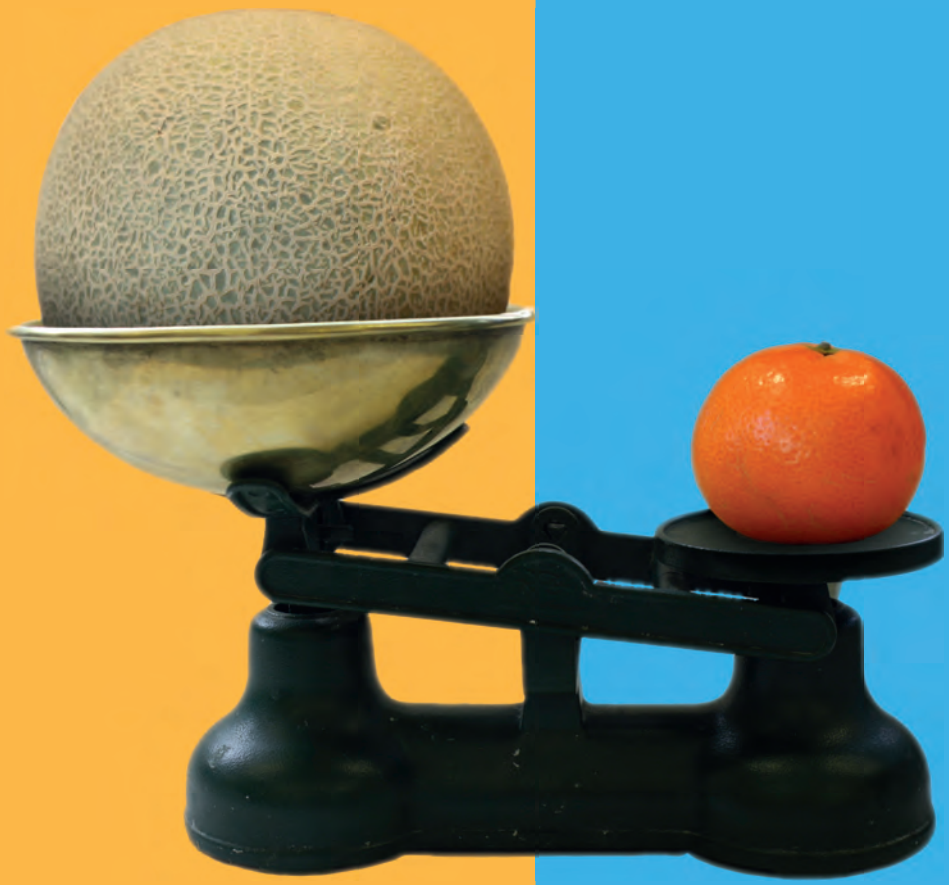
CURE FOR THE FUTURE

The real options approach in corporate real estate management

An exploratory study in Dutch healthcare



Maartje van Reedt Dortland

PROPOSITIONS

1. Exercising real options is more economically feasible in integrated project coalitions than in traditional project coalitions. (this thesis)
2. Sensemaking of flexibility by means of real options requires a change in reasoning. (this thesis)
3. A health organization board's involvement in the development of a real-estate strategy is a critical factor in the performance of this strategy. (a.o. this thesis)
4. When applying the decision support tool in a workshop, the experience of the participants with uncertainties and the consequences thereof both necessitates flexibility, and influences the degree of sensemaking. (this thesis)
5. The term *real options* is more abstract than what it is intended to be as practical method.
6. The wisdom of Erasmus 'prevention is better than cure' is not yet commonplace in the Dutch healthcare system and politics.
7. The proposition "not everything that counts can be counted, and not everything that can be counted counts" is often overlooked in (social)- scientific research. (proposition of W. B. Cameron or A. Einstein)
8. Creativity is hard work because knowledge acquisition is necessary for the production of creative ideas. It can be reached either by a fast and flexible 'out of the box' approach or by a slow and persistent 'in the box' approach. Therefore it is both comforting and discomforting for new PhD candidates that perseverance is a necessary characteristic that leads to a creative dissertation. (from the research of Bernard Nijstad)
9. Like endurance sports obtaining a doctorate is a balancing act: too fast of a start or starting the final sprint too early can lead to a suboptimal result or to not reaching the finish.
10. The last part of writing a thesis is remarkably similar to a rowing race. With the coxswain shouting: "Only ten more strokes till the finish! Come on, you can do it!! 10...9...8...7.....oh no...wait...sorry, twenty more to go! 20...19...18...17..."

Propositions belonging to the thesis 'Cure for the future: the real options approach in real estate management. An exploratory study in Dutch healthcare'

Maartje van Reedt Dortland

Friday, 14 June 2013

STELLINGEN

1. Gebruiken van reële opties is economisch meer haalbaar in geïntegreerde bouworganisatievormen dan in de traditionele bouworganisatievorm. (dit proefschrift)

2. *Sensemaking* van flexibiliteit door middel van reële opties noodzaakt een verandering in de manier van redeneren. (dit proefschrift)

3. De betrokkenheid van de Raad van Bestuur van een zorgorganisatie bij de ontwikkeling van vastgoedstrategie is een kritische factor voor het resultaat van deze strategie. (dit proefschrift)

4. Wanneer de beslissingsondersteunende tool wordt toegepast in een workshop, heeft de ervaring van de deelnemers met onzekerheden en bijkomende gevolgen, invloed op de mate van sensemaking over flexibiliteitsmaatregelen

5. De term reële opties is abstracter dan wat het beoogt te zijn als praktische methode.

6. De wijsheid van Erasmus "voorkomen is beter dan genezen" is nog geen gemeengoed in het Nederlandse zorgsysteem en de politiek.

7. De stelling 'niet alles dat telt kan geteld worden, en niet alles dat geteld kan worden telt' raakt vaak ondergesneeuwd in (sociaal-) wetenschappelijk onderzoek. (stelling van W. B. Cameron of A. Einstein)

8. Creativiteit betekent hard werken want kennis vergaren is een vereiste voor het produceren voor creatieve ideeën, en kan worden bereikt door een snelle en flexibele 'out of the box' manier maar ook op een langzame en volhardende 'in the box' manier. Het is daarom zowel geruststellend als verontrustend voor beginnende promovendi dat doorzettingsvermogen een noodzakelijke eigenschap is die leidt tot een creatief proefschrift. (n.a.v. onderzoek Bernard Nijstad)

9. Net als duursporten is promoveren een kwestie van doseren: een te harde start of een te vroeg ingezette eindsprint kan leiden tot een suboptimaal resultaat of het niet halen van de finish.

10. Het laatste deel van het schrijven van een proefschrift heeft opvallende overeenkomsten met een roeiwedstrijd. Met de stuur roepend: "Nog maar tien halen tot de finish! Kom op, jullie kunnen het!! 10...9...8...7.....o nee...wacht...sorry, nog twintig erbij! 20...19...18...17..."

Stellingen bij het proefschrift 'Kuur voor de toekomst: de reële optie benadering in Corporate Real Estate Management. Een verkennende studie in de Nederlandse gezondheidszorg'.

Maartje van Reedt Dortland

Vrijdag, 14 juni 2013

CURE FOR THE FUTURE:

THE REAL OPTIONS APPROACH IN CORPORATE REAL ESTATE MANAGEMENT

AN EXPLORATORY STUDY IN DUTCH HEALTHCARE

Promotion Committee

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CURE FOR THE FUTURE:

THE REAL OPTIONS APPROACH IN CORPORATE REAL ESTATE MANAGEMENT

AN EXPLORATORY STUDY IN DUTCH HEALTHCARE

PROEFSCHRIFT

ter verkrijging van
de graad van doctor aan de Universiteit Twente,
op gezag de rector magnificus,
prof. dr. H. Binksma,
volgens besluit van het College voor Promoties
in het openbaar te verdedigen
op vrijdag 14 juni om 12.45 uur

door

Maartje Wija Jacquelien van Reedt Dortland
geboren op 13 november 1979
te Utrecht

Dit proefschrift is goedgekeurd door:

Prof. Dr. G.P.M.R. Dewulf	Promotor
Dr. J.T. Voordijk	Assistent-promotor

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PREFACE

It is the evening before the *Batavierenrace* 2013. I think by myself that the onset to my PhD trajectory took place exactly five years ago. I could not imagine where running could lead to: after prof. Geert Dewulf finished the final and exhausting leg for our Civil Engineering team, he informed me whether I had something to do after my research at the Water department. It so happened that he was looking for a PhD candidate. I imagined that doing a PhD would be a nice challenge which it certainly became. I have become acquainted with the worlds of healthcare and construction and with new disciplines like management, real estate and architecture. I owe finishing this research to various people who I would like to mention.

First of all the core team around conducting this PhD research. Thanks Geert for persuading me to do this research. Your optimism and trust were stimulating, and the summarizing analyses of my research were sometimes illuminating. Mirjam and Anneloes, thanks for starting the research up and showing me the way in doing a PhD. Hans, with your middle name 'cut and paste' one would think that everybody learns the art of writing papers already in kindergarten. I admire how you can make a running story by shifting some text. The final phase of the trajectory shifted into second gear thanks to your fast comments on all the writings. I am thankful to the promotion committee who was willing to read, provide useful comments and discuss this dissertation with me during the defence.

I would like to thank the steering group existing of Theo Staats, Stephan Herbold and Gerjan Heuver, who made the research more relevant to practice with their expert input. Ans Vossebeld and Rina Buitenhek were vital for their guidance in the archive and the provision of data. In addition, I much appreciate that the project team of Carint Reggeland/Twinta allowed me to attend their meetings. Further I would like to thank the respondents of the various questionnaires and especially the participants to the workshops of the Röpcke-Zweers Ziekenhuis, the Van der Hoeven Kliniek and Lentis. And without Ruud Rusken, Annette Ruijsink and Hilda, these workshops would not have taken place. Giles Stacey provided valuable suggestions and corrections for improving the English text.

I am grateful to all the other colleagues at the department Construction Management and Engineering. Joop, thank you for introducing me to the topic of real options, and all other

colleagues who inspired over the years. Yolanda, Jacqueline and Cecile, many thanks for your support! The same counts for Martijn and his ICT crew. I enjoyed to have many fellow PhD´s around in our *kantoortuin*. Thanks Tijs, Maarten, Jochem and Hendrik, who were always in for organising nice events with the PhD's, and Hendrik for joining me almost each year to some British city for the yearly HaCIRIC conference. The lunchwalks and Batavierenraces were good distractions, as well as the nice ladies dinners which we initiated when we thought our number at the department was big enough. Julia and Marlijn, I enjoyed your company in the library in Utrecht; the change of environment and nice coffee were inspiring for writing. Besides, thanks for reading and commenting on the final chapters, together with Julieta and Mieke. Carissa, thanks for checking some English text at the last moment. Famke, it was nice to have a working buddy also in Zwolle the last months, thanks for joining me in 'the office'.

Many other friends supported me in various ways during the last 4,5 years for which I would like to thank them. Row- and running buddies in Zwolle, it is nice to play outside with you after a day behind the computer. All running and rowing friends from Wageningen, old house- and study mates, I enjoyed and still do, the dinners, weekends, festivals and sportive events with you. Vera and Janwillem, now we are almost finished, I'm looking forward to think of other bets to have reasons for nice get-togethers with bestuur Liebrand & co. Marjon, Eva, Adimka and Martine, it is great that we have been friends for such a long time.

Julieta en Marlijn, who are already experienced, it feels good to have you standing by my side during my defence.

Arianne en Susanne, I'm lucky to have you as sisters, but above all, as good friends as well. The team is complete with Gijs, Jan and Isa, and more to come. Also the Ruijten family is always a warm home to visit.

Pap en mam, bedankt dat jullie zulke geweldige ouders zijn. Dit proefschrift is ook aan jullie te danken vanwege jullie onvoorwaardelijke steun en ondersteuning bij alles wat ik onderneem. En door het bijbrengen van doorzettingsvermogen, waarvan jullie zelf ook veel blijken te bezitten. Jullie zijn in ieder geval mijn grote rolmodellen.

Last but not least, Johan, we are like *Buurman en Buurman,* but also close to Romeo and Juliet. With you, the future can only be positive.

Zwolle, April 2013

1

INTRODUCTION

Many countries have, for many years, been reviewing their healthcare systems with the aim of providing better healthcare against lower costs. For decades, real estate has been an important political instrument in controlling and reducing healthcare costs. The healthcare system has been changing, and healthcare real estate management has been confronted with various novel challenges. Addressing the new challenges facing real estate management in healthcare is the main motivation behind this PhD thesis. In this chapter, I present the background and structure of the various aspects that make up this thesis. Some key changes in healthcare policy are discussed in Section 1.1. Section 1.2 provides a description of Corporate Real Estate Management (CREM), the management field that is the focus of this study, and especially the role of flexibility and the potential benefits of the real options theory within CREM. The problem statement, objective and major research question are presented in Sections 1.3 and 1.4. The research perspective and its design are posited in Sections 1.5 and 1.6, after which I conclude this chapter by outlining the thesis.

