interest to learn whether the concept was applicable for different types of collaborative design in different types of projects, for example, other projects than multi-architect building projects.

7.4 Conclusions

The expert opinions and the analysis of the Ground Zero case have verified the research outcomes. The results of the verification can be concluded as follows.

The description of the characteristics and difficulties of collaborative design the challenges for managing collaborative design, which is based on the exploratory case studies using four building projects in the Netherlands, also applies to the Ground Zero case. The expert practitioners found that the description adequately addresses the important issues in collaborative design in multi-architect building projects.

In the Ground Zero case, some aspects of the description did not appear explicitly since the Ground Zero case was still in the stage of the design competition. These aspects were the level of detailing of the masterplan, the presence of an architectural supervisor, and the coordination with the client. Beyond the Ground Zero case, the interview respondents

assessed these aspects and underlined that these were relevant to describe the collaborative design in a multi-architect building project.

It is clear that the description applies to multi-architect building projects, which is also the case with Ground Zero; however, it has not been assessed in-depth whether the description also applies to other types of project, such as a complex project with a single architect (single architectural firm) or a less complex building project.

In Chapter 1 and 3, it has been written that this research focuses on the conceptual architecture design phase in which the architects hold the key role in the design process, and the observed characteristics of collaborative design distinguish a multi-architect building project from other types of project. However, the interview respondents discussed that the description may also apply to the conceptual architecture design phase of any complex building project in which the design team consists of multiple design actors; but the type of ideas generated through collective designing may be different. For example, instead of having various architects developing the masterplan together from the architectural viewpoint, the design actors in collective designing would discuss how the engineering solutions could be made as an architectural expression in the building form.

In a less complex building project in which the design team consists of only a few people with less related design tasks, some of the difficulties of collaborative design and the challenges for managing collaborative design would become less important. For instance, it would be less important for design management to stimulate social contacts for the interactions of individual creative processes.

Regarding the concept for managing collaborative design, the expert opinions underline the plausibility and practical relevance of the model and the principles. The interview respondents found that the principles were clearly described using real examples next to the theoretical explanation. Moreover, they found that the concept for managing collaborative design was useful to help them to reflect on their own cognitive and social processes in collaboration, to solve discrepancy between management and design, to get insight into the complexity of collaborative design, to comprehend the influencing aspects (frames) in managing design, to become aware of the needed social skills in managing design, and to understand how to combine the technical and social-psychological approach in design management.

The interview respondents also provided the following remarks that are important for understanding and improving the concept of managing collaborative design.

- The model may have a wider application than collaborative design in the conceptual architecture design phase since the cognitive, social and project frames and the interrelation between these frames can also be recognised in any form of collaboration in practice.
- While working with the cognitive frame, a design manager should realise that not all parts of the building project are subjected to collective designing. Individual creative processes to design each building still takes place. Collective designing is needed to develop the masterplan and common elements of the project and to achieve integration in the whole design.
- While working with the social frame, a design manager should appreciate the intrinsic motivation of the design actors to work in collaborative design and use this to

strengthen the design actors' commitment to teamwork. In the exploratory case studies as well as in the Ground Zero case, it was clear that most architects were willing to participate in the design team for the opportunity to work together with other renowned architects in such an important building project.

- While working with the project frame, a design manager should be aware of the external forces and the decision making processes by the stakeholders that influence the design process by the design team. In a complex project, design management may take a more or less formal role. The role of design coordination within the design team and between the design team and the client should be carried out in complementarity between design management and project management.
- It is appropriate that the principles of managing-by-designing can be customised to be applied by different persons in the role of design manager in different collaborative design situations.
- A design manager does not necessarily apply all principles in managing collaborative design, for example some architectural supervisors prefer and are better in managing by making sketches and drawings together with the design actors during the design workshops, while some other architectural supervisors manage collaborative design by verbally guiding the design actors using stimulating questions and constructive questions.
- Some principles may become more important than the others in specific situations, for example the actions taken by the design manager to assure the motivation of the design actors become very important at the moments when a long-running design process seems to stand still due to internal and external barriers.
- The potential of the principles is dependent on the personal skills and abilities of the design manager to exercise them. Practical experience and, perhaps, some sort of personal competency training are needed, especially by those who are not familiar with the social-psychological approach for design management.

This research is descriptive. Although to a certain extent the principles of managing-by-designing may be considered as recommendations on how design management can operate, these principles are primarily meant to describe – through real examples and theoretical explanation – several possible ways to manage collaborative design by designing the cognitive, social and project frames. In this research, these principles are not meant to be prescriptive. They do not set a rigid guideline that should be followed to manage collaborative design. Perhaps in future research, these principles can be developed to become normative after they are rigorously tested and validated through a certain period of implementation in practice or academic simulations.

Managing Collaborative Design

Chapter 8

Final conclusions and wider discussions

CHAPTER SUMMARY

Research on managing collaborative design is timely and important. The key question in this research is how to understand and manage collaborative design in the conceptual architecture design phase of a building project. This research aims at presenting a description of the practice of collaborative design and a concept for managing collaborative design in this context.

The first research outcome is a case-based description of the characteristics and difficulties of collaborative design in the conceptual architecture design phase and the challenges for design management. This research also presents a description of the existing academic knowledge and theoretical approaches that can be found in the recent literature of design management in architecture. This research concludes that in collaborative design, the design process is very much a social process. Designing is a social process that requires trust, sharing of ideas, negotiations, trade-offs, and consensus to bring the efforts into coherence. While advances in construction engineering and project management may offer solutions to many technical problems, the social complexity in collaborative design has yet to be addressed properly and dealt with by design management.

The second outcome of this research is, therefore, a concept for managing collaborative design that addresses the cognitive and social processes of the design actors during the collaborative design process in a building project. The concept is called managing-by-designing. The concept comprises a model describing that collaborative design is an interplay of cognitive, social and project frames, and several principles for managing collaborative design by designing these frames. The model in this concept describes the main aspects in collaborative design to be dealt with by design management and the interrelationship between these aspects. The principles are explained by describing real examples from the case studies and the theories that can be made practical in these examples.

Although the research and its outcomes are meant to be descriptive, some parts of the research outcomes may seem implicitly normative. A number of experts consulted during the research indicated that the model, which describes the cognitive, social and project frame, might apply more generally to different types of collaborative design; the principles of managing-by-designing might provide more than a description and some examples of known approaches, but to a certain extent also some recommendations on how to manage collaborative design; and the principles might serve as the basis to develop instruments and tools. This can be considered as a direction for future research.

8.1 Final conclusions

Collaborative design has been emerging in building projects around the world. As a building project becomes more and more complex, a closer and more intensive collaboration between various design actors from different organisations is inevitable. Furthermore, if a large building project is aimed at presenting an architectural ensemble that consists of different 'design styles' by different architects, multiple architects from different design firms are assigned to work together in the design team. To achieve 'harmony in diversity', collaborative design in the conceptual architecture design phase is essential, especially during the elaboration of the masterplan and the development of the preliminary building designs.

This research focuses on the conceptual architecture design phase. In this phase, the architects usually hold the key role in the design process, in direct consultation with the clients, local authorities, and multidisciplinary specialists. The activities in the conceptual architecture design phase aim at understanding the requirements and inventing the design concepts. This phase is relatively short compared to the overall project course, but it is very important to lay down the principal design ideas and decisions for the whole project.

Research on managing collaborative design is timely and important. The key question in this research is how to understand and manage collaborative design in the conceptual architecture design phase of a building project. This research aims at presenting a description of the practice of collaborative design and a concept for managing collaborative design in this context. The research outcomes that have been achieved and verified, as presented in the preceding chapters, can be concluded as follows.

The first research outcome is a case-based description of the characteristics and difficulties of collaborative design in the conceptual architecture design phase and the challenges for design management. This is based on exploratory case studies using four multi-architect building projects in the Netherlands. This research also presents a description of the existing academic knowledge and theoretical approaches that can be found in the recent literature of design management in architecture.

This research concludes that in collaborative design, the design process is very much a social process. Designing is a social process that requires trust, sharing of ideas, negotiations, trade-offs, and consensus to bring the efforts into coherence. While advances in construction engineering and project management may offer solutions to many technical problems, the social complexity in collaborative design has yet to be addressed properly and dealt with by design management.

Besides the involvement of a large number of stakeholders with often conflicting goals and visions, a reason for social complexity is the need for collective designing and the unfamiliarity of the design actors to do so. Collective designing is needed in the creation of an integral design solution. In collective designing, interactions between individual creative design processes of various design actors take place. Many architects involved may be leading experts in their fields, but they may not have much experience of idea generation in collective designing with other architects of the same calibre from other firms. Moreover, since internationalisation has been widespread in the architecture world, a design team often consists of large number of international architects that come together for a short period of the project, from a few months to a few years. The language, knowledge of local situation, and cultural differences add to the complexity of collaborative design.

The study of recent literature of design management in architecture shows that there is still a lack of rigorous research on how to stimulate and guide creative teamwork between the design actors. Much design management research focuses on the processes around designing, the outputs of the processes, and the organisations and systems that support designing; yet it overlooks the creative activities by the design actors. The design actors are only addressed in formal, structured, and systematic ways.

Having learned this, this research introduces a concept for managing collaborative design that addresses the cognitive and social processes of the design actors during the collaborative design process in a building project. This is the second outcome of this research.

The concept is called managing-by-designing. The concept comprises a model describing that collaborative design is an interplay of cognitive, social and project frames, and several principles for managing collaborative design by designing these frames. The model in this concept describes the main aspects in collaborative design to be dealt with by design management and the interrelationship between these aspects. The principles of managing-by-designing are explained by describing real examples from the case studies and the theories that can be made practical in these examples.

The concept for managing collaborative design introduced in this research incorporates relevant theories from social-psychology that are relevant for managing the human factors in collaborative design. The selected theories include: management complexity, cognitive psychology of the architect's thinking, personal and organisational knowledge, group dynamics, and reflective practice. The concept is based on a perspective that design and management are two activities that, to a certain extent, have some similarities in their thinking and action, in the context of conceptual architecture design phase. Design and management are inescapably intertwined as knowledge-intensive human practice, which works with and within uncertain situations, to deliberately initiate and devise creative processes for shaping more desirable reality. In this sense, managing collaborative design is not simply the steering of people, processes, and product development in a rigid problem-solving mechanism, but rather an iterative and interactive process to review the possibilities and refine the solutions in a both problem-finding and problem-solving approach.