1.1 The increasing relevance of corporate real estate management in healthcare

Worldwide, healthcare costs have been rising rapidly due to various trends, such as the ageing of the population, higher levels of chronic disease and disability, improved medical technologies and treatments plus rising public expectations. These rising costs of healthcare have become a growing concern (Saltman & Figueras, 1997) and real estate management, as a profession, has become increasingly important in healthcare organizations as a way to reduce these costs. The changing healthcare policies further increase the relevance of corporate real estate management. These changing policies are described in Section 1.1.1, where marketization in healthcare in Western countries is discussed, and in Section 1.1.2 where a more elaborate description of the changes in healthcare in the Netherlands is described which forms the context of this thesis.

1.1.1 The changing healthcare regime

The balance between public or private involvement in the provision of healthcare has shifted back and forth over the ages. The earliest attempt at public involvement in healthcare security dates from the era of ancient Egypt in the *Code of Hammurabi* (1792-50 BC). This included a system based on a fee-for-service payment that reflected the nature of the service and the patient's ability to pay. Further, laws with regard to provided services were established to address issues such as unsatisfactory therapeutic results (Chapman, 1984, in; Preker, Liu, Velenyi, & Baris, 2007). Until the 19th century, healthcare provision was only really available for the nobility, and healthcare as it was for the poor was provided by religious institutions. In the 19th century, governments of many countries adopted a central role in health policy.

In the late nineteenth century, health insurances started to be implemented in most developed countries. There was little financial risks since medical knowledge was poor and one could do little to help sick people. However, this changed after WWII and costs were rising in the 1960s and 1970s. The initial response in most countries in the 1970s and 1980s was to reduce costs (Cutler, 2002). In the 1980s and 1990s the willingness of governments to experiment with market approaches in social sectors increased, because it appeared that although public involvement was necessary, the welfare state approach was failing to provide efficient and equitable healthcare (Saltman & Figueras, 1997).

In these decades, the United States, many Anglo-Saxon countries and continental Europe adopted the New Public Management (NPM) ideology which largely mirrored the managerial approach seen in the private sector. NPM was a reaction to the 'classic public administration paradigm' which had been dominant for more than a century, but was increasingly questioned because of financial crises and slow bureaucratic processes (Pollitt, van Thiel, & Homburg, 2007). The core of NPM is the belief that "markets can produce public goods as long as the providers can be held accountable for their performance in terms of quality, accessibility and equity" (van Essen & Pennings, 2009). Concepts such as efficiency, results orientation, customer orientation and value for money became important aspects of reform (Hood, 1994). However, NPM is a broad ideology which is interpreted differently by various governments, and the reforms accordingly vary as a result of differences in political, social and management cultures.

Differences in healthcare reform among countries is illustrated by Wendt (2009) who identified 27 different typologies of healthcare systems in Europe. However, a common denominator of these reforms is that governments are currently redefining when and to what extent to intervene, and when to leave it to market forces. Moreover, the definition of marketization is diffuse (Paulus, Van Raak, Van Der Made, & Mur-Veeman, 2003). Illustrations of marketization or market competition based reforms are seen in the growth of the profit-making market, the rise of private entrants in hospital care and the introduction of new models for hospital funding that seek to better relate payment to performance (Maarse & Normand, 2009). NPM elements deal "on the one hand with changing accountability relationships between actors and on the other hand with the introduction of incentives for behaviour in order to improve the performance of the health care sector, in particular promoting cost containment and quality" (van Essen & Pennings, 2009, p.64).

Currently, a 'post–NPM' era can be recognized in which the focus has shifted from private sector accounting and control methods to greater self-regulation while emphasizing accountability, visibility and comparability (Dent, 2005; Järvinen, 2009). The introduction of Diagnosis Related Groups (DRGs) is an outcome of this. DRGs set costs for each type of diagnosis, based on cross-sectional studies as well as other factors that affect the costs such as capital investments. DRG-type systems are becoming more common in healthcare systems across Europe. Increasingly, also, hospital care is being delivered in many European countries by a mix of public and private profit and non-profit-making hospitals, with a wide variety of hospital governance systems (Degeling & Erskine, 2009; Maarse & Normand, 2009).

1.1.2 The changing healthcare policy in the Netherlands

Governmental regulation of health started in the Netherlands in 1851. The first aim of governmental policy was to give all citizens access to healthcare, by implementing health insurance, and this gained a statutory basis during WWII. After WWII, healthcare further developed but costs had to be controlled because of the poor economic situation. An important means to manage costs after WWII became the control of costs related to the construction and maintenance of buildings. Between 1945 and 2008, the supply side of healthcare was regulated by the government. Although healthcare was paid for by private initiative, through insurance provided by private institutions, it was regulated by the

government. When it came to capital investments such as new buildings, medical installations etc., the government would have to approve the investment after the plans were checked by a governmental institute, the *College Bouw Zorgvoorzieningen.* The permit provided a guarantee for banks to provide loans. Capital costs were remunerated for by insurance companies and a governmental contribution, based on re-calculation. Therefore, the health organizations did not bear any risk.

These regulations changed drastically with a new law implemented in 2008 to further stimulate marketization. The new law implied a shift from supply-side control to demand-side control by consumers and health insurance companies. This managed competition required everyone to purchase private, somewhat standardized, individual health insurance, with subsidies to make coverage affordable (Van de Ven & Schut, 2009). The responsibility for regulating capacity has been transferred to the health insurance companies who purchase healthcare delivery, in sufficient amounts and quality, from suppliers who compete on price. While budgeting had already been a means to reduce costs since the 1980s, the introduction of so-called Diagnosis Treatment Groups (DBCs - the Dutch acronym – a form of DRG) and later an improved version, the DOT (DBC On its way to Transparency), are gradually replacing this approach. DBCs have been introduced in the cure sector, and, in the care sector, a comparable system exists based on so-called 'care intensity packages' (ZZPs). The new system stimulates greater production. Since a critical determinant of competition is the organization of capital investments, a system has been introduced to make health organizations responsible for their own financing. Part of the DBC is allocated to covering capital investments. A similar system has been set up for the care sector, covering elderly, mental, youth and forensic care, through a so-called Normative Housing Component (NHC) that amounts to a budget for the housing component of healthcare delivery.

Some of the aims of decentralisation are to make health organizations more aware of the costs of facilities and to attract more private funding. However, the main aim is to increase efficiency by considering the costs over the whole lifecycle of a building. Besides cost saving measures such as reducing energy use, an ability to adapt to changing healthcare provision is needed. Although capital investments in the health sector account for only 2-6% of total healthcare expenditure in Europe, incorrect decisions in planning the layout of a building can lead to much higher costs over its lifetime – as much as the

equivalent of the original capital costs being required every two years (Rechel, Wright, Edwards, Dowdeswell, & McKee, 2009).

The trends discussed above can be expected to continue and change at an ever faster rate in the 21st century, and a key challenge is therefore to enable adaptation to the changing needs and expectations (Black & Gruen, 2005). This urgency is however not reflected in many countries since centralized models still dominate hospital planning in most European countries, and governments are directly involved in funding capital investments (Bjørberg & Verweij, 2009; Maarse & Normand, 2009). Given the major impacts of rapid but unpredictable developments, sooner or later the need for adaptation will become apparent to most countries and health organizations.

In order to raise awareness of the consequences of rapid change, and to guide health organizations in making important decisions in such an environment, insights into the various aspects of flexibility are needed.

1.2 Approaches in dealing with real estate and uncertainties

1.2.1 Flexibility as a means to deal with uncertainty

Real estate managers in healthcare face many challenges as a result of the abovementioned developments. Several advisory and research reports have been published aiming to increase efficiency in both the management and the technical aspects of real estate. Here, flexibility is an important factor since it creates opportunities to adapt to uncertainties in easier and more cost-effective ways.

Making real estate marketable is such a measure, but this can be problematic in the health sector because of its often specialized function (Raad voor de Volksgezondheid en Zorg, 2006). Technical innovations often occur within the lifespan of a building, and most buildings appear inflexible when it comes to adapting to these changes (Rechel, et al., 2009). A possible solution is to distinguish between more, and less, specialized areas in a hospital which differ in their speed of likely obsolescence. Strategically locating certain functions can make it easier to replace obsolete parts. Other types of flexibility include organizational flexibility, which allows the optimization of the use of the spaces in the building by clustering facilities; financial flexibility which is generated by increasing

revenues and decreasing costs by using short-term lease contracts, creating value in real estate, better using land and tuning investment decisions regarding buildings, ICT and medical inventory (College Bouw Ziekenhuisvoorzieningen, 2005). One can also create flexibility in the process management of a project, where choosing an appropriate type of project delivery is an important aspect (College Bouw Zorginstellingen, 2006). Integrated project delivery systems, or project coalitions as they are called in this thesis, are relatively new in the Netherlands and are promoted as a means to share risks between client and contractor and to incorporate flexibility within a long-term agreement with contractors (Blanken, 2008; Ministry of Finance, 2012). However, there is as yet little experience with these project coalitions in the Netherlands, and opinions are divided.

1.2.2 Corporate Real Estate Management

Making real estate more future proof by enabling adaptation requires a more strategic approach to real estate management. The profession known as Corporate Real Estate Management (CREM) has emerged during the 20th century with this very aim. CREM is defined as the management of a corporation's real estate portfolio by aligning the portfolio and services with the needs of the users, the organizational strategy, the financial goals and budget of the controller and the abilities of facility management. Since various stakeholders play a role, CREM addresses several management fields. In addition, the real estate manager has to consider the range of values that are attached to real estate in its varying roles when it represents the interests in the organization. Since healthcare real estate managers are often involved in developing real estate and project coalitions as a means to create flexibility, the initiative, design and construction phases of real estate development in healthcare CREM are included.

1.2.3 The Real Options Theory

A promising approach to creating proactive flexible strategies to deal with uncertainties is the real options theory. A real option is the right, but not an obligation, to exercise an option that creates flexibility (Myers, 1977). Its perceived advantages are that it provides a more structured way of approaching flexibility measures and that the typology of real options provides a categorization of flexibility. Further, it is a proactive approach towards uncertainty as opposed to most strategies which are reactive. In addition, an innovative characteristic of real options is that their value increases when uncertainty increases. As a consequence, uncertainty obtains a more positive connotation. The most commonly

mentioned types of real options are the options to grow, to abandon, to scale, to switch function, to defer and to accelerate (Amram & Kulatilaka, 1999). Although the concept has been widely accepted among academics, the approach is less used in practice than one might expect (Triantis, 2005). Using real options in decision-making is often referred to in terms such as real options valuation, real options analysis and real options reasoning. Real options valuation often implies the quantitative valuation, in financial terms, of a certain real option. The value of a real option increases when uncertainty increases and, therefore, the value depends on the volatility of that uncertainty. However, since many of the uncertainties that affect health organizations are difficult to quantify, the focus in this research is more on the use of real options *as a way of thinking* about flexibility. Real estate managers should think in a more structured way about the consequences of a real estate strategy that includes or excludes real options. Real options reasoning reflects a certain logic but, as Pierre Bourdieu states, practice has a logic which is not that of logic. Consequently, I want to determine whether this practical real options reasoning exists in CREM and, if so, what it entails and whether real options reasoning, as a method, improves real estate managers' thinking on flexibility measures.

1.3 Problem statement

Flexibility is needed to adapt to the challenges facing today's healthcare organization (McKee & Healy, 2002). However, flexibility is a broad term and, further, one needs to carefully determine the extent that flexibility will be applied since it does not come without a cost and is consequently a waste of money and effort if it is not used. Real estate managers in healthcare are increasingly challenged with new developments such as the substantial revision of the regime for financing capital investments in the Netherlands. These developments demand a more professional approach towards real estate management, and this involves greater insight into how uncertainties might evolve and what this would mean for the organization and its real estate. Boosting practical knowledge on how to mitigate uncertainties through flexible real estate strategies is necessary to improve healthcare systems in general.

Another topic addressed in this problem statement is that the real options approach is much addressed in the academic world, but practical application lags behind its potential use. Authors have argued that practitioners have insufficiently developed competences in

terms of real options thinking (Lander & Pinches, 1998). Besides, real options reasoning does not occur in a structured way, which hampers the dissemination of useful practical knowledge (Ford, Lander, & Voyer, 2002). More specifically, there is little understanding of how a real option approach could be implemented in healthcare decision-making.

1.4 Objective and research questions

The objective of this research is to develop a method to enhance sensemaking among real estate managers and other decision-makers in health organizations on the uncertainties they face and the accompanying flexible real estate strategies. In this research, I use the real options approach as a way of thinking about flexibility. One aspect of this objective is to investigate whether the real options concept connects with the perceptions and associations of real estate practitioners. A first step therefore will be to investigate which flexibility measures real estate managers adopt and how they deal with uncertainties, and to see if real options can be found in practice even if they are not recognized as such. This would increase the probability of the real options approach proving acceptable. Reflecting these objectives, the main research question is therefore:

- **How can real options be used in decision-making regarding strategic real estate management in healthcare?**

To address this research question, the following sub-questions are answered in the subsequent chapters:

- What is the current body of knowledge on the use of real options in Corporate Real Estate Management practice? (Chapter 2)
- What types of project coalitions are chosen for the development, construction and operation of real estate in both the cure and the care sectors? (Chapter 3)
- What is the rationale behind the type of project coalition chosen? (Chapter 3)
- What types of flexibility are considered within separated and integrated project coalitions, and to what extent are they actually exercised within these project coalitions? (Chapter 3)
- What categories and types of real options can be recognized in healthcare real estate management and in different types of project coalitions? (Chapter 3 and 4)
- What conditions determine whether real options can be exercised? (Chapter 4)

- How can scenario planning and real options reasoning be incorporated in a tool that stimulates CREM practitioners to think about flexible real estate strategies? (Chapter 5)
- Does scenario thinking and real options enhance the collaborative sensemaking of a health organization's multiple stakeholders in dealing with future changes and developing a flexible real estate strategy to adapt to these changes? (Chapter 6)

1.5 Research perspective

As a researcher, one needs to take a stance on how one will approach the subject of the research. Both ontology and epistemology have consequences for the theoretical perspectives that are used to investigate the phenomenon. Ontology concerns with how the researcher perceives the structure of reality, the study of 'what is'. Epistemology questions what knowledge of reality is and how we can obtain it. Therefore it has implications for the methods used to investigate reality. Both ontological issues and epistemological issues are intertwined (Crotty, 1998). The various philosophical perspectives were categorized within paradigms by Kuhn (1970), who later defined a paradigm as "what members of a scientific community, and they alone, share" (Kuhn, 1977). A paradigm influences which research strategies, i.e. methodologies, are adopted. Methods, in turn, are the procedures and rules for collecting and analysing data. The relationships between epistemology, theoretical perspectives or paradigms, methodologies and methods are hierarchical in that epistemology determines which methodologies are used but not the other way around (Crotty, 1998).

Many centuries before the introduction of paradigms, Aristotle recognized three types of knowledge: *episteme, phronesis* and *techne.* A parallel between these knowledge types and the paradigms of *objectivism, constructivism* and *pragmatism* can be recognized. Objectivism and constructivism form the two extreme epistemologies, the first incorporating the often mentioned positivistic paradigm.

Episteme is universal knowledge that is context independent and produced by the framework of *objectivism.* This paradigm implies that objects have a meaning -a meaningful reality which is independent of any act of consciousness- such as a tree which has the meaning of tree already in it. Objectivism is the dominant epistemology in the

natural sciences since the objects being studied cannot themselves reflect on the findings. According to objectivism, the ontology, i.e. the form of the reality and the idea of what it is that we can know, is a single apprehensible reality (Guba & Lincoln, 1994). Reality is time and context free, and often has the form of cause-effect laws. Here, the researcher is considered to be objective. However, in sociological research the objects of study are subjects that do interact with the researcher and reflect on the findings and, in this way, knowledge is created. In result, the meaning of reality is context dependent and never the same. Therefore, in sociological research, constructivism is more dominant. The ontology of constructivism implies that the meaning of realities can be grasped in the form of multiple, intangible mental constructions, socially and experimentally based, and local and specific in nature. Constructions are not true in an absolute sense, but are informed and/or sophisticated (Guba & Lincoln, 1994). In contrast to objectivism, constructivism holds that subjects create meaning of objects. *Phronetic* knowledge is produced here since it is context dependent and concerned with the values of the subjects involved.

Objectivism and constructivism are often respectively associated with quantitative and qualitative methodologies (Tashakkori & Teddlie, 2010). Another paradigm, that of pragmatism, claims that both methodologies can be used to investigate certain phenomena. The research question should guide the methodologies chosen. The two methodologies can be complementary since a quantitative methodology creates breadth while a qualitative methodology creates depth (Flyvbjerg, 2001). The design science paradigm (Romme, 2003; van Aken, 2004) is derived from the pragmatic paradigm and seeks to develop so-called mode 2 knowledge: scientific knowledge applicable in practice and developed in cooperation with practice. As such, it produces *techne* knowledge. *Techne* knowledge is practical and often referred to as craft or art. Just as with *episteme* knowledge, *techne* knowledge can be verified or falsified, but this time only in relation to the purpose of the practice of action. Therefore, it is both context dependent and pragmatic: rather than by logical reasoning, practical thinking is derived through trial and error (Patas, Milicevic, & Goeken, 2011). According to Aristotle, a well-functioning society has all three knowledge types. I agree with his viewpoint, and use all the knowledge types in this research.

The real option theory is a mathematical theory that reflects *episteme* knowledge. It is recognised as knowledge that is applicable in practice but apparently it has not yet developed sufficiently into reliable *techne* knowledge since it not yet used to any large

extent (Block, 2007). However, at least in some areas of application, real option theory is being used extensively, for example in the extraction of natural resources such as fossil fuels. Designing, constructing and maintaining real estate are activities which are described by a *techne* type of knowledge since there are procedures available. *Episteme* knowledge also plays a role in CREM in the form of physical laws that prescribe why a building does not collapse. However, in Corporate Real Estate Management, the values of various stakeholders also play a role and, therefore, *phronetic* knowledge is needed to analyse the effects of certain *techne* types of knowledge. In *phronetic* research, the following three value-rational questions are applicable (Flyvbjerg 2001, p. 60):

- Where are we going?
- Is this desirable?
- What should be done?

These are the questions that health organizations are also asking themselves. In this research a method is developed which can support them in addressing and answering these questions.

1.6 Research design

In order to answer the research question, the research is divided into several phases with their own research questions. In this section, the various research phases are described and the methods I have chosen to answer the research questions. The motivation and the various methods are described in more detail in each chapter as they are applied.

Phase 1 – Chapter 2: Towards phronetic knowledge on the use of real options in Corporate Real Estate Management

In this phase, the following research question will be answered: What is the current body of knowledge on the use of real options in Corporate Real Estate Management practice?

The real options theory and its role in real estate management and project management are elaborated on, in both engineering projects and health, by means of a literature review. Aristotle's *episteme, techne and phronesis* knowledge systems are used to make an inventory of which types of knowledge have been generated in these areas. Attention is

focused on the literature that addresses flexible real estate strategies in CREM, scenario planning, real options and sensemaking (Weick, 1995).

Phase 2 – Chapter 3: Project coalitions in healthcare construction projects and the application of real options: an exploratory survey

This phase seeks answers to the following research questions: What types of project coalitions are chosen for the development, construction and operation of real estate in both cure and care sectors? What is the rationale behind the type of project coalition chosen? What types of flexibility are considered within separated and integrated project coalitions, and to what extent are they actually exercised within these project coalitions? What categories and types of real options can be recognized in healthcare real estate management and in different types of project coalitions?

In this phase, more general data is obtained on the use of flexibility and the applicability of real options in general, and explore the current status of real estate management in healthcare. In this way, the research problem can be further refined and the remainder of the research become more focussed. To create breadth in the research data, a survey is employed (Flyvbjerg, 2001) to assess what types of project coalitions are chosen in the development, construction and operation of real estate in both cure and care sectors, and the rationale behind these choices.

Phase 3 – Chapter 4: Real option thinking in project coalitions in Dutch health care: two case studies of construction projects.

The research questions addressed in this phase are: What categories and types of real options can be recognized in healthcare real estate management and in different types of project coalition? What conditions determine whether real options can be exercised?

Here, since one aim of the research is to investigate practice in real estate management in the care sector, and in particular the use of real options reasoning, conduct two in-depth case studies are conducted, one in a hospital and one in an elderly care organization. The focus is on the categories and types of real options that can be recognized in healthcare real estate management and in various types of project coalition. Aristotle saw knowledge of 'particular circumstances' as a main ingredient of *phronesis* or practical knowledge. Through the case studies, the conditions and considerations that guide the reasoning

behind creating real options are investigated, and the conditions that enable the creation and exercising of real options.

Phase 4 – Chapter 5: Towards a decision-support tool for real estate management in the health sector using real options and scenario planning

This phase deals with the question: How can scenario planning and real options reasoning be incorporated in a tool that stimulates CREM practitioners to think in terms of flexible real estate strategies?

The aim in phase 4 of the research is to develop a tool that supports decision-making on adopting flexible real estate strategies to adapt to future uncertainties, and thus to create a *techne* type of knowledge. The design framework of Hevner *et al.* (2004) is used to develop the tool. This approach is, according to the design science paradigm, a design that focusses on solution-oriented technological rules (Romme, 2003; van Aken, 2005). Various methods are used to provide input for the tool. For example, concrete examples of real options derived from the case studies in research phase 3 are inputs. Scenario planning (van Notten, Rotmans, van Asselt, & Rothman, 2003) is used to complement real options thinking in order to stimulate practitioners to think about future uncertainties. Further, the Delphi method is used to create an inventory of developments that would have a high impact on health organizations but have a low probability. These developments serve as inputs for scenario development. The tool gains scientific rigour by being tested in a workshop setting in a hospital. The research phase concludes with design propositions for further improving the tool.

Phase 5 – Chapter 6: Sensemaking of real estate management using real options and scenario planning

The final question, addressed in this phase, is: Does scenario thinking and real options enhance the collaborative sensemaking of a health organization's multiple stakeholders in dealing with future changes and developing a flexible real estate strategy to adapt to these changes?

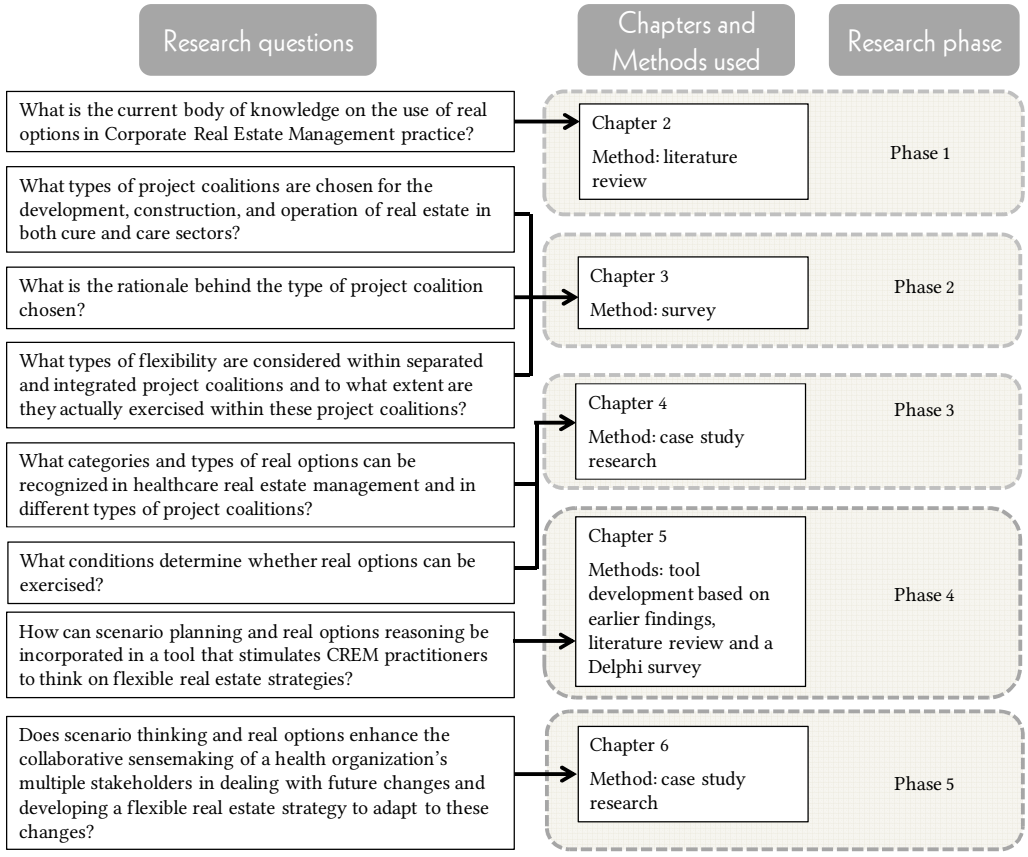
The last phase of the research entails a final evaluation of the real options approach as used in the context of real estate management in healthcare. The aim is to develop *phronetic* knowledge by answering the above research question. The tool developed in

phase 4 is evaluated by means of judgement in specific contexts. The contexts employed are workshops in three different organizations, each representing a different healthcare sector: a hospital, a forensic clinic, and a mental and elderly care organization. Here, an action research approach is used since the research aims to bring about change and its relationship with the researched is one of collaboration (Almekinders, Beukema, & Tromp, 2009).