In the concept for managing collaborative design introduced in this research, design management is seen as a participative role in designing, rather than a formal-directive management function. Design management becomes a catalyst that stimulates and guides the mutual interactions between individual creative processes. It acts more as a peer, rather than as a superior leader. It provides coaching and consultation to the architects, rather than giving instructions and commands.

In its direct-participative role, managing collaborative design deals with the cognitive, social, and project frames of the design actors in designing. The design actors working on a real project are engaged in the creation of design solutions to be constructed through unique cognitive process of idea generation, as well as in the social process in which group behaviour plays an important role to achieve the desired synergy effect. Since these frames do not pre-exist and cannot be standardised, design management creatively generates and customises them to apply in different situations and to meet the project content and the characteristics of the design actors and organisations. In other words, design management works by designing these frames; and therefore, the concept is called managing-by-designing.

The research outcomes have been verified using expert opinions and a case study of the collaborative design in the design competition for Ground Zero / New World Trade Centre in New York. The results of the verification show that the description of the characteristics and difficulties of collaborative design, and the challenges for managing collaborative design, which is based on the exploratory case studies using four building projects in the Netherlands, also applies to the Ground Zero case. The aspects that did not appear in the Ground Zero case were discussed with the experts. Based on the Ground Zero case and their experience, these experts found that the description adequately addressed the important issues in collaborative design in this context. These experts also found that the concept for managing collaborative design was plausible, in terms that the concept was practically sensible and if applied it might bring a reasonable contribution to the attempt to manage collaborative design.

In addition to the verification carried out in this research, it is noteworthy that the research outcomes are further supported by the findings of Emmitt (2006) who has observed design workshops in building projects in Denmark. In line with this research, Emmitt discovers that a workshop is an essential tool to maximise value and to reach agreement. Different cultures exist from the creation of a design concept through to the production, and the workshops provide a vehicle for addressing potential difficulties. Emmitt also recalls the significant role of the process facilitator –which may be compared to the role of a design manager as described in this research– to act as an informal leader, charged with creating an effective social system that can drive the project forward based on consensus. In Emmitt's opinion, which again is in agreement with the findings of this research, the process facilitator must possess excellent interpersonal skills and have sufficient knowledge of construction to be able to guide the process, allowing sufficient time for discussion, but by the same token knowing when to prevent unnecessary talk around the subject. The success of the process-facilitated workshop is coloured by the experience and skill of the facilitator.

Although the research and its outcomes are meant to be descriptive, some parts of the research outcomes may seem implicitly normative. A number of experts consulted during the research indicated that the model describing the cognitive, social and project frame might apply more generally to different types of collaborative design; the principles of managing-by-designing might provide more than a description and some examples of known approaches to manage collaborative design, but to a certain extent also some recommendations on how to manage collaborative design; and the principles might serve as the basis to develop instruments and tools, for example, the instruments to organise creative design workshops or tools to support the achievement of shared understanding in teamwork. This can be considered as a direction for the future research that will continue to build the research outcomes after these are rigorously tested and validated through a certain period of implementation in practice or academic simulations.

For the further development and implementation of this research and its outcomes, the following issues should also be taken into account. This research may promote a certain shift of viewpoint from technical-rational thinking and systematic approach which are popular in the 'classic' project management towards the integration of a socio-psychological approach in managing collaborative design. Such a shift may not be simple to achieve within a short time. Many managers may need a personal competence training to adopt and adapt a social-psychological approach. Many architects may need to be convinced that design management did not intend to limit their creative process, but to enhance this by achieving synergy in collaborative design. The positioning and acceptance of design management in the project organisation is also important for the functioning of design management with its formal and informal roles. Another issue is that the implementation of a social-psychological

approach may become easier when the descriptive concept is supported by directly applicable instruments, tools, and procedures. These still need to be developed and integrated with the existing instruments, tools, and procedures used in the current practice.

8.2 Wider discussions

This research intends to contribute to the further development of design management in architecture. In terms of practical implication, this research anticipates a progressive impact in the practice and science of design management in architecture, rather than a one-time radical breakthrough. Currently, design management in architecture concentrates on two main operational fields: the building organisations and the building projects. Design management in building organisations manifests itself in the strategic, internal and external operational management of design firms. Design management in building projects applies to the management of design or design-related matters in the project course. The latter has drawn more attention and taken a growing amount of research in the schools of architecture and construction around the globe.

This research is also oriented to the discussions of design management in the building projects. To better recognise and position different research in this operational field, a matrix as shown in Figure 8.1 can be used. For the purpose of clarification, the matrix shows a simple categorisation of research areas, although in reality there is no strict boundary between them. A research project may cover subjects across the research areas.

<i>Focus of design management</i>	<i>Development phase in a building project</i>								
	Programming	Conceptual design	Preliminary design	Design development	Design engineering	Realisation / construction	Commissioning	Use and maintenance	
Design actors									
- Designers									
- Advisors									
- Stakeholders									
- Users/communities									
- etc.									
Design processes									
- Information									
- Tasks									
- Coordination									
- Decision-making									
- etc.									
Design products									
- Programme									
- Drawings/models									
- Buildings/components									
- Performance/costs									
- etc.									

Figure 8.1 Research areas of design management in building projects

Traditionally, designers manage their own idea generation process in the conceptual architecture design phase based on the programme of requirements and general terms received from the clients. When design enters the engineering and realisation phases, design management comes in to coordinate the processes and facilitate the development of the products. This is where most design management research in architecture, whose root is in the disciplines of construction engineering and construction management, is found up to now.

Since the conceptual architecture design phase has become more and more complex and since collaborative design in this phase has become a real necessity, the intervention of design management is also expected in the early phase of design. Here design management is to deal with the idea generation, which essentially occurs in the creative processes of the design actors. Architectural design is seen as a social process involving the designers from different disciplines, as well as the stakeholders and users which participate directly or indirectly. This is the main focus of this research, which combines knowledge from both technical and social sciences.

When looking at the designers from the social-psychological perspective, this research discusses the potential of applying the designers' skills in other fields of practice beyond architectural and urban design. Design thinking and attitude are not only limitedly relevant for the creation of buildings, but also for the creation of organisations and strategies. This research shows that the designers' skills are crucial for design management. Beyond design management, there are indications of the wider relevance of design thinking and attitude in other fields of management practice, for instance for the managers who have to tackle complex business strategies and organisational problems.

The changing nature of design activities and professional services has also opened a new opportunity to employ the architect's skills in business research. Architectural thinking in its pure form can be applied to question organisation, identity, culture and programme, and to define ways to explore the potential in the 'black box' of manager's business intuition. Reinier de Graaf from AMO/OMA (in a lecture at TU Delft, 2005) supports this opinion by saying that one has to dare to look differently to the role of the architect, not only as executor of plans, but to be involved as early as possible in the organisation and project strategy. The changes in architectural practice in the Netherlands have also been studied by Meel et al (2002).

In the business world people tend to view research from another definition than in the natural sciences. Here, research is never described as something outside the domain of practice. It is rather described as something that occurs within practice, and as an activity that underpins practice. Business research is to study or develop business strategy which is made for specific purposes and supposed to be unique and innovative among others in the market. In this context, research can be seen as a way of accelerating the process of understanding, and hence it should lead not only to a better understanding of business or management, but also to a better understanding for managers about how best to go about their work (Easterby-Smith et al, 1991). This leads to the consideration of describing business research that is closer to the architectural design.

Specific boundaries and benchmarks must firstly be clarified for acknowledging that architectural design can also be a form of research inquiry. In a very helpful way Groat and Wang (2002) address the question of how research quality is maintained when a non natural science, non-positivist approach to research is adopted. They suggest that the social sciences offer well-accepted research methods that might allow certain forms of design

activity to be regarded as modes of research. In describing their model of research, they match the quality measures familiar to the positivist paradigm –such as validity, reliability, objectivity, and generalisability– with new measures, namely credibility, transferability, dependability, and conformability.

Thus, if research activities associated with design are to be considered good quality research, they should aim to be credible, transferable, dependable, and confirmable. Credibility is a measure of the truth value of research activity, in much the same way as validity measures the truth in the natural sciences. A research activity associated with design can be shown to be credible if it can be confirmed through something akin to triangulation, whereby a variety of sources and techniques are used to cross-check the research outcome. To achieve transferability, a sufficiently 'thick' description of one's activities and outcomes must be provided so that others can adequately assess the value of the research. To establish dependability, a research activity associated with design should establish an audit trail that documents all the processes by which data was collected, decisions were made, processes were followed, and outcomes were analyzed and interpreted. Neutrality, ensured by the presence of objectivity in the natural sciences, is guaranteed in naturalistic research associated by design by establishing conformability through transparency of activity and reflexivity on the part of the researcher. This is the type of reflexivity identified by Schön (1983) in his seminal work in which he identifies the rigor required of a practitioner who is involved in listening to a design situation's talk-back.

Design is and should remain to be the core activity of architects. However, design can be seen much wider than creating forms and spaces. Designing can be about anything: buildings, products, organisations, processes, communications, policies, etc. Peters (2005) says that design is hugely underrated as a strategic tool. Design is the essence of emotional attachment to a product or service or experience; and therefore, the wellspring of the corporate culture and of the brand proposition itself. Considering this, architects can take new forms of profession, for instance by becoming custodians of customer values and design models, consultants of customer business, or facilitators of stakeholder interests. Their skills, creativity, and holistic thinking bring significant added value as the architects become design managers and business researchers who are capable of jumping into the 'black box' of professional human cognition. The attempts to foster and set forward the changing roles of the architect must have the goal to build, maintain, and enhance the architects' expertise over the specialist body of knowledge associated with the practice of the profession. The development of new knowledge, that is, research, in all its various forms, is an essential activity in meeting this goal.