1.7 Outline

The following chapters cover the various research phases described above. Some chapters have been published as papers in, or submitted to, scientific journals, which is noted where relevant. Chapter 2 provides a literature review on the use of real options in relevant areas of research. Chapter 3 presents the results of an exploratory survey among Dutch healthcare organizations on the use of real options in various types of project coalitions. This subject is further refined and investigated in two in-depth case studies which are presented in Chapter 4. Some of the results are then used as input to a decision-support tool, whose layout and testing are described in Chapter 5. The testing of the tool in three healthcare organizations and its evaluation is further elaborated in Chapter 6. Its role in enhancing sensemaking of flexible real estate strategies involving real options is discussed in Chapter 6. The thesis concludes with a discussion of the research and answers to the main and sub- research questions, presented as an overall conclusion to the main themes. Propositions that could serve as starting points for further research are also suggested. Table 1 shows the outline of the thesis.

Table 1. Outline of the thesis



2

TOWARDS *PHRONETIC*[1] KNOWLEDGE ON THE USE OF REAL OPTIONS IN CORPORATE REAL ESTATE MANAGEMENT

Abstract

Healthcare organizations face many uncertainties. One of the most important of these is the increase in healthcare costs over time and the measures that will be imposed on health organizations to mitigate this trend. Corporate Real Estate Management is the profession that manages real estate aimed at optimally facilitating the primary process in healthcare. As a result, flexibility is needed in matching supply with both current and future demands. Shared understanding and sensemaking should take place among real estate managers so that they are able to identify the various needs of the organization and to be able to act upon related changes by developing flexible real estate strategies. An important strategic decision in real estate management is the type of project coalition since this has far-reaching consequences for flexibility. When developing real estate strategies, a shared understanding is needed among the various organizational interests in order to be able to align possibly conflicting interests related to real estate. In particular, sensemaking of the organizational strategy, of which the real estate strategy is a part, should take place. An important factor in this is an awareness of future developments and uncertainties which might influence the organization. A promising approach to classifying and evaluating flexibility is the real options approach since this is a proactive approach to uncertainty management. Although the real options concept is often valued as a rational decision making model, we propose using the concept for natural decision making and sensemaking. Creating *phronetic* knowledge through case studies would allow us to understand why and how real options are used, or could be used in the future, and heuristics could be developed. In this way, real estate management should become more resilient to changes, which will lead to a more efficient and effective healthcare system.

[1] *Phronesis* is the Greek word for wisdom or intelligence. It is one of the knowledge systems thought of by Aristotle, besides *episteme* and *techne*. It is often translated as 'practical wisdom' (Flyvbjerg, 2001).

2.1 Introduction

2.1.1 Corporate Real Estate Management and developments in healthcare

Since the 1980s, marketization has been an important approach by national governments to controlling healthcare expenditures. In the Netherlands, marketization received a fresh impulse with the introduction of DBCs (a variant on diagnosis related groups) in the cure sector and 'care intensity packages' in the care sector. As a consequence, health organizations are remunerated for each treatment they provide. This remuneration not only covers the medical costs but also capital investments such as real estate. As a result, health organizations now have to rely on delivering sufficient care to finance their organization. In theory, this should increase efficiency and effectiveness in the healthcare system in general and in real estate management in particular (Bellers, 2008; Raad voor de Volksgezondheid en Zorg, 2006). The Corporate Real Estate Management (CREM) profession should manage real estate in such a way that it optimally facilitates the primary process. Besides the policy change just outlined, many uncertainties influence the demands on health organizations worldwide: demographic changes, patterns of disease, opportunities for medical intervention with new knowledge and technology, financing of real estate, governmental regulations plus public and political expectations (Barlow, Bayer, & Curry, 2005; McKee & Healy, 2002).

One way to deal with future uncertainties in real estate is flexibility since this enables adaptation to changing circumstances. Insights are needed into how flexibility can be incorporated into the real estate strategy of healthcare organizations. A promising approach suggested for providing these insights is the real options theory (Gehner, 2008; Olsson, 2004; Vlek & Kuijpers, 2005). Real options, as a way of thinking, can help real estate managers recognise that uncertainty is not inherently negative, and can even provide value. A real option is defined as a right, not an obligation, to exercise an option; and the idea derives from financial options (Black & Scholes, 1973). Myers (1977) applied options to *real* investments, i.e. tangible assets: so-called *real* options (Amram & Kulatilaka, 1999; Bowman & Hurry, 1993; Dixit & Pindyck, 1994; R.G. McGrath & MacMillan, 2000; Trigeorgis, 1996). Real options provide value through the ability to be flexible, and this value increases as uncertainty increases.

The involvement of various stakeholders in the real estate development process results in changes in both the design and exploitation phases. Strategic decisions at the front-end of

a project influence the flexibility that is later available. The degree of flexibility will depend on a number of strategic decisions, including the choice made for a certain type of project coalition. This choice is one of the factors that determine which real options will become available.

CREM can be observed from two perspectives: from that of the owner-user and from the real estate developer. The first uses CREM to support the goals of the organization which is housed within real estate, while the latter is only interested in the financial returns on the real estate. Most of the literature on real options looks from an investor perspective and, hence, is only limitedly applicable to owner-users, and more specifically to the corporate real estate managers, in health organizations. Most of this literature addresses the valuation of real options in a quantitative way in the sense that this is calculated based on general assumptions and a generic applicability. This approach is recognised by Flyvbjerg (2001) as an *episteme* type of knowledge. The application of real options to a particular context to calculate its value is *techne* knowledge, i.e. a certain technology or prescription to perform an action. We are interested in how real options thinking would work in the specific contexts of various situations seen in healthcare real estate management. In addition we are interested in how real estate managers in healthcare value the implications of using real options in their daily practices, and on the various interests in real estate management. This type of knowledge which is concerned with practical applicability, is called *phronetic* knowledge. We address the various types of knowledge more deeply in the next section.

2.1.2 Knowledge systems

Flyvbjerg (2001) defined various categories to distinguish types of knowledge systems that are derived from the philosophers such as Socrates, Aristotle, Nietzsche and Foucault. He derived a multilateral perspective to position natural science and social science by utilising three non-exclusive knowledge concepts: *episteme, techne* and p*hronesis,* which he characterises as follows:

- *Episteme* knowledge "corresponds to the modern scientific ideal as expressed in natural science" (Flyvbjerg 2001, p. 56). It is universal knowledge achieved by analytical rationality. It is universal, invariable and context-independent. Based on general analytical rationality, the original concept is known today through the terms 'epistemology' and 'epistemic'.

- *Techne* knowledge corresponds with 'craft' and 'art' and is applied, with a certain goal in mind, according to a pragmatic instrumental rationality. It is pragmatic, variable, context-dependent and oriented towards production. This practical instrumental rationality is governed by a conscious goal. The original concept appears today in terms such as 'technique', 'technical' and 'technology'.
- *Phronesis,* or *phronetic* knowledge, is practical wisdom on how to behave in particular circumstances that can never be a general truth. The focus is on ethics and deliberating about values with reference to praxis. This knowledge is pragmatic, variable, context-dependent, oriented towards action and based on practical value-rationality. The original concept has no analogous contemporary term. It is concerned with the analysis of values – 'things that are good or bad for man'- as a point of departure for action. This knowledge concept is most closely related to praxis and focusses on what is variable, and what cannot be encapsulated by universal rules, in specific cases.

According to Flyvbjerg the role of social science is different from the natural sciences in contributing to science: the power of social science is to provide a rich analysis of the values and power that play an important role in social and economic developments of societies. It is not useful to approach social science from the perspective of *episteme*, copying the natural sciences, since Flyvbjerg concludes that there is no universal scientific theory. Research in natural sciences and social sciences each demand a different orientation and phrasing of research questions and are therefore different activities.

In this chapter, a literature review is provided that uses Flyvbjerg's (2001) three knowledge systems of e*pisteme, techne and phronesis* to identify what types of knowledge have been considered regarding the subjects of CREM, project management in construction and real options. Here, we categorise the literature on CREM and real options according to these knowledge systems in order to see how the literature views issues that are important in healthcare CREM and assess its applicability.

We first elaborate on current issues in CREM. Second, we elaborate on a promising concept, the real options theory, for dealing with flexibility. Then we provide the literature overview based on the three knowledge systems, of real options applications in CREM, and in related fields that are relevant for CREM and healthcare, which we

categorise based on the three knowledge systems. Finally, we draw conclusions and directions in which this thesis will proceed.

2.2 Corporate Real Estate Management

Corporate real estate has developed since large corporations started to appear at the beginning of the 20th century and has increasingly become seen as a strategic asset (Krumm, 2001; Roulac, 2001). With the increasing recognition of the importance of real estate, the discipline of Corporate Real Estate Management (CREM) emerged. It is defined by Dewulf et al. (2002, p.32) as:

"The management of a corporation's real estate portfolio by aligning the portfolio and services to the needs of the core business (processes), in order to obtain maximum added value for the businesses and to contribute optimally to the overall performance of the corporation."

In this section, we elaborate on current issues in CREM and first discuss different perspectives on CREM and the development of real estate strategies. Following this, we provide an overview of the literature on flexibility in CREM and in construction in general. Finally, we discuss the role of project coalitions in real estate.

2.2.1 Perspectives on CREM

According to De Jonge et al. (2008) CREM can be observed from various perspectives: 1) functions of real estate, 2) development stages of real estate management, 3) various sources of 'added value' of real estate and 4) stakeholders. In this section, we elaborate on these perspectives.

First, there are various *functions* of buildings that can be distinguished, such as facilitating activities, protecting people against rain, cold, wind and violent actions, expressing special meaning, corporate identity and cultural values, and adding economic value (van Der Voordt & Wegen, 2005 in: de Jonge, et al., 2008, p.11).

Second, the various *stages* in corporate real estate development discussed by De Jonge et al. (2008, based on Joroff et al., 1993) are related to the level of abstraction in decision making, starting from the operational level and progressing towards the strategic level.

Each stage represents a different role and a corresponding task for corporate real estate management: task managers – technical; controllers – analytical; dealmakers – problem solving; entrepreneurs – business planning; and business strategists – strategic. For the purposes of this study we need to take into account the entire construction lifecycle: from design through to management of the real estate.

Third, real estate creates a range of *added values* for an organization. De Vries (2007) couples these added values with the objectives of real estate: productivity, profitability and distinctiveness, see Table 2. These objectives are also related to the various interests held in CREM: productivity to users, profitability to controllers and operational management, and distinctiveness to organizational management. Van der Zwart and Van der Voordt (2012) link the added value of real estate to the various interests held in hospitals. Based on interviews, they concluded that satisfying patients and personnel, stimulating innovation and improving the organizational culture are the most important values in hospitals.

Table 2. Added values and objectives in real estate (De Vries, 2007)

	Productivity	**Profitability**	**Distinctiveness**
Increasing productivity			V
Supporting image			V
Enhancing flexibility		V	
Improving culture			V
Stimulating innovation	V		
Increasing satisfaction	V		
Enhancing synergy	V		
Reducing costs		V	
Controlling risks		V	
Expanding funding possibilities		V	

Fourth, four main *stakeholder* groupings are recognised in CREM, as shown in Figure 1. Stakeholders can be distinguished from a strategic vs. operational perspective and from an organization vs. real estate perspective. The first group, *policymakers,* are those stakeholders that represent the organizational strategy and perceive real estate from a business perspective. When policymakers are both the users and the owners of a building, their organizational vision determines the CREM. *Controllers* are another subcategory of

stakeholders and these also act on a strategic level but have a real estate perspective: they view the financial aspects of real estate in relation to the overall financial position of the organization. They balance the spending of resources. *Users* act on the operational level and have a business perspective. Facility management translates their needs into real estate facilities. The *technical managers* which are often part of facility management, are the fourth group of stakeholders and represent the technical interests.

In the CREM literature, the focus is mostly on the operational phase of the building: how to meet the current and future demands of users who are already settled within the building. This perspective is probably more applicable to buildings such as offices since these are often already built before the users decide to rent. However, in healthcare, the buildings are rarely built for unknown users. Health organizations are semi-public organizations that have to serve societal interests and therefore they can be more restricted/controlled by governmental interventions than can private corporations. However, the Dutch government is gradually implementing marketization in the healthcare sector and, as a result, more responsibilities and risks are being transferred to health organizations. This development increases interest in achieving efficient CREM of healthcare assets.