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Mahler4	Amsterdam Zuidas Masterplan Amsterdam Zuidas (1998) Masterplan Mahler4 (2000) Openbare Ruimte Zuidas: Ontwerp en Hoofdlijnen (2001) Visie Zuidas (2004) [in Dutch] Website www.mahler4.nl (Last visited 2004) Website www.zuidas.nl (Last visited 2004) Zuidas Projects (2004) Zuidas: An Integrated Projected Alignment / EIA Study, The Urban Quality of the Alternatives (2001)	Projectbureau Amsterdam Zuidas Municipality of Amsterdam Architecten Cie Municipality of Amsterdam Municipality of Amsterdam Municipality of Amsterdam Municipality of Amsterdam
Nieuw Stadshart Almere	Almere: City by the Water (2001) Faseringsdraaiboek Stadshart Almere, versie E (2002) Het Gevoel van de Stad: Verslag van de Workshop Openbare Ruimte (2002) [in Dutch] Opgave en Ontwerp Stadscentrum Almere (2002) [in Dutch] Website www.stadscentrum-almere.nl (Last visited 2004)	Dienst Stadscentrum Almere Almere Hart C.V. Dienst Stadscentrum Almere and Architecten Cie Seminar, Almere, 16 December 2002
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Annex 1

Brief summary of the interviews findings in the exploratory case studies

Respondents (personally interviewed or refer to published interview reports)		Case study	What makes collaborative design in the project unique, and why?	What are the main difficulties in collaborative design, and why?
No.	Name, function related to the case examined			
1	Alkemade, Floris, Architect, urban designer and architectural supervisor	Stadshart Almere	- A key project for Almere, with a high ambition to realise a radical urban masterplan and building architecture, and involving many renowned local and foreign architects in realising an integral urban complex - Supervision from urban design aspect as well as from other aspects throughout the process	- The integral urban plan requires more consultations, more coordination, and more mutual trust - The designers do not have political or economical power, but pouring the decision-makers with new solutions and ideas
2	Bruijn, Pi de, Architectural supervisor	Mahler4	- Masterplan that functions as a strong frame that allows individual design freedom, yet assures the designs to fit the bigger urban picture - A metropolitan project whereby there is close collaboration between all kinds of parties: national and local government, designers, developers, investors, social organizations, and residents	- The project is divided into several phases. Some buildings are to be designed and built earlier than the others although they all stand above an integral basement. - The buildings have different shapes and sizes and there is diversity in the designs by different architects. Despite of this, the total harmony must be achieved.
3	Burg, Fred van der, Urban designer	De Resident	- Collaboration in developing and implementing a masterplan based on a design approach that was different from the mainstream Dutch urban design - Interpersonal trust was proven to lead to successful informal meetings	- Dynamic project circumstances - No established guideline of the design requirements and development process - Composing diverse design 'styles' by international architects
4	Daan, Gunnar, Architect	De Resident	- Teamwork makes a prominent project successful - Learning from the know-how of other 'top architects' from different countries and age-groups	Harmonising the design of a building with other buildings by different architects without losing own architectural design characteristics

5	Drijver, Peter, Architect	De Resident	- Commitment of the stakeholders and the design actors to Rob Krier's masterplan - An interesting project with high ambition and opportunities to explore new design possibilities - Direct collaboration in workshops with national and international 'top architects'	- Difficult location and complex design requirements including new buildings and refurbished buildings - It was not decided in the beginning which architect would elaborate which building, so that in a later phase, swaps of buildings from one architect to another occurred
6	Galjaard, Johan, Project manager	De Resident and Oosterdoks- eiland	- Selection of 'the right persons' determines the success of multidisciplinary and multi-phases coordination of design, engineering, and construction - A large-scaled project that is successful in maintaining a total plan consists of diverse designs by various architects - Each building has its own architectural 'style', yet the project presents a harmonious totality	The (technical) interaction between different project elements is extensive. For a smooth process, all plans should be developed in the same time with intensive coordination with all design actors. However, to a certain extent this is not always possible since the progress of the design and construction of particular buildings may not be the same with that of the others since each building has its own complicated problems.
7	Geldof, Cees, Urban designer	Mahler4	A large-scaled project with multiple stakeholders and a collection of top architects, as desired by the client to stimulate the interaction between different architects to result in innovation	- Very large number of parties involved added complexity of decision-making - Selecting design actors that have the willingness and ability to work in creative teamwork
8	Harms, Anton, Project manager	De Resident	- Design workshops that involve multiple stakeholders and multidisciplinary specialists allow comprehensive problems to be addressed and discussed directly - Masterplan that is translated into guidelines to introduce common design element like open space, building shape, materialization, and colour	Interconnected buildings require integral architectural and engineering solutions that can only be developed in frequent and effective consultation with different design actors
9	Kitao, Yasunori, Observer / external researcher	De Resident	A project that reflects the collaboration between the 'master architect' (architectural supervisor) and the 'block architects' (building architects) that is based on trust, respect, and consensus.	The position and mandate of the architectural supervisor is not completely and formally defined; an architectural supervisor for the urban area is appointed by the public client and the supervisors for the architectural design team are appointed by the private client.
10	Lieverse, Dingeman, Representative of client / local authority	Stadshart Almere	- An important project that successfully realises the need of 'recognition' for the growing city of Almere by presenting a diversity of design made by various designers that are harmoniously composed at a strategic location - Masterplan with a common design vision that is important for design consensus	How to steer the process of collaboration with many stakeholders and design actors so that the initial ambition to realise high-quality architecture will be maintained until the project completion amid difficult political and economical circumstances

11	Lousberg, Louis, Project manager	Oosterdoks- eiland	- The creation of the particular and total designs are more collective and interactive than in conventional projects as the design actors have the opportunities to widely discuss the ideas and problems in design workshops - The 'charisma' of the architectural supervisor that brings a positive impact on teambuilding between the design actors	- The social complexity is critical and resulting from the inter-relationship between so many parties, especially due to the fact that there are more than one clients with often conflicting objectives, i.e. the municipality and the real-estate developer - Collaborative design is dependent to many parties - Changes in the organisation of the stakeholders affect the project organisation and usually bring negative consequences for the design process, such as delay or design changes
12	Made, Hans van der, Urban designer	Oosterdoks- eiland	The difference from other complex projects is that people try to solve the comprehensive design problem in Oosterdoks-eiland through collective and interactive design, instead of dividing the projects into small parts to be solved separately	- Changes of the architects in the design team while the design process was progressing - Design workshops were not fully effective with a large number of attendants
13	Mans, Dik-Geert, Project manager	De Resident and Oosterdoks- eiland	- A new experience in coordinating the design development of the whole project and finding solutions for integral and specific problems in collaboration with all design actors - Design coordination through integral engineering of details - Workshops as opportunities to inform and get feedbacks from all architects on particular and integral engineering solutions	- Complicated decision-making processes by a large number of stakeholders and design actors - The design actors are dependent and vulnerable to changes in project strategies that affect the design processes and products

14	Meijer, Ton, Representative of client / real estate developer	De Resident	- The architect supervisor (Kees Rijnboutt) organises the design process through a number of workshops in which each design proposal is open for comment by other design actors and clients - 'Herenoverleg' as a particular steering instrument in which Noordanus (municipality), Rijnboutt (architectural supervisor), and Meijer (real estate developer) meet monthly to discuss main issues and take decisions without bureaucracy - In the right setting, it is possible and remarkable to stimulate from a group of very talented architects a high degree of loyalty to a clear urban vision and respect for each others views - One important consideration is the initial selection of the architects	- In De Resident, Krier's conceptual ideas were not very familiar to the Dutch urban planners, authorities, investors, and contractors. A success can only be achieved as those involved in the building process have reached an understanding about the design and its 'inner meaning'. - Because our architectural schools and the common (conventional) mode of commissioning architects are oriented to specialised work as part of the team -instead of a matter of building in ensemble-, the planning process requires a special procedure - We have to develop and build in one continuous flow and we want to achieve a high level of architectural and functional quality. We therefore have to find new ways to do things differently. - Conventionally, the task of achieving the greatest possible architectural diversity can be accomplished by inviting several architects to design individual buildings within the fixed framework of an urban design scheme. However, in De Resident, there is an additional aspect which is the collaborative design process. The 'myth of isolation' must be fundamentally challenges.
15	Nieuwenhuizen, Jan, Representative of client / local authority	Stadshart Almere	A city centre based on visionary thinking of the masterplan architect and building architects that is in line with the future vision of the city council of Almere	A radical idea can only be realised if there is adequate political support as well as economical and social assurance from a large number of parties.
16	Rijnboutt, Kees, Architectural supervisor	De Resident and Oosterdoks- eiland	- Selection process of the architects involving many consultations with the stakeholders and supervisors as well as 'assessments' to learn the teamwork commitment of the candidate architects - The use of 'cooking pressure' design workshops to facilitate direct exchange of design ideas and design decision-making by all key design actors - Architect supervisor that functions as informal leader and social catalyst in the design team	- Complicated processes to achieve commitment and agreement from all stakeholders and design actors - Practising design leadership that is based on personal approach to stimulate team creativity and conducive social atmosphere in the design team
17	Rossem, Vincent van, Observer / external researcher	De Resident	- A remarkable project that is to the credit of all involved that the outcome really merited a collective design - Collective design through design workshop was at first a daring experiment - Everybody was committed to the design 'line' introduced in the masterplan	- In the beginning of the project, most design actors were not familiar with the public-private partnership and collaborative design approach, as some 'beginners' faults' were made, a.o. regarding the decision-making mechanism - In a creative debate, emotion can become involved, and therefore, a design leader with good human skills is required to maintain the good teamwork

18	Schmitt, Maarten, Architectural supervisor	Stadshart Almere, additional case of urban development in Lille	- An integral city centre containing a mix of different urban design and architectural characters made by various designers - Masterplan that functions as a design platform and reference of a common design vision - Q-Team with supervisory and advisory roles among the design actors and between the design actors and the stakeholders	Managing collaborative design in a large-scaled project with multidimensional complexity that requires complementary knowledge and skills of different experts, therefore, the Q-Team consists of urban designers, an architect, and a sociologist
19	Schoenmaker, Mariet Representative of client / real estate developer	De Resident, Stadshart Almere, and Oosterdoks-eiland	- Despite the absence of a directly comparable example or precedent, the project success is possible by teamwork of high-quality experts / professionals with their rich experience and know-how to solve comprehensive problems - Workshops that gather all design actors to solve not only architectural problems, but also functional and financial requirements	In an ideal situation for collaborative design, all designs should be developed simultaneously to allow the design actors to discuss and solve the problems together. However, due to the large scale of the project and the major investment needed, a project needs to be carried out in phases, as buildings are designed in subsequent order.
20	Soeters, Sjoerd, Architect and architectural supervisor	De Resident	- One of the first projects in the Netherlands with intensive collaboration between diverse architects in developing the masterplan and conceptual building design - Close teamwork with the clients and other design actors - Team commitment that is proven to be more powerful than emotion during heated discussions in the design team	- Mutual understanding with experts from different background - 'Bridging' the design team aspiration and the client requirements - Creating an integral design that is able to solve the comprehensive problem
21	Vaartjes, Nanno, Representative of client / real estate developer	De Resident, Stadshart Almere, and Oosterdoks-eiland	- Commitment of both the public and private clients to the masterplan idea by Rob Krier - Collaborative design between many (international) architects through interactive design workshops	The positioning, roles, and responsibilities of each party should be clearly defined. However, due to the complexity, many things have taken place rather ad hoc and some coordination has relied on informal basis.
22	Zuuk, René van, Architect	Stadshart Almere	- A large-scaled project based on the radical design vision of the masterplan architect (Rem Koolhaas) - A unique experience to present a design that is realised among those of other highly-reputable architects	The project contains sub-projects with numerous contrasting designs, yet it must display an innovative city-centre as a whole and it must meet complicated client expectations

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Annex 2

Brief summary of the interviews findings in the verification of the research outcomes

Respondent	Expert's own analysis of the case studies		Expert's opinion on the research outcomes		Remarks
	Observed problems of collaborative design	Design management approach needed	Understanding the core issues of collaborative design	Concept for managing collaborative design	
1 Adams, Monica Architect	- The ambition is to create diversity by combining different architects in an integrated building complex. However, for such collaboration all design actors must have a good teamwork attitude. In reality, this is not always the case since it is difficult to select candidates who have suitable design expertise and teamwork attitude. The design workshops were important and necessary, but did not continue after the conceptual architecture design phase. - Sometimes some members of the design team are less committed or do not have the right attitude for collaborative design.	- Design management should play an important role in helping the architects in translating clients' ambition and project vision into architectural concepts. Each project is different, so it takes a different design management approach. Even for the same project, the design management approach in the conceptual architecture design phase should be different than in the design development and engineering phase. - Integral design management that has sufficient authority for design decision making as well as a formal function as a bridge between the clients and the designers, engineers, etc.	- The advantages and difficulties of collaborative design have been experienced in the practice and the research gives a clear overview of all important aspects related to collaborative design and how to deal with these. Enrichment of architectural quality by combining architects with different design approaches. - Workshop method that accommodates close collaboration leading to interpersonal trust and sustainable partnerships between different architectural firms.	The research gives ideas and perspectives how can collaborative design be improved. For example everybody knows that it is important to have a total design vision, but in practice sometimes it is difficult to instil the vision. The concept discusses this using a cognitive frame. Another example is how the concept clarifies several approaches to improve social cohesion in the design team.	- The findings of the research seem also useful to describe and clarify the situation in other projects beyond the case studies in NL (e.g. a multi-architect building project in Lyon). - The research is valuable for introducing a social-psychological approach that is certainly important, but not to be separated from the necessary technical and information management.

2 Bruijn, Pi de Architectural supervisor	Although the video of Ground Zero design competition is valuable as a case study, we must realise that a design competition is not a real construction project. In the conceptual architecture design phase, there is much room for exploration. It is an art of design management to know what can be broken through and what are fixed constraints. Good experienced architects know this, and therefore, are able to propose innovative ideas. This process can be enhanced through creatively-managed teamwork.	The masterplan is a powerful instrument for managing collaborative design. It can be used by the architectural supervisor to stimulate ideas as well as to draw certain guidelines so that the freedom in design will not result in a chaotic whole. It can be used to make assure the harmony between the project and the rest of the city. The architectural supervisor plays an important role in the achievement of consensus among the design actors and between the design actors and the clients.	- The research gives a clear overview of many aspects in collaborative design. It is nice to learn how the research categorises and links different aspects to understand the essence of collaborative design. Such description has not been made by other studies. - Collaborative design through interactive workshops to develop a masterplan and building designs was quite new experience for everybody in the beginning of the project. The research presents a comprehensive description of the circumstances and important issues. It discusses the connection between products (masterplan, building design, design guidelines, vision documents, etc.), processes (workshops, consultations, decision makings, etc.), and actors (architects, urban designers, engineers, advisors, managers, clients, local authorities, etc.).	The concept puts actors-processes-products aspects as well as cognitive-social-project approaches into logical containers and linkages. Some principles have been exercised in the practice, but many not be fully understood especially by those who are new in this type of project. This is an important knowledge contribution of the research.	It may be interesting to see how the social-psychological approach is integrated with an approach to enhance product development (e.g. masterplan creation) based on urban design methodology.
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3 Coenen, Jo Architectural supervisor	The video of Ground Zero shows the architects activities which only form a small part of the complexity of collaborative design. It is very important to understand and deal with the political difficulties for projects as large and as high-profile as Ground Zero or multi-architect building projects in the Netherlands.	Design management means designing together with the clients and the design actors. An architectural supervisor should also be a good negotiator. Trust and respect are the keys for team success.	The most difficult problem is beyond design itself. The research appropriately addresses this as social complexity. The research also describes the causes and the consequences of this complexity.	The concept presents some principles and examples without the intension of becoming a generic strategy for managing collaborative design. Managing design is personal. It depends to the human skills of a very few experienced professionals. Evidently, there are only a handful of architectural supervisors in the Netherlands. There cannot be any 'cook book' of how collaborative design is to be managed.	The research subject is very relevant and interesting, yet it is also very broad and largely intangible.
4 Damen, Ton Advisor	The technical and function requirements of the project is complex. Above this is the political agenda of the stakeholders. Especially in a high-profile project. In the design team, architects usually have an ego to produce the most remarkable design. It is the question of how to have a good 'trade-off' between individual ego and the success of such an important project that will mean a lot for (the professional success of) each party including every architect.	The design manager must have broad and deep knowledge of design as well as management. Beside, he or she must have long-track of experience in complex projects whose problems cannot be systematically explained and solved. Technical tools (e.g. ICT instruments, project management procedures) are required to support the management, but must not be relied upon as the core of successful management. Economic incentives can be used to support the social-psychological approach. Therefore, the professional intuition is crucial, just as important as being a (senior) professional that is respected by all design actors.	Although the context and the content of the projects may vary, the essence of the problem of collaborative design is the same with that in any other fields. Collaboration takes people that need to be motivated and guided using personal approach. Some experienced managers are able to carry out social-psychological approach. For them, the research presents a nice and complete overview of possible ways and consequences.	The concept is a collection of multidisciplinary knowledge that is useful as a learning instrument, but not yet as a problem solver. The concept gives some guidance, but it is not intended to be a (strict) guideline.	The selection of cases of multi-architect building projects is proper for PhD work because such 'extreme' cases are interesting for academic purposes and can serve the attempt to study many different problems. However, the researcher should bear in mind that solutions for the cases may not be directly applicable or generalisable for every project in the practice.

5 Eekelen, Bert van Project manager	Complexity is not only determined by the number of parties involved, but also by the personality of the decision makers and design actors as well as the content of the project. A large and complex project such as Zuidas requires a special approach and a close collaboration between the parties. This is the added-value of teamwork. In the project, people are not only searching for design and engineering solutions, but moreover, together we contribute to an innovative development and a new concept.	Make clear and simple agreements over the responsibilities in the processes and projects, and lay these down. The responsibilities may not be laid down on different places. In the beginning of the process, take a democratic decision on who are the managers and project leaders in charge.	The research brings a valuable contribution of knowledge about 'multi-architect building projects' as well as social-psychological approach that have not been much discussed in architectural and project management literature. The key for a successful management of collaborative design is to have an adequate manager (experienced, knowledgeable, reliable, and respectable) among a highly competent and committed team.	The concept may help common project managers to understand how designers think and work since not all project managers have learned design as education background. On the other hand, the concept may be useful for the designers to reflect on what they are doing and to understand how this can be improved by design management.	There are many complex projects beyond multi-architect ones. Further studies may prove that the research is to certain extent relevant beyond multi-architect collaboration, for example for multi-advisors collaboration in project Culemborg.
6 Herder, Albert, Architect	- The design progress is not the same for all architects; changing design decision by the clients. - The difficult communication between architectural design and building engineering and construction because the design coordination throughout the whole development process is fragmented.	Consistency of design decision making process between the design group leader (supervisor) and the client project leaders. Continuously changing design requirements along with the market uncertainty that affected the private clients and the changing configuration of the design team.	Collective and interactive designing characterise the design process in this project; the creative leadership by of the architectural supervisor. Collaborative design through creative workshops; the role of the architectural supervisor (Kees Rijnboutt) with more personal approach to stimulate and guide the teamwork.	It is true that design management is needed to deal with the social complexity due to the 'tension' between designers and clients as well as among the designers that 'compete' to build the 'best' building.	By re-describing and reinterpreting the current situation, the research provides a professional designer or manager with an insight into the complexity of collaborative design and hints at possible approaches to manage them.
7 Kras, Douwe Project manager	For complex projects, the first thing needed is a clear vision and statement of importance: who wants what and why. Design always faces problems with individual and collective goals.	Football coach principle: top football team must be coached by top and very respectable coach, so if the architects are 'stars / primadona', the management must also be 'star'.	The division of people, processes, and products are good to map the problems into certain point of attention and to learn how a problem is related to other problems and situations.	Regarding social-psychological aspects, the concept gives some clear insight into some important issues that may only be intuitively perceived by practitioners.	- The research is descriptive. It is not prescriptive or problem-solving. - The most interesting thing about the research is that from a 'new' viewpoint, it clarifies the situation we were facing and the approaches we were taking during the project.