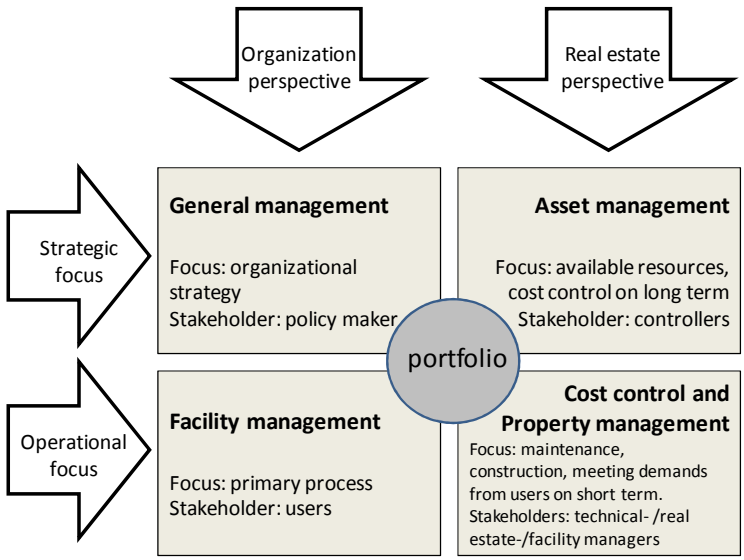


Figure 1 *CREM perspectives, focus and stakeholders. (Den Heijer, 2011, edited; G. Dewulf, Krumm, & De Jonge, 2000)*

2.2.2 Flexibility in real estate strategies

The task of Corporate Real Estate Management is to match current and future demands and supplies (de Jonge, et al., 2008), and this implies the need to develop strategies that describe how one deals with future uncertainties. Flexibility is a means to proactively create measures that enable one to adapt to unforeseen changes as a result of uncertainty. In this section, we will describe the different definitions of and perspectives on flexibility found in the literature.

In the real estate literature, flexibility is seen as an important aspect. From a survey among real estate and construction companies, Israelsson and Hansson (2009) extracted an overview of factors that affect flexibility in buildings which are both 'hard' and 'soft'. The first 'hard' factor is material standards. It is assumed that standardisation increases flexibility. Production plays a large role since building materials are prefabricated and thus should be right from the outset. Otherwise problems with flexibility will occur in the future. The first 'soft' factor they refer to is planning for future changes and the service life of the building since this should provide increased flexibility. Financial aspects are important here: investment costs will be higher if one invests in flexibility, but can pay back as soon as the first renovation. The most important 'soft' factor is the awareness of users, property-owners and builders as to the fact that the building has flexible capacities; otherwise these will not be used. The most important hard factor, on third place, is 'installations' since the size of installations hampers flexibility. These factors are important in our research when considering whether real options are applicable. A striking conclusion by Israelsson and Hansson (2009) is that the two soft factors awareness and finance are more important than the hard factors in affecting flexibility; the users still determine whether the build-in flexibility is being used. The authors also identified the roles that various stakeholders play in generating opportunities for flexibility. In our research, it is valuable to consider combinations of decision-makers and factors that influence flexibility.

Several other studies have addressed technical and architectural measures that create flexibility. Gann and Barlow (1996) describe technical measures that can be taken to convert buildings to fulfil other functions, and discuss relevant policy issues. Slaughter (2001) develops a systematic approach to examine the nature of changes that can be expected to occur in built facilities and analyses specific design strategies that can significantly increase a building's flexibility. Changes in a building can address its

functions, the capacity of its systems and the flow of the environment and people within and around the facility. Olsson's (2006) study on flexibility in project management provides a useful framework (summarised in Figure 2) for studying flexibility.

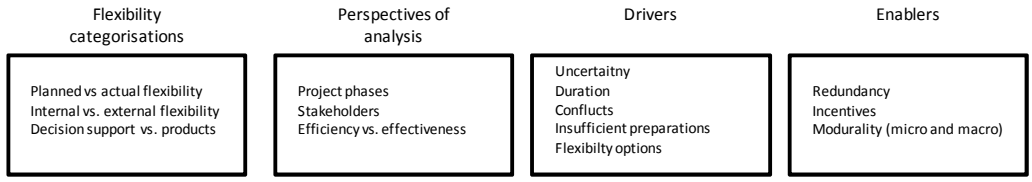


Figure 2 *Olsson's (2006) framework for analysing flexibility*

First, flexibility categorisations are made based on planned vs. actual flexibility, internal vs. external flexibility and decision process vs. products. The planned flexibility prior to a project can be different to the actual flexibility. External flexibility refers to adjustments in the scope of a project while internal flexibility refers to how changes are made within a defined scope. Flexibility might also be incorporated in the decision process, while technical solutions create flexibility in the product that is to be built.

Second, these categorisations can be seen from various perspectives. The first perspective to consider is that of the project phase, given that each phase demands different types of flexibility. Miller and Lessard (2001), for instance, argue that large changes should be avoided once construction has started. The second perspective is that of the stakeholders, who might have different demands regarding flexibility. For instance, since the project manager is the "guardian of efficiency" (Kreiner, 1995 in: Olsson, 2006), he or she has less to profit from flexibility than the user who is aiming more at effectiveness. This is related to the third perspective they distinguish: efficiency.

Third, one can look at drivers of flexibility. The first is uncertainty, which we also recognise as the main driver in our research. A long duration to a project might result in the strategic view changing and therefore the plans no longer being valid. Flexibility options can be both a reason for conflict and a solution. It can be a solution when stakeholders are indecisive, and a source of conflict when one stakeholder does not want to change initial decisions while another no longer favours the initial decisions made in the process. Including flexibility options invites their use, and so they can be seen as drivers of flexibility. A lack of preparation can also be overcome by flexibility and thus can be seen as another driver.

Fourth, an enabler of flexibility is redundancy, which creates sufficient space to adjust. Financial incentives, such as in contracts with contractors, can create flexibility. This is an important issue since outsourcing services is viewed as an important trend in healthcare delivery, and contracts are an important means to ensure flexibility (Blanken, 2008). Dewulf and Wright (2009) also recognise that contracts have more importance in transactions between parties that deliver services. Another enabler is technical flexibility, such as through modularity.

Gibson and Lizieri (1999) and Gibson (2000, 2001) developed a model, see Figure 3, that links the importance of real estate to the flexibility in both the individual asset and in the composition of the real estate portfolio. They argue that flexibilities can be grouped in three areas: contractual (financial) flexibility by means of contractual arrangements that allow one to dispose of or vacate spaces; physical flexibility that enables one to configure spaces; and functional flexibility that enables spaces to be used for various functions (Gibson, 2003). Gibson also recognised that flexibility should be considered in the design phase, and not only in the exploitation phase. Flexibility in lease contracts can also be reflected in personnel contracts: employees which are less necessary to the organization can have more flexible contracts.

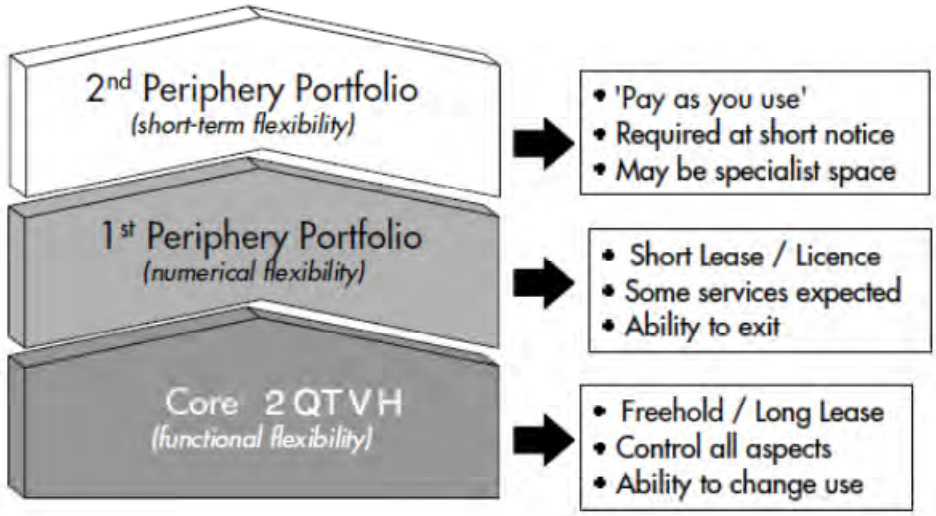


Figure 3 *The core/peripheral corporate property portfolio (Gibson & Lizieri, 1999)*

The various levels of flexibility used to categorise a real estate portfolio by Gibson and Lizieri is similar to the categorisation made by the Dutch *Bouwcollege* (College Bouw

Zorginstellingen, 2007a, 2007b). The Bouwcollege developed a 'shell model' that was specifically applied to hospitals which often consist of only one building. In this model, various layers represent the functions of the hospital. The core is formed by the 'hot floor' in which all the high tech facilities are to be found. The first shell is the 'fabric' with medical and other support, and the second the 'hotel' where nurses and beds are located. The outer shell is the 'office' which houses administrative functions that could also be located outside the hospital. From the inside outwards, these functions become less specific and increase in marketability. The models of both Gibson and Lizieri (1999) and of the *Bouwcollege* (2007a) are insightful approaches for health organizations to categorise the level of flexibility of their assets, but they fail to provide insight into how flexibility can be created during the decision making process.

2.2.3 Product flexibility and architecture

The aim of architects and developers is to gain more efficient and effective support for housing construction activities. This is enabled by flexibility, a result of the architectural paradigm of functionalism (van der Voordt and Wegen, 2005). According to van Duin (1996) the functional analysis of buildings must involve three elements (van der Voordt and Wegen, 2005, p.31):

- A description and identification of social needs, activities and dependencies and their relationships with one another.
- An explanation of the way in which form influences function.
- An analysis of the relationship between form, function and norm.

Research on the flexible use of space has been conducted since the 1920s. The functionalism paradigm gave an impulse to innovative concepts to increase functional efficiency, including flexibility concepts. As a reaction to the uniformity of houses built after WWII, the 'open building' concept was developed, which included permanent supporting elements and interchangeable built-in components. In the Netherlands, the IFD (Industrial Flexible and Demountable) was launched to enhance flexibility. In literature, various definitions on flexibility can be found, but according to Gijsbers (2011) many definitions are similar. He uses the following definition: "Flexibility is the characteristic of a building or construction product which enables adaptation to the demands and wishes of the users". Flexibility of buildings can then be further divided into process flexibility

and user flexibility. The former is defined as: "Freedom of choice and having a say by the first user(s) with regard to the design of the building during the design- and construction phase of the building". The latter is defined as "the ability of a building to undergo spatial and functional changes in the user phase. Technical flexibility enables these two flexibility types. Gijsbers (2011) divides user flexibility further into spatial and functional flexibility, each further subdivided as shown in Table 3.

Table 3. Subdivision of user flexibility (in the user or exploitation phase), based on Gijsbers (2011, pp. 69-70)

Type of flexibility	Subdivision	Description	Main difference
Spatial flexibility: enables the adaptation of dimensions, shapes and aestethics of space	Lay-out flexibility	Altering of the interior of a room can be done without changing the shape and dimensions. Changing the finishing of the room to change the aesthetic is also a form of interior flexibility.	Gross building volume remains unchanged
	Division flexibility	The ability to change in lay-outs of rooms, in which shape and dimensions of rooms are changeable within the user space of one user.	
	Parcelling flexibility	The ability to change in the subdivision of the floor plan. This concerns the room division between all separate users of the building.	
	Volume flexibility	When the gross building volume changes, this is the ability to extend or decrease the building volume and the number of square meter user surface by attaching or removing of building parts.	Change of gross building volume
Functional flexibility	Polyvalence	Changing the function of a room. The user doesn't change, the main function remains unchanged and no architectural adaptations are made.	Main function remains unchanged
	Revaluing flexibility	The functionality of a room can be improved with limited effort. The user can change but the main function remains unchanged.	
	Function neutrality	The capacity of a building or building part to house another function, without or with limited architectural adaptations. Function neutrality is often combined with overcapacity of constructive and installation technical elements and an oversizing of space.	Change of main function

Stolwijk (1987) and Pawiroredjo (2010) showed that building typologies of hospitals (Schaap et al., 2007). However, these typologies require certain measures to create flexibility which can be recognised as real options. The typologies are presented in Figure 4.

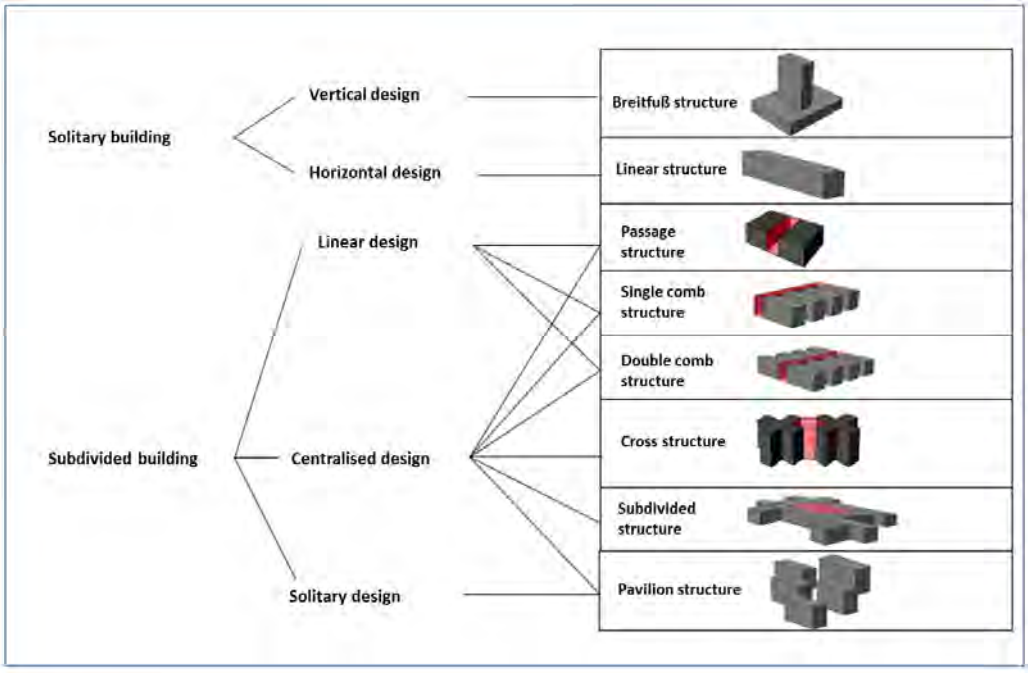


Figure 4 *Building typologies of hospitals (translated from Schaap et al., 2007 in Pawiroredjo, 2010)*

The measures to obtain flexibility in relation to the design characteristics of the product are identified by Gijsbers (2011). Investments in these flexibility measures will create real options that can be exercised later. Table 4 describes how these measures are linked to real options. In this way we show which practical measures can be taken to create real options. We also included the building typologies of Pawiroredjo (2010) to illustrate that building typologies influence flexibility as well. These hospitals applied the aforementioned 'shell model' to their designs, which implies that function clustering enhances various types of flexibility. Appendix A describes the typologies of various Dutch hospitals and the way in which they provide flexibility, in combination with the application of the above mentioned 'shell model'.

Table 4. Types of flexibility and design characteristics when applying flexibility measures in practice, related real options and hospital typologies enabling flexibility. Derived from Gijsbers (2011) and Pawiroredjo (2010).

Type of flexibility	Subdivision	Real option	Design characteristics	Practical measures	Hospital typologies
Spatial flexibility: enables adaptation of dimensions, shape and aesthetics of space	Lay-out flexibility	Switch function[2]	Spatial dimensions	-Floor space -Shape -Length /width relation	Linear structure: Martini hospital Groningen: linear structure with standard sizes suitable for multiple specializations and prefabricated flexible basic elements Passage structure – Orbis Medical Center and comb structures hospital Gelre Zutphen and Deventer: standardized rooms for switching functions
			Position and size of wall openings	-Position and size of window openings (daylight) -Position and size of door openings -Sufficient wall length because of furniture	
			Level of facilities	-Position and number of installation technical facilities for active use (electricity, water, sewage, gas, etc.) -position and number of installation technical facilities for passive use (ventilation, heating/cooling)	
	Division flexibility	Switch function, abandon	Positioning of fixed parts in floor plan	-fixed parts can hinder the freedom of division -prevent level differences	Pavilion structure - Isala clinics Zwolle and linear structure - Martini hospital Groningen: standardised construction allowing different divisions
			Movability and removability of division-determining elements	-free placement and removability of inside walls -free placement removability of wall openings -free placement of specific functional facilities like sanitary	
			Planning grid and construction system	-adapted way of construction -size between carrying walls -depth of building	
			Adjustability and ability to zone installation technical facilities	-placement and changeability of tube structure -switch ability and separate adjustability of installations -accessibility of tube carriers	Pavilion structure – Isala Zwolle, linear structure – Martini Groningen and comb structure hospital Gelre Zutphen: standardized construction allows division flexibility

[2] One can speak of a real option if extra investments are needed to create the flexibility measures in comparison to other ways of arranging the lay-out. The concept is explained in paragraph 2.3.1.

					Open building – INO Bern: vertical open shafts enable adaptation of infrastructure
	Parcelling flexibility	Switch function, abandon, growth, scale up and down of existing spaces	Main dimensioning of floor plan	-switch ability of spaces -universal module measures -removability of separating walls and floors	Pavilion structure – Isala Zwolle, linear structure – Martini Groningen and comb structure hospital Gelre Zutphen: standardized construction allows parcelling flexibility
			Parcelling of installation technical facilities	-decentralization of vertical tube distribution and infrastructural facilities for passenger travel -ability to parcel horizontal tube structure	
	Volume flexibility	Switch function, abandon, growth, scale up and down of existing spaces	Construction technical facilities	-ability to disassemble and modulation of building shell -modular set up of spatial design -prefabrication extension module	Comb structure Deventer hospital and Gelre Zutphen and passage structure Orbis Medical Center: extra space and open flanks allow horizontal expansion
			Overcapacity	-overcapacity carrying construction -overcapacity installation technics	Passage structure Orbis Medical Center: allowing vertical expansion
Functional flexibility	Polyvalence	Switch function	Neutrality in use of spaces	-spatial dimensions -level of facilities -level of finishing	Deventer, Zutphen Groningen: standardized rooms for different specialisms
			Switch ability of spaces	-temporary spatial divisions/openings -flexible furniture	Martini hospital
	Revaluing flexibility	Switch function (updating to current needs)	Revaluing abilities at level of finishing	- finishing and image of the interior - finishing and image of the exterior	
			Revaluing abilities of construction physical performances of the interior climate	-thermal isolation value -noise protection -air quality -thermal comfort -thermal hygric comfort -daylight entrance -fire safety	
			Revaluing abilities of installation technical facilities	-accessibility -disintegration -replace ability -overcapacity -energy generation	
	Function neutrality	Scale up and down,	Spatial dimensions	-redundancy in floor surface -uniformity in	Deventer, Zutphen Groningen: standardized rooms

		grow		dimensioning -height of ceiling / floor height -opening up of building/accessibility	for different specialisms. Zutphen: standardized sizes between carrying walls
			Overcapacity of installation technical and infrastructural facilities	-infrastructural facilities with regard to passenger traffic -infrastructural facilities with regard to tube traffic -installations for air quality -installations for thermal comfort -installations for thermal hygric comfort -electro technical installations -mechanical engineering installations -facilities for noise protection -facilities for daylight entrance -facilities for fire safety	Sittard, Deventer, Zutphen: connections of technical installations allow expansion or moving of building parts
			Overcapacity carrying construction	-spatial dimensions -variable load	Orbis Medical Center: overcapacity for vertical expansion

2.2.4 Project coalitions as part of the real estate strategy

Strategic decisions are made at the front end of a project that influence flexibility in the long run, such as over the choice of a certain type of project coalition. In other words, how the various phases of a construction project are organized, i.e. the project coalition form, has consequences for flexibility in the decision making process of the project and for the technical measures that enable flexibility in the building. Consequently, this section provides a short overview of the literature on flexibility in project coalition types.

Healthcare assets may be procured in various ways ranging from traditional, or conventional, procurement where the client bears most of the risks and retains the responsibilities in-house to integrated service delivery that includes the transfer of risks and responsibilities to external providers. Construction projects are executed by project coalitions, with a specific coalition forming the resource base of a project (Winch 2010). Other relevant aspects are the package of tasks which is procured, the procurement method used to select contractors and the reward system (van Iersel, 2005). Winch (2010)

describes four basic types of project coalition structures: separated, integrated, mediated and unmediated. The separated form of project coalition, often referred to as traditional in the Netherlands, is one in which all subsequent tasks are only procured after a phase is completed. Most risks and responsibilities remain with the client. In an integrated project coalition, several tasks, covering aspects such as design (D), build (B), finance (F), maintenance (M) and operation (O), are integrated into a single contract, and these can be observed in several forms. Here, certain risks are transferred from the client to the contractor for a given price. In general, the client's influence on the process is less when using an integrated project coalition than with a separated form. In a mediated project coalition, the client and the contractor together seek solutions and allocate risks to those best able to bear them.

Skitmore and Marsden (1988) and Chan et al. (2001) observe that flexibility is one of the main criteria when selecting a procurement method. They recognise that project coalitions are an important factor in creating flexibility and used increasingly in healthcare because of the various uncertainties affecting the primary process. Therefore, the type of project coalition used should be considered when analysing flexibility in healthcare real estate and construction. Although various decision support tools have been developed, e.g. by CROW (2012) and specifically for healthcare (Koster, 2008), using a real options approach when analysing the options for project coalitions could have additional advantages by providing a structure and guidelines for decision making. In addition, these decision support tools use general assumptions while the functioning of project coalitions depends on various case-specific factors. This thesis therefore aims to provide more in-depth information on the functioning of project coalitions in terms of possibilities for different types of flexibility.

Since the project coalition forms the organisation of the project, enabling flexibility in the process, organisational flexibility plays a role here. This is operationalized by Volberda (1992) who states that organisational flexibility is a two-dimensional concept: "In this context, flexibility is a function of the control capability of the management and the controllability of the organization" (Volberda 1992, p.83). The study of Volberda assesses under which organizational conditions and environmental characteristics certain types of flexibility are likely to be found and which trajectories for improving flexibility are appropriate. The model targets to diagnose a lack of flexibility and identify measures to

improve this. However, the assumption in this thesis is to identify suitable ways of organising the project *in advance* of the project. Moreover, since Volberda's model is suited for long term primary processes, it would be more suitable for analysing the flexibility of the primary process of the health organization, which can be facilitated by the real estate.

2.3 Assessing flexibility by means of real options

The theory of real options is an established perspective for looking at flexibility in large capital investments. It is derived from financial options (Black & Scholes, 1973) for which the authors received the Nobel prize for economics. The use of options appears to have a long history, with Gelderblom and Jonker (2003) showing that grain dealers in Amsterdam were already using options and forwards in 1550. In the late 1800s and the early 1900s, there were active options markets in London, New York, Paris and other European exchanges (Von Helfenstein, 2009). In this section, we start with a general description of the real options concept. Next, we elaborate on various categorisations of managerial flexibility and real options, the different techniques and models based on real options, and the various ways that real options can be applied in practice. Since real options are a method to proactively deal with uncertainties, we describe the role of real options in risk management strategies. We finish with the recommendation, as the focus of our research, to develop heuristics that could enhance the use of real options in practice.

2.3.1 The concept of a real option

Myers (1977) introduced the idea of an *option* to *real* assets. It is the right, but not an obligation, to invest in a certain option. It is different from the other meaning of 'option', as an alternative, since the cost of the right to exercise an option is determined in advance. A real option can only be exercised under certain conditions. The flexibility available, which is known in advance, therefore has a value and hence a real option is different from a choice or an alternative. Another aspect of real options is their timing since, in some cases, the best moment to exercise the option can pass and a real option can expire. Several advantages are mentioned regarding using real options analysis (ROA) when deciding on investments in comparison to the more often used discounted cash flow methods such as the Net Present Value (NPV). An NPV is based on the current value of an asset and only considers one possible option. Further, the calculation of an NPV assumes the linear development of a project, irrespective of uncertainties surrounding it (de

Neufville, 2003). The NPV is the calculated value of a project after it is finished, and this can be either positive or negative. However, it ignores the possibility that managers have the ability to intervene in the development of a project. This approach overlooks real options, which are contingent decisions - one can wait to see how events unfold and then choose from two alternatives: to exercise the option or not. As a result, one can proactively manage uncertainties and potential negative consequences by reducing exposure to uncertainty and increasing the payoff should there be a good outcome, and adapt the strategy to that aim (Amram & Kulatilaka, 1999). According to Luehrman (1997), ROA can be complementary to discounted cashflow (DCF) methods. Benaroch (2002) describes this as an active form of NPV using the following formula:

$$\mathrm{NPV}_{\mathrm{Active}} = \mathrm{NPV}_{\mathrm{Passive}} + f(\text{value of real options embedded in the project})$$

Real options thus provide additional value in a project, and real option valuation is directed at calculating the value of the real option. According to Luehrman (1997), this is key to resource allocation, which in turn is key to firm performance. Further, key performance is related to market performance and thus to the return for stakeholders. Borison (2005) claims that this view is shared by almost all real options practitioners. The NPV formula above also assumes that the goal of ROA is to maximise value. However, the real estate of health organizations has to add value to a variety of stakeholders and not only in the form of financial value. On this basis, the performance of a real estate project in terms of value added could be operationalised by analysing the consequences for the various interests in the health organization that CREM has to serve.