8 Lousberg, Louis Project manager and researcher	The design competition of Ground Zero is an example of a very high-profile project that receives complication not merely from design, but mostly from political circumstances. Oosterdokseiland is somewhat comparable, but much less high-profile than Ground Zero. The problems are found in the difficult location and conflict of interests between the municipality and real-estate developer. There are also problems with the commitment and teamwork in the design team.	Kees Rijnbouts as an architectural supervisor has proven to be effective in solving social problems in the design team and guiding creative collaboration. Design management needs to adopt both 'hard' and 'soft' approaches. For the design development and engineering phase, the 'hard' approach is needed for accuracy and timeliness. For the conceptual architecture design phase, the 'soft' approach is needed as a manager must be diplomatic, tactful, and skilful in negotiation and communication. It can be said "Hard on the case, soft on the people".	- Through the process of team development, the "safe environment" must be created. The personality of the supervisor can give great influence on the team climate. With the good team climate, individual "macho-type" architects will be persuaded to be more open and cooperative. With the good team climate, people must not feel threatened by critics. - Collaborative design is socially complex in particular because of there are multiple stakeholders with different goals and decisions, and because the design actors are asked to engage in a more interactive design process that is not always well-coordinated.	- Experienced managers have practiced some of the creative way to manage collaborative design, although there are some conventional managerial reflexes that are contra productive to creativity. Design management should be positioned as a role, rather than as a formal function. As a role, the approach is personal-attached. Some people can help the design team through their ability to guide discussions and workshops. Some others, like Jo Coenen, may choose to steer collaborative design by directly involve in 'making drawing on the table' together with the architects. - Within the social frame, the concept presents ideas and examples of how to build mutual understanding with the clients and other design actors. Within the project frame, the concept discusses the relevance of design coordination procedure and necessary skills.	The research can have a potential impact by describing the situation and making the professionals realise / aware of different ways to handle the complexity. It is also useful for learning purposes for the professionals to reflect on themselves and on others to enable the personal competences they actually have. Thus, the results of the research is more relevant for personal development in contrast to "something tangible" that can immediately be used to solve a practical problem.
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9 Rijnboutt, Kees Architectural supervisor	The video of Ground Zero competition gives some good indications of teamwork phenomenon in the design team: someone takes a role as the informal leader of the group, some people are critical, there is fun and excitement while working, etc.	A social-psychological approach is of key important. If an architectural supervisor is to take the design leadership role in terms of architecture, he must be objective and involved completely with the team members. He must possess rich knowledge and experience of architecture design, large and complex projects, as well as how design actors think and work. He should be the one that understands the aspirations of both the clients and the design actors.	The description is comprehensive and relevant. It has to be understood in the full content and context of the projects like functional requirements, location complexity, etc. The characteristics and challenges of collaborative design have often been discussed by people, but have never been elaborated as in this research.	The description of cognitive, social, and project frames are useful for knowing that some people emphasise some aspects while overlook other aspects. By understanding this, design management can keep balance of all important factors for a successful collaborative design. The concept is also open for many different issues in each different project that cannot be contained in a strict procedure or strategy.	Many times, professionals take a successful approach according to their experienced and intuitive. The knowledge basis in architecture school is not always adequate. The research is interesting since it tries to find confirmation and knowledge basis from other disciplines.
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10 Schooten, Jeroen van Architect	- A prominent project within very complex circumstances due to the location and the involvement of a large number of parties. - Collaborative design was most effective only with certain architects with whom interpersonal trust was established. - Inconsistency of design decision-making by the client's project managers. - Lack of time in the design workshops to substantially discuss design ideas from different architects due to the involvement of too many parties in the workshops.	- Consistent project managers that take coherent decisions supported by all departments of the client organisations (e.g. marketing, realisation). - Effective collaboration between the project managers and the architectural supervisors / design coordinators that are capable to guide the design team both in terms of design issues as well as social/teamwork aspects.	The research clearly describes what it takes for collaborative design, e.g. a masterplan that should introduce an integrating design vision, yet flexible enough to accommodate innovative design solutions found during the design process; design workshops that should become an event in which everybody can discuss particular and total problems of the project.	- The concept is an open concept. It presents a logical thinking how to understand and tackle the problems without limiting other possibilities to manage collaborative design. Many principles in the concept can be confirmed in the practice, for instance regarding the social frame, Kees Rijnboudt's consistency and capability as an architectural supervisor in maintaining good 'social atmosphere' in the design team. - The concept for managing collaborative design can give an insight for everybody about what happens in the thinking (cognitive), communicating (social), and planning (project) activities in collaborative design. How knowledge of this can be turned into actions by the design actors is dependent to the experience and preferences of each professional as well as the changing project circumstances.	The good understanding by all design actors about the problems of collaborative design and how they could be dealt with may help to prevent the design process to become an unclear and messy one negatively affecting the moral of the design actors.
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11 Termote, Rob Project manager	Main management problems of Oosterdokseiland: MAB project leaders have too little experience and seniority; very high ambition has been set by the board of directors, then the (lack of experience) project leaders are assigned to realise it; and MAB project leaders often react too slow when there are discrepancies between the architects and the clients. All of these may have affected the moral of the architects since the architects are not immediately reassured of the solutions. This eventually raises the issues of trust between the architects and the client.	The supervisor should be given more authority to represent the client. If there is conflict between the architect and the client, the client must not be irritated and repressive. It must be creative to accept and deal with the 'primadona architects'. In reality, this has never happened. The repressive acts by the client actually press the potential of the top architects. Furthermore, technical instruments are not completely appropriate to solve management problems since instruments only work on concrete information although there are so many matters which cannot be directly seen or proven, therefore, management needs to gain the overview of the situation by also using the professional intuition and experience.	The key is trust, respect, understanding, sharing, and bringing people to each other through good contacts; combined with adequate technical knowledge needed in the specific work field. Since the design process is interactive, the management must also become much more interactive. At this moment, no one in the practice has ever been able to rigorously describe how this should appropriately be done.	The research gives the description needed by the professionals. Team climate and social culture are absolutely needed to make the team function effectively. The client / manager needs to be socially creative. The concept indicates that there must be a middle point balance. Using another analogy, it is like the figure of a sand clock. The creative aspiration from the architects (from the bottom side) must be responded by the creative attitude by the client (from the upper side). The balance point must remain in the middle.	The research is theoretical, yet it provides rigorous description and it is useful for awareness rising among the managers and designers about the essence of the problems in collaborative design and the ways that may be used to solve the problems or improve the current practice.
12 Timmeren, Arjan van Architect and researcher	The problems of collaboration can manifest in any multi-actor project. Due fragmented knowledge and field of expertise, management of collaborative design is needed.	Design management should adopt the principles of integral design, cross-functional management, interdisciplinary teamwork, and cross phases project approach.	The problems are socially and technically integrated. So tackling these, integral design management also means using knowledge from other management fields beyond construction management.	The research presents a wide range knowledge survey and some possibilities to transform this into design management.	The essence of collaboration the same in any complex project. Some needs more technical management, some more social, according to the content of the project and to the phase of progress.

13 Voskuilen, Ron Advisor	In such a design competition, there is a lot of design freedom. In a real construction project, the freedom is much less, and therefore, there are difficulties in dealing with what everybody wants and what is possible.	Exploring design ideas is rather to be assigned to architects. The manager can support collaborative design by providing a clear role division among all people involved. The managers are also the bridge between architects and other experts by acquiring information from and making decisions based on multidisciplinary considerations, like economy, legal, social, utility, safety, etc.	Some problems can indeed be approached and solved from social-psychological viewpoint. This perspective must be integrated with the systematic approach of project management, for examples, organisational procedures and guidelines are still needed.	- The concept presents important issues that exist in every complex project, but may not have received full attention and rigorous method to manage. As a concept, it is clear, but is still rather theoretical. - There is a doubt whether we can ever find someone capable of understanding architectural design and engineering, and at the same time possessing good human skills and management experience to carry out such a heavy task of managing collaborative design in such a complex project.	Social-psychological approach for managing collaborative design is absolutely needed. However, not every manager is capable of doing that. The research is most useful for managers that have affinities to design, management, and social leadership.
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Managing Collaborative Design

Brief curriculum vitae of the researcher

Rizal Sebastian (1976) obtained the degree Bachelor in Architecture with cum laude from Bandung Institute of Technology in Indonesia. He was granted a scholarship through TALIS programme to pursue master education at South Bank University London in the UK in conjunction with Hogeschool van Arnhem en Nijmegen in the Netherlands. He received the degree Master of Science in Construction Management with distinction.

Rizal has completed PhD research on architectural design management at Delft University of Technology in the Netherlands. As a researcher, he has written a number of articles which have been published in scientific and professional journals, and has been a speaker at international conferences. He has also participated in teaching and supervising graduate students, and has been invited as a guest lecturer at several universities.

Rizal has been practising architectural design, project management, research, and consultancy for eight years until now.

During his years of employment with ARCADIS, he was involved in high-rise office building and multifunctional urban projects. His research interest emerged when with multidisciplinary and international design teams in these projects.

At PRC Bouwcentrum, Rizal worked as a consultant in charge of national and international projects on building research, urban development, and housing policy. These projects were carried out for and in-collaboration-with municipalities, government ministries, and the European Commission.

Currently, Rizal is a senior researcher/consultant at TNO, the Netherlands organisation for applied scientific research. He is specialised in innovation in building processes, focusing on design and procurement strategies, project organisations, tendering, and contracting.

Rizal is married to Lina, and the father of Matthew Emmanuel.

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Managing Collaborative Design

Executive summary

Collaborative design has been emerging in building projects around the world. As a building project becomes more and more complex, a closer and more intensive collaboration between various design actors from different organisations is inevitable. Furthermore, if a large building project is aimed at presenting an architectural ensemble that consists of different 'design styles' by different architects, multiple architects from different design firms are assigned to work together in the design team. To achieve 'harmony in diversity', collaborative design in the conceptual architecture design phase is essential.

This research focuses on the conceptual architecture design phase, especially during the elaboration of the masterplan and the development of the preliminary building designs. In this phase, the architects usually hold the key role in the design process, in direct consultation with the clients, local authorities, and multidisciplinary specialists. The activities in the conceptual architecture design phase aim at understanding the requirements and inventing the design concepts. This phase is relatively short compared to the overall project course, but it is very important to lay down the principal design ideas and decisions for the whole project.

Research on managing collaborative design is timely and important. Many people in practice and research believe that the current practice of collaborative design can be improved. However, no one has an adequate insight into the complexity of collaborative design to be able to identify the core problems and the way forward. In the academic world, design management is considered a rather new knowledge field in architecture. The existing knowledge is fragmented and experimental. There is a lack of literature concerning how collaborative design in the conceptual architecture design phase is initiated and managed, and how the management approach affects design achievements.

The key question in this research is how to understand and manage collaborative design in the conceptual architecture design phase of a building project. This research is descriptive. It aims at presenting a description of the practice of collaborative design and a concept for managing collaborative design in this context. A description of the characteristics and difficulties of collaborative design and the challenges for design management will provide an insight into the practice of collaborative design. A concept for managing collaborative design will be useful by the professionals to reflect on their current practice and to improve the way of managing collaborative design.

The overall research methodology can be explained as follows. A part of the research is built up of exploratory case studies. Four recent projects in the Netherlands, in which multiple architects from different firms were involved, were selected and examined. The projects were De Resident in The Hague, Nieuw Stadshart in Almere, Oosterdokseiland and Mahler4 in Amsterdam. In these projects, multiple architects were asked to collaborate with each

other in designing different buildings that are interconnected within an integrated urban complex. A multi-architect building project serves as an ultimately relevant case of complex collaborative design that needs to be appropriately managed. Since, moreover, such project is at the highest level of significance and complexity, it may address various issues and difficulties related to collaborative design. In this sense, the analysis and conclusions of the research on such project are expected to serve as valuable lessons for other projects.

Another part of the research is built up of literature survey over recent studies on design management in architecture and relevant theories from other disciplines. Based on the empirical and theoretical analysis, a concept for managing collaborative design, which includes a model and several management principles, is presented. The research outcomes are evaluated using expert opinions and supported by the observation of the collaborative design in the case of design competition for Ground Zero / New World Trade Center in New York.

The first outcome of this research is a case-based description of the characteristics and difficulties of collaborative design in the conceptual architecture design phase and the challenges for design management.

From the exploratory case studies, this research identifies there characteristics with regards to collaborative design in a multi-architect building project, namely: the masterplan as a platform for collaborative design, the way the design team is composed and the informal design leadership, and the creative design workshop for collective designing.

The masterplan as a platform for collaborative design introduces an innovative –and somewhat provocative– design vision that unites all designers to create ‘new’ architecture in the urban context. The process to create the masterplan can become a real collective design. If in the masterplan it is given that several buildings designed by different architect are interconnected, these architects are required to collaborate with each other. The masterplan can also present certain common design elements, such as colour, materials, or open spaces that can reconcile different design ‘styles’ of different architects.

In many multi-architect building projects, the architectural design team consists of renowned international architects, which are expected to produce high design quality. In the conceptual architecture design phase, an architectural supervisor is usually assigned as a semi-formal leader of the design team to give inspiration and guidance in teamwork next to the main task of assuring the architectural and urban design harmony and quality. Dialogs and consultations between the architects and the architectural supervisor, among the architects themselves take place in attempt to coordinate the development or refinement of the masterplan and building designs.

A creative design workshop is important to facilitate the interactive and collective designing. A design workshop facilitates the attempts to comprehend the situation and the requirements and to invent the principal design solutions through collective creativity. A design workshop is a special meeting like a ‘pressure cooking’ sessions involving all principal design actors and decision makers, in which the partial and overall designs are presented, discussed, and decided. A design workshop is characterised by direct and informal dialogs, informal and inspiring design leadership, and direct decision-making mechanism.

From the exploratory case studies, this research also identifies the difficulties of collaborative design in a multi-architect building project. These difficulties are related to technical and social complexities. The technical complexity is caused by complex

requirements of an integrated multifunctional project. The social complexity is due to the involvement of a large number of stakeholders. These stakeholders often have conflicting goals. Besides, the decision-making processes involving these stakeholders often become complicated when there is only limited information to get the insight of the design process and there is uncertainty regarding the long-term consequences of the decisions. Particularly in the design team, there is another social complexity which is resulted from the need for closer and more intensive interactions between the design actors in collective designing.

Furthermore, from the exploratory case studies this research finds that managing collaborative design deals with three main aspects: the design process including the cognitive process of different design actors; the interaction between these individual design processes, in principle through social contacts and interpersonal communication; and the way a real building project is organised in its context. The biggest challenge to manage collaborative design is to deal with the human factor and social complexity in collective designing, particularly in order to stimulate and guide the interactions between the creative design processes of individual design actors in such a way that collective designing can take place. In the current practice, there are attempts to deal with this challenge, but many attempts are carried out based on practical experience without being really based on fundamental knowledge of managing creative teamwork. Social complexity in collaborative design may not be really new, but its importance has not been adequately addressed and dealt with by design management.

The study of recent literature of design management in architecture shows that there is still a lack of rigorous research on how to stimulate and guide creative teamwork between the design actors. The review of recent literature on design management in architecture in this research may be considered as one of the first attempts to categorise the available approaches according to their main focus, namely on the design actors, processes, or products.

Design management that mainly focuses on the design actors includes the systematic decision-making approach, which investigates ways to optimise the design decision-making process using mathematical calculations for optimising decisions; and the organisational-protocol approach, which concerns the internal and external management of a design office.

Design management that mainly focuses on the design processes includes the design-methodological approach, which sees design processes as interplay of several methods, and provides transparent and systematically structured encyclopaedia of scholarly methods; and the engineering-instrumental approach, which considers a design process as a rational problem solving mechanism employing systems thinking and includes methods, tools, and techniques to coordinate design tasks and information.

Design management that mainly focuses on the design products includes the value, performance, and quality measure approach, which stresses the creation of objects to meet aesthetic and functional expectations in use, as well as economical and technical requirements in production.

Much design management research focuses on the processes around designing, the outputs of the processes, and the organisations and systems that support designing; yet overlooks the creative activities by the design actors. The design actors are only addressed in formal, structured, and systematic ways, which may neglect the subjective judgement, creative thinking, and the interactions between those of different design actors in collective designing.

Having learned this, this research introduces a concept for managing collaborative design that addresses the cognitive and social processes of the design actors during the collaborative design process in a building project. This is the second outcome of this research.

The concept comprises a model describing that collaborative design is an interplay of cognitive, social and project frames, and several principles for managing collaborative design by designing these frames. The concept is called managing-by-designing.

The concept for managing collaborative design introduced in this research incorporates relevant theories from social-psychology that are relevant for managing the human factors in collaborative design. Social psychology is the branch of psychology that studies persons and their relationships with others and with groups and with society as a whole. It deals with the behaviour of groups and the influence of social factors on the individual. The selected theories include: management complexity, cognitive psychology of the architect's thinking, personal and organisational knowledge, group dynamics, and reflective practice.

Design management can learn to recognise the designers' cognitive processes in order to channel the cognitive patterns in collaborative design. It needs to pay attention both to the explicit knowledge which can be transferred to the design team through documents and protocols, as well as the tacit knowledge which can only be shared through social interaction and coaching. Concerning the group creativity, design management can employ the deliberate insight model in which the creativity in a group is seen as an insight shift. Insight shift is often triggered by the idea of the other group members towards the better understanding of the problem and solution. Design management can also learn from the theory of reflective practice. Designing is a reflective conversation when the designer shapes the situation in accordance to his initial appreciation of it, the situation 'talks back', and the designer responds to its 'back-talk'. In collaborative design, the design actors can also reflect on each other's thinking and working process in the so-called reflection-in-collaboration.

The concept for managing collaborative design introduced in this research is based on a perspective that design and management are two activities that have some similarities to a certain extent in their thinking and action, in the context of conceptual architecture design phase. Design and management in practice resemble each other as knowledge intensive human activities that work with and within uncertain situations, to deliberately initiate and devise creative processes for shaping more desirable reality. In this sense, managing collaborative design is not simply the steering of people, processes, and product development in a rigid problem-solving mechanism, but rather an iterative and interactive process to review the possibilities and refine the solutions in a both problem-finding and problem-solving approach.

In the concept for managing collaborative design introduced in this research, design management is seen as a participative role in designing, rather than a formal-directive management function. Design management becomes a catalyst that stimulates and guides the mutual interactions between individual creative processes. It acts more as a peer, rather than as a superior leader. It provides coaching and consultation to the architects, rather than giving instructions and commands.

In its direct-participative role, managing collaborative design deals with the cognitive, social, and project frames of the design actors in designing. The design actors working on a real

project are engaged in creation of design solutions to be constructed through unique cognitive process of idea generation, as well as in the social process in which group behaviour plays an important role to achieve the desired synergy effect. Since these frames do not pre-exist and cannot be standardised, design management creatively generates and customises them to apply in different situations and to meet the project content and the characteristics of the design actors and organisations. In other words, design management works by designing these frames; and therefore, the concept is called managing-by-designing.

The principles of managing collaborative design by designing the cognitive, social, and project frames are explained in this research using real examples from the case studies and supported by theoretical references that can be made practical in these examples. Managing collaborative design by designing the cognitive frame suggests that design management is to develop and configure heuristic devices to stimulate and facilitate the generation of creative ideas by individual and group. Managing collaborative design by designing the social frame means that the managers should create the environment that fosters positive group behaviour for collaborative design. Managing collaborative design by designing the project frame deals with the real goals, visions, constraints, resources, and outcomes of an architectural project on which the design actors are working.

These research outcomes are mainly descriptive. The outcomes of the empirical and theoretical research are the description of the practice and relevant theories. The concept for managing collaborative design is also descriptive to a large extent. None of these research outcomes is 'hard product' that can be quantitatively measured and tested. Therefore, to verify the research outcomes, expert opinions and a case study of collaborative design in the design competition for Ground Zero / New World Trade Centre in New York. A number of experienced practitioners, including architects, urban designers, architectural supervisors, and project managers, were selected and interviewed to obtain the expert opinions.