In the common approach to ROA, the value of a real option is influenced by the volatility of the uncertainty which the real option should mitigate. If this volatility is high, the value of the real option increases. This is counterintuitive since most people try to avoid risk. Further, not all investments can be defined as a real option. The approach is most appropriate for investment choices that concern high uncertainty and irreversibility, which is generally the case for healthcare construction projects. Irreversibility is defined here as the inability to undo the investment, for example by selling the asset for the same price. The other condition for using this approach, provided by Adner and Levinthal (2004b), concerns flexibility in the target market and in the technical agenda. The target market is fixed when the product developed can be used for only one purpose. The extent

to which various development approaches can develop the product determines the flexibility of the technical agenda. If both are flexible, then a path-dependency logic is more appropriate in determining investment. However, when a product has only two fixed outcomes, the real options concept becomes applicable. These two conditions are depicted in Figure 5.

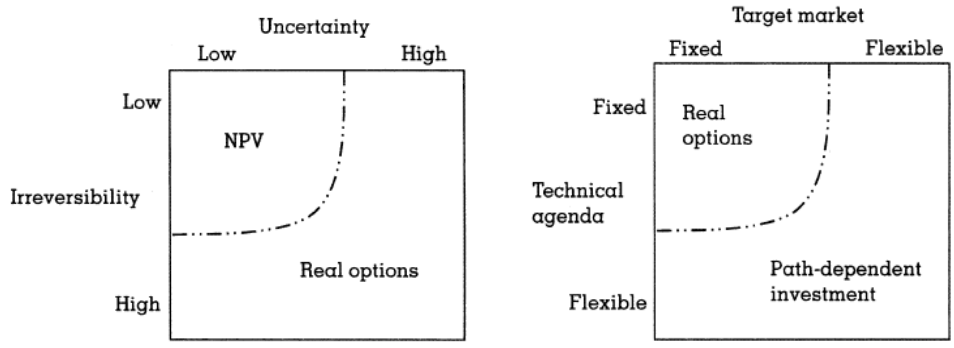


Figure 5 *Boundaries of applicability for net present value and real options, and the applicability of real options and path-dependent investment (Adner & Levinthal, 2004b).*

Construction projects usually involve large, irreversible investments, and the real estate market for health can be considered as fixed since hospitals have limited use for other purposes. As such, based on Figure 5, the real options approach can be considered appropriate for assessing flexibility in real estate projects in the healthcare sector.

2.3.2 Categorisations of real options

Various, frequently cited, works (Amram & Kulatilaka, 1999; Copeland & Antikarov, 2001; Dixit & Pindyck, 1995; Trigeorgis, 1993b) list actions that reflect managerial flexibility in investment choices, and defined as real-option types: the options to defer, to stage, to abandon, to change the scale of investment, to switch use, to expand or contract and to grow. One real option might imply the use of additional real options, creating a compound option. Also combinations of real options might exist, for example the option to stage an investment could incorporate the option to defer. In addition, a portfolio of real options can exist such that one can choose between various types of real option (Luehrman, 1998; Trigeorgis, 1993a). Luehrman (1998) offers an appealing metaphor for managing a portfolio of real options: a gardener grows tomatoes in an unpredictable climate. The condition of the tomatoes varies over time: at one moment some might be

ripe to pick while others are already rotting and others need more fertiliser, protection against insects etc. There are various ways to deal with these situations: the passive gardener just picks the ripe ones at the end of the season, the weekend gardener picks ripe tomatoes before they rot or get eaten, while the active gardener looks more closely at what is happening in the garden and reacts by watering, fertilising and weeding. Translated to real options: decision making becomes more than just exercising an option or not: rather, the active manager monitors the uncertainties influencing the value of the real options and reacts by choosing the most appropriate ones.

Besides the various real option types discussed above, various authors have proposed other categorisations which are more suited to their area of research. Amram and Kulatilaka (1999) made a taxonomy based on the mechanisms that create these types of flexibility. Their work is mainly focussed on enterprises but we consider it to also be applicable to CREM in healthcare. The taxonomy consists of investment and disinvestment options, timing options, contractual options and operating options. Investment and disinvestment options may significantly change the asset configuration by using scaling up, or down, and growth options. Timing options can also be placed under investment and disinvestment options such as when they are used to delay or accelerate options. Contractual options are contractual terms that change the risk profile faced by asset owners; i.e. the contingency adaptability in project coalitions. Luo (2002) defines contingency adaptability in contracts as 'the degree to which guidelines and possible solutions for handling various unanticipated contingencies are incorporated in the contract' (p.916). All option types can be defined and included in contracts, as part of contractual options. The use of real options could add further contingency adaptability to contracts.

De Neufville et al.(2008a) make a distinction between two types of real options in project management in the construction industry, where real options 'on' the project are focused on accelerating or deferring projects and real options 'in' engineering systems are focused on optimising the technical design. This broad but clear distinction between the product and the process is very useful for our application of real options. Real options 'in' the project can address changes related to the technical and architectural aspects of the project whereas real options 'on' the project deal with changes in the process of a project. This further categorisation is useful since it further specifies various real-option types including scale up and down, grow, switch, abandon and select.

The types and goals of real options can overlap, and different mechanisms can create the same real option. An overview of the categorisations and examples in healthcare is presented in Table 5. Nevertheless, these categorisations provide a sound overview of the types of flexibility available for investments in healthcare real estate.

Table 5. Types of real options and examples of application in construction projects

Amram and Kulatilaka (1999). Type of real options	**Real options e.g. Trigeorgis (1993a) Sommer and Loch (2004), Fichman et al. (2005)**	**Project management (De Neufville 2008)**	**Examples of application in real estate construction projects in health**
Waiting-to-invest option	Defer	'on' the project	When there is uncertainty on governmental regulation, the project might need deferral
Growth option of a market	Growth, switch function	'in' the project	Other demands can necessitate switch function of expansion/shrinking of the real estate
Flexibility options	Growth, scale up and down, switch function	'in' the project	When demands of the organization change: expand the building, scale up or down and switch function
Exit options	Abandon	'on' the project	When finance cannot be obtained, the project should be able to abandon
Learning options	Select	'on' the project	Select multiple architects to obtain knowledge on the best one
Irreversible investments	Stage	'on' the project	A construction project is irreversible. By staging the project after each stage a go-no go point is implemented

2.3.3 Real options analysis, valuation and reasoning

The approach to assessing real options as part of making investment decisions varies in the literature. Real option analysis (ROA) is most commonly used in describing the quantitative assessment of real options (Adner & Levinthal, 2004a, 2004b; Leiblein, 2003), and also referred to as real options valuation (ROV) (e.g. Carlsson, Fullér, Heikkilä, & Majlender, 2007). The valuation techniques which are often used, both in papers and in practice, are binomial lattices, risk-adjusted decision trees, Monte Carlo simulation and the Black-Scholes option pricing model (Block, 2007). In some cases, real options reasoning (ROR) is used to identify the reasoning of organizations when making investment

decisions. In this approach, 'only' the structure of the real option concept is used in decision making, and a quantitative assessment is not necessarily implied (e.g. Barnett, 2008; Krychowski & Quélin, 2010; R. G. McGrath & Nerkar, 2003). As such, real options are used "as a way of thinking" (Triantis and Borison 2001, p.10).

According to Triantis and Borison (2001), real options are used as a language to frame and communicate decision problems: the use of real options "as an organizational process" is a management tool to identify and exploit strategic options (p. 10). Busby and Pitts (1997) found that real options were most often used intuitively among firms in the Financial Times Stock Exchange who responded to their survey. They also showed that practitioners often lacked a systematic approach for assessing real options in advance. The same was also found to be true for the managers of construction projects who did not use real options as such but intuitively managed uncertainty, although in an experiment they valued flexibility and conceptually understood the values of options (Ford & Lander, 2011). This way of decision making, based on intuition and experience rather than probabilistic techniques, can also be recognised among real estate managers (Gehner, Halman, & De Jonge, 2010). Consequently, various authors have proposed qualitative models to assess real options; Miller and Waller (2003) combine decision making and real options in choosing in which businesses in the firm one should invest, i.e. which growth options are the most valuable. Managers can, for example, estimate the value of deferring an investment even if they cannot quantify it precisely (K.D. Miller & Folta, 2002). McGrath and MacMillan (2000) assess the same issues by asking various questions on the feasibility of certain businesses. Gil (2009) combined a decision tree with questions to determine whether options should be safeguarded in large engineering projects, a method which he applied in a case study of Heathrow Airport. When quantitative assessments are not feasible, qualitative reasoning might be sufficient: "managers' heuristics may be deficient, yet their patterns of strategic decisions may crudely approximate decisions informed by real options valuation techniques" (McDonald, 2000; in: K.D. Miller & Shapira, 2004, p.281). On this basis, the focus of our research is on developing qualitative heuristics with real options.

2.3.4 The use of real options in practice

Triantis (2005) observes that "the extent of acceptance and application of real options today has probably not lived up to the expectations created in the mid- to late-90s when

real options first began to take hold [in] a broad cross-section of companies" (Triantis 2005, p.8). Despite the many advantages that have been claimed for ROA, some authors also mention criticisms which could be reasons for its limited application. According to Benaroch (2002), some aspects of the original ROA approach fail to address the needs of some sectors, such as IT investment. These aspects are also relevant to the use of ROA in CREM. One objection is that the ROA literature mainly looks at financial risk, exogenous market risk and cost risk, despite other risks, such as organizational risk and risks from technological developments, also being important (Benaroch, 2002). Further, in ROA, often no more than two risks are considered at the same time. Given the absence of any guidance as to which real options should be used to mitigate which risks, Benaroch (2002) and Hilhorst (2008) tried to fill this gap for IT investment, but this has not been done in other areas relevant for CREM. Another criticism is that standard valuation methods ignore the fact that "the value of [an] individual option in series of cascading options may be lowered or enhanced by interactions with other options" (Benaroch 2002, p. 5).

De Neufville (2003) commented that it is often difficult to make accurate options analyses. Further, various pieces of research among practitioners have found that approximated and thus inaccurate outcomes are a drawback of using ROA, although other discounted cash flow methods might also overly rely on assumptions or simplifications to be able to deliver a realistic picture of the value of a project. For example, the Net Present Value technique assumes that projects are positively valued when firms can exploit temporary competitive advantages and governments do not exist or are neutral (Myers, 1977; Pinches & Lander, 1997 in: Lander & Pinches, 1998). Fichman (2004) states that therefore "in such circumstances, it would be unfortunate if practitioners were to fall back on unguided managerial intuition rather than seek to apply the logic of real options in a systematic but qualitative fashion" (Fichman, 2004, p.150).

Various authors propose solutions to bridge the gap between theory and practice. Triantis (2005) essentially proposes improved mathematical models that are both simpler and more heuristic-like since current models were often too complex to be of practical use. However, he also states that models should be mathematically refined to overcome the criticism that real options markets are assumed to be perfect, in line with the financial options on which they were based. Other modelling aspects that should be improved included being able to value the whole firm and to incorporate managerial behaviour,

insofar as this can be modelled. These issues have also been examined by Lander and Pinches (1998) although they propose simpler models such as decision trees and influence diagrams.

Other critics argue that ROA can be "overly seductive" (Adner & Levinthal, 2004b, p.86), tempting managers to overinvest in risky projects that ultimately fail (Barwise, Marsh, & Wensley, 1987; Coff & Laverty, 2001 in: Barnett, 2008). Although these risks are especially relevant to private firms that invest in new products, examples of over-large investments can also be found in public real estate.

The presence of several conditions can boost the usefulness of real options. Both the organizational design (Kumaraswamy, 1996) and behavioural and organizational considerations (Busby & Pitts, 1997) should enable the exercising of real options. Even recognising latent real options, or "shadow option", can be a problem (Bowman & Hurry, 1993). Once they are recognised, various conditions need to be in place for the shadow options to be viable; an aspect which Benaroch (2002) operationalised for IT investments.

There is even a divergence of view as to whether ROA is helpful or harmful, as discussed in an overview of the literature by Barnett (2008). ROA could be used to overvalue real options in order to defend poor investment choices and, therefore, Reuer and Leiblein (2000) argue that the decision making processes inherent to ROA should be more transparent. This is in line with the use of ROA as 'a way of thinking' as described by Triantis and Borison (2001): "as a language that frames and communicates decision problems qualitatively" (p. 10). The reasoning and structuring of real options should be understood before additional valuation tools are used. We therefore prefer the term real options reasoning (ROR) since this emphasises real options as a way of thinking rather than as a means of valuation.