The result of the verification shows that the description of the characteristics and difficulties of collaborative design and the challenges for design management, which are based on the exploratory case studies using four multi-architect building projects in the Netherlands, also applies to the Ground Zero case. Furthermore, the expert opinions underline the plausibility of the concept for managing collaborative design, in terms that the concept is practically sensible and if applied it may bring a reasonable contribution to the attempt to manage collaborative design.

Although the research and its outcomes are meant to be descriptive, some parts of the research outcomes may seem implicitly normative. A number of experts consulted during the research indicated that the model describing the cognitive, social and project frame might apply more generally to different types of collaborative design; the principles of managing-by-designing might provide more than a description and some examples of known approaches to manage collaborative design, but to a certain extent also some recommendations on how to manage collaborative design; and the principles might serve as the basis to develop instruments and tools. This can be considered as a direction for the future research.

Samenvatting (Dutch summary)

Collaborative design komt steeds vaker voor in bouwprojecten over de hele wereld. Wanneer een bouwproject steeds complexer wordt, is een intensere en nauwere samenwerking tussen de verschillende ontwerpverantwoordelijken onvermijdelijk. Wanneer bovendien een groot bouwproject als doel een architecturaal ensemble, dat bestaat uit verschillende 'ontwerpstijlen' door verschillende architecten, heeft, krijgen meerdere architecten van verschillende ontwerp bureaus de opdracht om samen te werken in het ontwerpteam. Om "eenheid in verscheidenheid" te bereiken is *collaborative design* essentieel in de schets en voorlopig ontwerpfase.

Dit onderzoek concentreert zich op *collaborative design* in de schets en voorlopig ontwerpfase, vooral tijdens de verdere uitwerking van het masterplan en de ontwikkeling van de het voorlopig ontwerp van de gebouwen. In deze fase spelen de architecten meestal een sleutelrol in het ontwerpproces, in directe samenspraak met cliënten, lokale autoriteiten en multidisciplinaire specialisten. De activiteiten in de schets en voorlopig ontwerpfase hebben als doel om de eisen duidelijk te krijgen en om de ontwerpconcepten uit te vinden. Deze fase is relatief kort in vergelijking met de totale projectduur, maar is het van groot belang om de voornaamste ontwerpideeën en beslissingen uit een te zetten voor het hele project.

Onderzoek naar het management van *collaborative design* is nodig en noodzakelijk. Veel mensen die werkzaam zijn in de praktijk en in onderzoek, geloven dat de huidige praktijk van *collaborative design* kan worden verbeterd. Niemand heeft echter voldoende inzicht in de complexiteit van *collaborative design* om de kernproblemen en de in te slagen weg te kunnen identificeren. In de academische wereld wordt ontwerpmanagement beschouwd als een tamelijke nieuw vakgebied binnen architectuur. De bestaande kennis is gefragmenteerd en experimenteel. Er is een gebrek aan literatuur over hoe *collaborative design* in de schets en voorlopig ontwerpfase wordt voorgesteld en beheerd en hoe de management benadering invloed heeft op ontwerpprestaties.

De sleutelvraag in dit onderzoek is hoe *collaborative design* te begrijpen en beheren in de schets en voorlopig ontwerpfase van een bouwproject. Dit onderzoek is descriptief. Het heeft als doel om een beschrijving te geven van de huidige praktijk van *collaborative design* en een concept aan te dragen om in deze context *collaborative design* te beheren. Een beschrijving van de eigenschappen en problematiek van *collaborative design* en de uitdagingen voor ontwerpmanagement zullen inzicht brengen in de praktijk van *collaborative design*. Een concept voor het beheren van *collaborative design* zal nuttig zijn voor professionals om hun manier van beheren van *collaborative design* te verbeteren.

De gebruikte onderzoeksmethodologie kan als volgt worden uitgelegd. Een deel van het onderzoek is opgebouwd uit verkennende casestudies. Hiervoor zijn vier recente projecten in Nederland geselecteerd en onderzocht, waarbij meerdere architecten van verschillende ontwerp bureaus zijn betrokken. Deze projecten zijn: De Resident in Den Haag, Nieuw Stadshart in Almere, Oosterdokseiland en Mahler4 in Amsterdam. In deze projecten werden meerdere architecten gevraagd om met elkaar samen te werken in het ontwerpen van verschillende gebouwen die onderling verbonden waren binnen een geïntegreerd stedelijk complex. Een multi-architect project dient als een zeer relevante casus van complex *collaborative design* dat op de juiste manier moet worden beheerd. Aangezien zo een project bovendien op het hoogste niveau van significantie en complexiteit staat, kunnen er verscheidene kwesties en problematiek van *collaborative design* aan bod komen. In die zin

wordt er verwacht dat uit de analyse en conclusies van het onderzoek van zo een project waardevolle lessen kunnen getrokken worden voor toekomstige projecten.

Een ander deel van het onderzoek is gebaseerd op een literatuurstudie van recente studies over ontwerpmanagement in architectuur en relevante theorieën uit andere disciplines. Gebaseerd op de empirische en theoretische analyse, wordt er een concept voor het management van *collaborative design* gepresenteerd dat een model en verscheidene management principes inhoudt. De onderzoeksresultaten zijn geëvalueerd aan de hand van expertmeningen en een casestudie van *collaborative design* in de ontwerpwedstrijd voor Ground Zero / New World Trade Center in New York.

Het eerste resultaat van dit onderzoek is een beschrijving van de eigenschappen en problematiek van *collaborative design* in de skets- en voorlopig ontwerpfase en de uitdagingen voor ontwerpmanagement. Deze beschrijving is gebaseerd op casestudies.

Vanuit de verkennende casestudies identificeert dit onderzoek eigenschappen met betrekking tot *collaborative design* in een multi-architect project, namelijk: het masterplan als een platform voor *collaborative design*, de manier waarop het ontwerpteam wordt samengesteld en het informele ontwerpleiderschap, en de creatieve ontwerpworkshop voor het collectief ontwerpen.

Het masterplan als een platform voor *collaborative design* introduceert een innovatieve en enigszins uitdagende ontwerpvisie die alle ontwerpers samenbrengt om 'nieuwe' architectuur te creëren in de stedelijke context. Het proces om het masterplan te creëren kan een echt collectief ontwerp worden. Als in het masterplan is aangegeven dat verscheidene gebouwen, die ontworpen worden door verschillende architecten, onderling verbonden zijn, dan moeten deze architecten nauw met elkaar samenwerken. Het masterplan kan ook bepaalde gemeenschappelijke ontwerpelementen voorstellen zoals kleur, materiaal of open ruimtes die verschillende ontwerpstijlen van verschillende architecten kunnen verzoenen.

In veel bouwprojecten waar meerdere architecten bij betrokken zijn, bestaat het ontwerpteam uit befaamde internationale architecten, waarvan wordt verwacht dat ze hoge ontwerp kwaliteit leveren. In de skets- en voorlopig ontwerpfase wordt er meestal een architectuur supervisor aangesteld die fungeert als semiformele leider van het ontwerpteam die, naast de belangrijkste taak, het verzekeren van de harmonie en de kwaliteit van het architectonisch en stedelijke ontwerp, het teamwerk begeleidt en inspireert. Dialoog en overleg tussen de architecten en de architectuur supervisor en eveneens tussen de architecten onderling heeft plaats gevonden in een poging om de ontwikkeling en verbetering van het masterplan en het voorlopig ontwerp van de gebouwen te coördineren.

Een creatieve ontwerpworkshop is belangrijk om het interactieve en gemeenschappelijke ontwerpen te faciliteren. Een ontwerpworkshop geeft ruimte aan de pogingen om de situatie en de voorwaarden te begrijpen en om de voornaamste ontwerpvoorwaarden uit te vinden door collectieve creativiteit. Een ontwerpworkshop is een speciale bijeenkomst, zoals 'pressure cooking' sessies waarbij alle voornaamste ontwerpverantwoordelijken en beleidsvormers betrokken zijn, waarin over de gedeeltelijke en volledige ontwerpen wordt gepresenteerd, gediscussieerd en beslist. Een ontwerpworkshop wordt gekenmerkt door directe en informele dialogen, informeel en inspirerend ontwerpleiderschap en een direct beleidsmechanisme.

Vanuit de verkennende casestudies identificeert dit onderzoek ook de problematiek van *collaborative design* in een veelvoudig bouwproject. Deze problematiek is gerelateerd aan technische en sociale complexiteiten. De technische complexiteit wordt veroorzaakt door de complexe voorwaarden van een geïntegreerd multifunctioneel project. De sociale complexiteit is te wijten aan het grote aantal stakeholders. Deze stakeholders hebben vaak conflicterende doeleinden. Bovendien worden de besluitvormingsprocessen waarbij de stakeholders betrokken zijn vaak gecompliceerd wanneer er maar beperkte informatie beschikbaar is om inzicht te krijgen in het ontwerpproces en er onduidelijkheid is met betrekking tot de langetermijneffecten van de besluiten. Daarnaast is er in het ontwerpteam een andere sociale complexiteit die het resultaat is van de nood aan nauwere en meer intensieve interacties tussen de ontwerpverantwoordelijken tijdens het collectief ontwerpen.

Bovendien komt er uit de verkennende casestudies naar voren dat het management van *collaborative design* betrokken is op drie centrale aspecten: het ontwerpproces inclusief het cognitieve proces van verschillende ontwerpverantwoordelijken; de interactie tussen deze individuele ontwerpprocessen, in principe door sociale contacten en interpersoonlijke communicatie; en de manier waarop een echt bouwproject wordt georganiseerd in zijn context. De grootste uitdaging bij het management van *collaborative design* is om rekening te houden met de menselijke factor en de sociale complexiteit in het collectief ontwerpen, vooral om de interacties tussen de creatieve ontwerpprocessen van individuele ontwerpers op zo een manier te stimuleren en te begeleiden dat het collectief ontwerpen kan plaatsvinden. In de huidige praktijk zijn er pogingen ondernomen om deze uitdaging aan te gaan, maar veel van deze pogingen gebeuren op basis van praktische ervaring zonder echt gestoeld te zijn op fundamentele kennis van het beheren van creatief teamwerk. Sociale complexiteit in *collaborative design* is misschien niet helemaal nieuw, maar het belang ervan is tot nu toe nog niet adequaat behandeld en aangepakt door ontwerpmanagement.

De studie van recente literatuur met betrekking tot ontwerpmanagement in architectuur laat zien dat er nog altijd een gebrek is aan serieus onderzoek naar het creatief stimuleren en begeleiden van teamwerk tussen de ontwerpverantwoordelijken. Het overzicht van recente literatuur over ontwerpmanagement in architectuur in dit onderzoek kan beschouwd worden als een van de eerste pogingen om de beschikbare benaderingen te categoriseren volgens hun centrale aandachtspunt, namelijk op de ontwerpverantwoordelijken, processen of producten.

Ontwerpmanagement dat zich voornamelijk focust op de ontwerpverantwoordelijken omvat de systematische besluitvormingsbenadering, die manieren onderzoekt om het besluitvormingsproces in ontwerpen te optimaliseren gebruikmakende van wiskundige berekeningen; en de organisatieprotocol benadering die zich bezig houdt met de interne en externe management van een ontwerp bureau.

Ontwerpmanagement dat zich voornamelijk focust op de ontwerpprocessen omvat de ontwerpmethodologische benadering, die ontwerpprocessen ziet als een samenspel van verschillende methoden en voorziet transparante en systematisch gestructureerde encyclopedieën van geleerde methoden. Zij omvat ook de technisch instrumentele benadering die een ontwerpproces beschouwt als een rationeel probleemoplossend mechanisme dat tegelijkertijd systeemdenken gebruikt en methoden, instrumenten en technieken omwerptaken en informatie te coördineren.

Ontwerpmanagement dat zich voornamelijk focust op de ontwerpproducten omvat de waarde-, prestatie- en kwaliteitsmethode benadering, legt de nadruk op de creatie van

gebouwen met als doel tegemoet te komen aan zowel de esthetische en functionele verwachtingen die gangbaar zijn als de economische en technische vereisten bij productie.

Veel ontwerpmanagement onderzoek focust zich op de processen met betrekking tot ontwerpen, de output van de processen en de organisaties en systemen die het ontwerpen ondersteunen maar heeft geen oog voor de creatieve activiteiten door de ontwerpverantwoordelijken. De ontwerpverantwoordelijken worden alleen aangesproken op formele, gestructureerde en systematische wijze, die de subjectieve beoordeling, het creatief denken en de interacties tussen de verschillende ontwerpverantwoordelijken in collectief ontwerpen verwaarlozen.

Voortbouwend op dit gegeven, introduceert dit onderzoek een concept voor het management van *collaborative design* dat betrokken is op de cognitieve en sociale processen van de ontwerpverantwoordelijken tijdens het *collaborative design* proces in een bouwproject. Dit is het tweede resultaat van dit onderzoek.

Het concept omvat een model dat *collaborative design* beschrijft als een samenspel van cognitieve, sociale en project kaders en een aantal principes voor het management van *collaborative design* door het ontwerpen van deze kaders. Het concept wordt "managing by designing" genoemd.

Het concept voor het management van *collaborative design* in dit onderzoek maakt gebruik van theorieën uit de sociale psychologie die relevant zijn voor het beheeren van menselijke factoren in *collaborative design*. Sociale psychologie is de strekking van psychologie die mensen en hun relaties met anderen, met groepen en met de samenleving in haar geheel bestudeert. Zij handelt over het gedrag van groepen en de invloed van sociale factoren op het individu. De geselecteerde theorieën zijn onder meer: management complexiteit, cognitieve psychologie van het denken van de architect, persoonlijke en organisatorische kennis, groepsdynamiek en reflectieve praktijk.

Ontwerpmanagement kan leren om de cognitieve processen van de ontwerpverantwoordelijken te herkennen, om zo de cognitieve patronen in *collaborative design* in goede banen te leiden. Het moet zowel aandacht besteden aan de expliciete kennis die overgebracht kan worden aan het ontwerpteam met documenten en bijhorend protocol, als aan de impliciete kennis die alleen maar kan worden gedeeld via sociale interactie en coachen. Met betrekking tot de groepscreativiteit, kan ontwerpmanagement het bewuste inzichtmodel inzetten, waarin creativiteit in een groep wordt gezien als een inzichtverschuiving. Een inzichtverschuiving wordt vaak uitgelokt door het idee of de zoektocht van de andere groepsleden naar een beter begrip van het probleem en de oplossing. Ontwerpmanagement kan ook lessen trekken uit de theorie van *reflective practice*. Het ontwerpen is een reflectieve dialoog wanneer de ontwerper vormgeeft aan de situatie in overeenstemming met zijn initiële beoordeling, de situatie 'praat terug', en de ontwerper reageert dit 'antwoord'. In *collaborative design* kunnen de ontwerpverantwoordelijken in de zogenaamde "reflectie in samenwerking" ook reflecteren over elkaar's ideeën en werkprocessen.

Het concept voor het management van *collaborative design* dat in dit onderzoek geïntroduceerd wordt, is gebaseerd op een perspectief dat aangeeft dat ontwerp en management –in de context van de skets- en voorlopig ontwerpfase– twee activiteiten zijn die tot op een bepaald punt een aantal gelijkenissen vertonen in hun denken en doen. Als kennisintensieve menselijke activiteiten die werken met en in onzekere situaties, om opzettelijk creatieve processen te in gang te zetten en uit te denken om een meer

aantrekkelijke realiteit vorm te geven, lijken design en management op elkaar. In deze zin is het management van *collaborative design* niet simpelweg het sturen van mensen, processen en productontwikkeling in een rigide probleemoplossend mechanisme, maar eerder een iteratief en interactief proces om de mogelijkheden te doorlopen en om de oplossingen te verbeteren in zowel een probleemvindende en probleemoplossende benadering.

In het concept dat in dit onderzoek geïntroduceerd wordt voor het management van *collaborative design*, wordt ontwerpmanagement eerder beschouwd als een participatieve rol in het ontwerpen, dan als een formeel hiërarchische management functie. Ontwerpmanagement is een katalysator die de wederzijdse interacties tussen individuele creatieve processen stimuleert en begeleidt. Het gedraagt zich meer als een adviseur dan als een leidinggevende. Het voorziet eerder in het coachen en adviseren van de architecten, dan in het geven van instructies en bevelen.

In zijn rechtstreeks participatieve rol is het management van *collaborative design* betrokken op de cognitieve, sociale en project kaders van ontwerpverantwoordelijken in het ontwerpen. De ontwerpverantwoordelijken die werken aan een echt project, zijn betrokken bij de creatie van ontwerp oplossingen die moeten worden opgebouwd door zowel de individuele cognitieve processen van ideeëngeneratie, als in het sociale proces waarin groepsgedrag een belangrijke rol speelt om het gewilde synergetische effect te bereiken. Aangezien deze kaders niet vooraf gegeven zijn en niet kunnen worden gestandaardiseerd, creëert ontwerpmanagement deze en past ze aan zodat ze in verschillende situaties kunnen toegepast worden en zij tegemoetkomen aan de inhoud van het project en de karakteristieken van de ontwerpverantwoordelijken. Met andere woorden, ontwerpmanagement werkt door het ontwerpen van kaders, en daarom wordt het concept "managing by designing" genoemd.

De principes voor het management van *collaborative design* door het ontwerpen van de cognitieve, sociale en projectkaders worden in dit onderzoek uitgelegd aan de hand van echte voorbeelden uit de casestudies en ondersteund met theoretische verwijzingen die in deze voorbeelden concreet kunnen worden toegepast. Het management van *collaborative design* door het ontwerpen van het cognitieve kader suggereert dat ontwerpmanagement heuristische instrumenten moet ontwikkelen en configureren om de generatie van creatieve ideeën door het individu en de groep te stimuleren en te vergemakkelijken. Het management van *collaborative design* door het ontwerpen van een sociaal kader betekent dat managers een omgeving moeten creëren die positief groepsgedrag voor *collaborative design* bevordert. Het management van *collaborative design* door het ontwerpen van het projectkader betreft de echte doeleinden, visies, beperkingen, bronnen en uitkomsten van een project waaraan de ontwerpverantwoordelijken werken.

Deze onderzoeksresultaten zijn voornamelijk descriptief. De uitkomsten van het empirische en theoretische onderzoek zijn de beschrijving van de praktijk en relevante theorieën. Het concept voor het management van *collaborative design* is ook voor het grootste deel descriptief. Geen enkel van deze onderzoeksresultaten is een 'hard product' dat kwantitatief kan worden gemeten en getest. Om de onderzoeksresultaten te verifiëren zijn de experts om hun meningen gevraagd, en is er een casestudie gebruikt van een *collaborative design* in de ontwerpwedstrijd voor Ground Zero / New World Trade Center in New York. Een aantal experts, waaronder architecten, stedelijke ontwerpers, architectuur supervisors en projectmanagers zijn geselecteerd en geïnterviewd om expertmeningen te verkrijgen.

Het resultaat van de verificatie toont aan dat de beschrijving van de eigenschappen en problematiek van *collaborative design* en de uitdagingen voor ontwerpmanagement, die

gebaseerd zijn op de explorerende casestudies gebruikmakende van vier veelvoudige bouwprojecten in Nederland, ook toegepast kan worden in het geval van Ground Zero. Bovendien onderstrepen de expertmeningen de plausibiliteit van het concept van het management van *collaborative design*, in de zin dat het concept praktisch zinnig is en dat het, indien toegepast, best een redelijke bijdrage kan leveren bij een poging om *collaborative design* te beheren.

Ook al zijn dit onderzoek en zijn resultaten beschrijvend bedoeld, kunnen sommige delen van de onderzoeksresultaten impliciet normatief lijken te zijn. Een aantal deskundigen die geconsulteerd zijn tijdens het onderzoek hebben aangegeven dat het model dat het cognitieve, sociale en project kader beschrijft misschien meer algemeen toegepast kan worden op verschillende types van *collaborative design*. Zij concludeerden dat de principes van het "managing by designing" misschien meer kunnen opleveren dan een beschrijving, maar bijvoorbeeld ook aanbevelingen om *collaborative design* te beheren. De principes kunnen misschien dienen als basis om instrumenten te ontwikkelen. Deze opmerkingen kunnen worden beschouwd als een mogelijke richting voor toekomstig onderzoek.