2.3.5 Uncertainty strategies and real options

Managerial flexibility has value in the presence of uncertainty since it creates advantages, including over less-flexible competitors. Uncertainty as such does not exist; rather, itis a result of human mediation. To understand why uncertainty occurs, Van Asselt (2000) developed a taxonomy of sources of uncertainty. The two major sources of uncertainty are:

- Variability, also referred to as 'objective uncertainty': the system/process can behave in different ways or is valued differently. Variability is an attribute of reality.
- Lack of knowledge, also referred to as 'subjective uncertainty' is a property of the analysts performing the study and/or of our state of knowledge.

Hence, uncertainty has both an ontological and epistemological dimension. The ontological uncertainty implies the variability of the general properties of objects and the epistemological uncertainty is the lack of knowledge because of the human inability to know everything. Therefore, the reduction of uncertainty has theoretical and practical limitations. Van Asselt defines uncertainty as follows:

> "The entire set of beliefs or doubts that stems from our limited knowledge of the past and the present (esp. uncertainty due to lack of knowledge) and our inability to predict future events, outcomes and consequences (esp. uncertainty due to variability)" (van Asselt 2000, p.88).

Related to uncertainty is the concept of risk since they both deal with the limited predictability of complex issues. Most often, one refers to risk when there is a possibility that something might go wrong. Risk is a broad notion and is used in various fields as the subject for decision making. According to van Asselt (2000) there is no universal definition of risk yet. Risk issues differ with regard to (van Asselt 2000, p.172):

- The *level of control*: personal control versus collective affair
- The *time-horizon*: momentary, short-term, medium-term and long-term (i.e. inter-generational)
- The *spatial scope*: individual, indoor, local, regional, national, continental, and global
- The *level of uncertainty*

Based on these aspects, risk issues can be classified as operational, tactical and strategic risk. Figure 6 shows the relation between the level of risk and the degree of uncertainty.

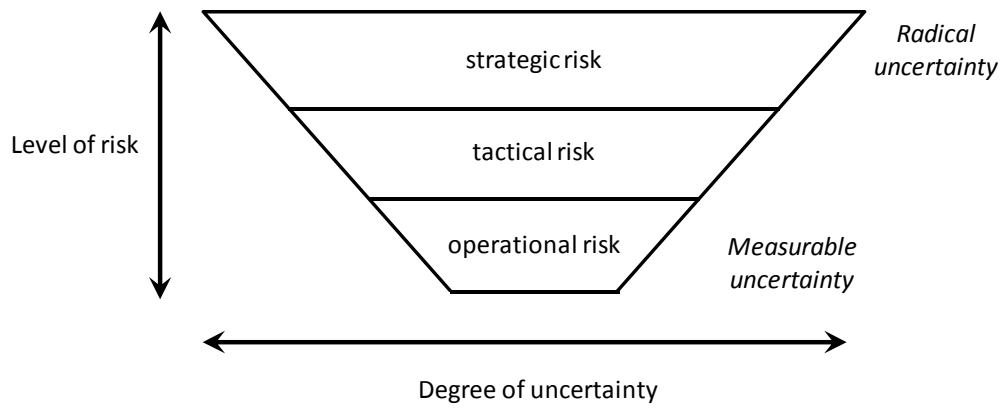


Figure 6 *Level of uncertainty and type of risk (van Asselt, 2000)*

Since strategic risk implies more factors, dimensions and scales, the degree of uncertainty regarding these aspects is also higher. However since strategic risks influence decision making of risks on the operational level, radical uncertainties which cannot be influenced, play a role in decisions on the operational level as well. This issue is also incorporated in the categorisation of risks for organizations as developed by Halman (1994), see Table 6. The category of decision making which is applicable to real estate managers in health organizations is dynamic and non-frequent. Three dimensions of risk play a role here: the degree of uncertainty, the risk impact and the ability to influence the risk. Since in project management these risk dimensions can be high, risk cannot be prevented. Therefore decision making methods which do not prevent risks but proactively mitigate the consequences, such as real options analysis, are applicable.

Table 6. Risk seen as a static choice problem or as dynamic interaction (translated from Halman, 1994)

	Frequent	Non-frequent
Static risk choice problem "gamble vision"	Objectively measurable: frequency of failure Example: number of days off in budget of contractor	To be judged subjectively: Degree of (reasoned) believe in probability of failure Example: part in acquisition
Dynamic risk choice process "control vision"	Objectively measurable: frequency of failure as a result of uncontrolled process Example: quality procedures in process industry	Subjectively measurable: Degree of (reasoned) belief in uncontrolled process Example: project control

According to Courtney et al. (1997), the level of uncertainty in risky situations influences the type of decision making tools that are most applicable. Research in the area of behavioural decision making shows that in situations with more risk, decision makers rely less on rational models but rather more qualitative approaches (Cyert & March, 1963; Maritan, 2001). Therefore Courtney et al. (1997) proposes different methodologies for decision making under different levels of uncertainties, see Table 7.

Table 7. Uncertainty framework (Courtney, et al., 1997 in: Alessandri, Ford, Lander, Leggio, & Taylor, 2004)

Level	Description	Suggested analytical tools
1.Sufficiently clear future	A single forecast precise enough to determine strategy	Market research, value chain analysis, discounted cashflow methods
2. Alternate futures	A few discrete outcomes that define the future	Decision analysis, option valuation models, game theory
3.Range of futures	A range of possible outcomes, but no natural scenario	Scenario planning, technology forecasting
4.True ambiguity	No basis to forecast the future	Analogies and pattern recognition, nonlinear models

Uncertainties on the first two of these levels are probably obvious and it is likely that real estate managers will somehow address them in their strategies (Evers, Van der Schaaf, & Dewulf, 2002). In comparison, level 3 and level 4 uncertainties are less easy to consider and should therefore be the main drivers for flexibility. According to Courtney et al. (1997), pattern recognition and qualitative tools are best suited to deal with such uncertainties.

The classic risk management strategies are avoiding, reducing, transferring and retaining. Another strategy that is important in construction work is sharing. Each type of real option creates flexibility that will correspond most closely to one of these risk mitigation strategies. Hilhorst (2009) derived option-based risk management strategies from Benaroch (2002). We illustrate the management strategies with examples from CREM in healthcare in Table 8.

Table 8. Risk management strategies with real options, based on Hilhorst (2009)

Risk management strategy and characteristics	Corresponding real options
Risk reduction includes both prevention and loss of control efforts. This is achieved by obtaining more information on uncertainties, for example through learning-by-waiting or by developing several alternatives to spread risk.	Option to defer Option to select
Risk transfer such as from the client to the contractor.	Option to stage
Risk sharing with contractors in a consortium	Option to stage
Risk avoidance by eliminating or avoiding certain risks - by reconfiguring the project in order to remove a risk or reduce it to an acceptable level. Appropriate when the exposure to the risk is potentially frequent or severe, and it cannot be reduced or transferred.	Option to grow Option to scale up Option to scale down Option to switch use
Risk retention is the only strategy left when risks cannot be reduced or avoided.	Option to abandon

Consequently, we will focus on how real estate managers deal with multiple uncertainties that are difficult to predict and thus to quantify, and therefore hard to incorporate in quantitative models. Further, an awareness of uncertainties and flexible real estate strategies is a prerequisite for using ROV models. Therefore, we will focus on real options as a way of thinking, and explore heuristics for using ROR that could guide decision-makers.

2.3.6 Heuristics for applying real options in CREM

An important criticism of real options analysis (ROA) is the lack of empirical studies on how practitioners use ROA and a similar lack of concrete directions on how to use ROA in practice (Krychowski & Quélin, 2010; Reuer & Tong, 2007). Also the idea of real options *reasoning* (ROR), rather than using real options in a computational way, is relatively unexplored in literature. A recommendation in literature is that heuristics should be developed to make ROR more applicable in practice. Kogut and Kulatilaka (2001b) define four qualities of a heuristic: "easy to use, easy to communicate, provides a better direction than ones currently employed and motivates people who have to implement the strategy" (p.4). They further warn that heuristics "upset the norms of academic research" and are criticised because they are not clearly derived from scientific theories or because they just reflect dominant perceptions. However, Romme (2003) and Van Aken (2005) claim that science as the exclusive mode of research should be questioned in management sciences.

Flyvbjerg (2001) concurs, and therefore distinguishes the traditional 'science' knowledge, labelled *episteme* knowledge, from *techne* and *phronetic* forms.

As a basis for research, Van Aken (2004) proposed the design science paradigm since one of the results of this type of research are prescriptions of a heuristic nature. In this type of approach, heuristics are developed to solve problems, rather than to describe which is the main purpose in organizational research. These heuristics are merely general prescriptions, or *design exemplars,* which should be refined for a particular situation. They can be formulated as "if you want to achieve Y in situation Z, then something like action X will help" (Van Aken, 2004, p. 227). The following formula describes this: mechanism + context = outcome (Pawson & Tilley, 1997), and this approach creates what can be labelled as *techne* knowledge. Rigorous heuristics can be developed by finding evidence in the field and then testing them. Beyond investigating how ROR can be used for sensemaking regarding flexibility, we would also like to create *phronetic* knowledge. This can be achieved by asking questions as to the influence of these heuristics for creating flexibility on stakeholders and values in specific CREM cases.

The next section provides an overview of how various authors have dealt with risk and uncertainty in CREM by using real options, and in which knowledge systems they sought answers.

2.4 Application of real options in real estate- and construction project- related literature

ROA has been applied in various high-investment sectors, such as in the oil and energy industry, and applied to natural resources, land development, flexible manufacturing, government subsidies and regulation, R&D, new ventures and acquisitions, foreign investment and strategy (Trigeorgis, 2005). It has also been used in other areas such as human resource management in the form of 'opportunity platforms' (Barnett, 2007; Kogut & Kulatilaka, 2001a). Real estate is a high investment sector, and it has been a subject addressed in the literature on real options. In this section, we provide an overview of the literature that focusses on real options in real estate management, on option thinking in the engineering project literature and on how options are used in healthcare project coalitions.

2.4.1 Real options in CREM literature

Real estate development was one of the first subjects to which ROA was applied, albeit primarily from an investor's perspective, rather than that of the owner-user, with the aim of directly generating income from real estate. An overview of the real estate management literature that deals with real options is provided in Table 9. Valuation models have been developed for various real options. Titman (1985) valued the defer option of keeping land vacant because of uncertainties over the value of buildings built on the land. Capozza and Li (1994) model the timing of an investment, and the intensity of the investment. A similar model was developed by Williams, who used rents and construction costs to determine value. Capozza and Sick (1991) modelled the valuation of leased properties. Geltner et al.(1996) and Grenadier (1996) model the real estate market in general. Kalligeros (2003) and Rocha et al.(2007) have used specific cases to model the value of real options, and the model of Quigg (1993) is consistent with empirical data. All these pieces of research are based on practical instrumental rationality governed by a conscious goal, and in the definitions of Flyvbjerg (2001) thus develop a *techne* type of knowledge, rather than on values related to practice, which is the characteristic of *phronetic* knowledge.

The value of the real options considered in these papers is related to the value of the real estate if sold on the market. Other interests that play a role in corporate real estate management are missing. The main approach, described by de Neufville (2003) as a common approach, to dealing with uncertainty is to estimate the uncertainties, and this was viewed by Block (2007) and Zhang (2010) as a drawback of using ROA in practice.

Most real options considered in the CREM literature are financially oriented. This was noted for the first period of CREM research by(Gibson & Barkham, 2001) who argue that flexibility should be seen from other viewpoints, such as physical, functional and organizational - aspects that are missing in the literature on CREM and real options. The literature on project management in the construction industry notes other important factors with which real estate managers often have to deal, such as design and construction. As such, the literature on project management and real options will be reviewed in the next section.

Table 9. Literature on real estate and real options

Literature	Knowledge system	Categories in projects	Phase	Risk mitigation strategy	Taxonomy	Real options	Uncertainties underlying real options
(Capozza & Li, 1994)	Techne	'on' the project	Initiative, exploitation	Reduce, avoid	Timing option, (dis)investment option	Conversion of vacant land to urban uses and developed land to alternative uses.	Uncertain rents.
(Quigg, 1993)	Techne	'on' the project	Initiative	Reduce, avoid	Investment option	Option to defer investment in developing land.	Price of underlying asset, the building and development costs.
(Capozza & Sick, 1991)	Techne	'on' the project	Initiative, exploitation	Reduce, avoid	Investment option	Option to redevelop.	Rents.
(Titman, 1985)	Techne	'on' the project	Initiative	Reduce, avoid	Investment option	Option to select type of building, determine optimal timing of investment.	Future real estate prices, type of building to build on land.
(Grenadier, 1995a)	Techne	'on' the project	Initiation, construction, operation	Reduce, avoid	(Dis)investment option	Option to lease more or fewer units, option to defer investment. Model for optimal timing.	Uncertainty on demand for rent.
(Williams, 1991)	Techne	'on' the project	Initiation	Reduce, avoid	(Dis)investment option	Option of the landowner to determine the date and density of development, or to abandon the property.	Stochastic evolution over time of the operating revenues and construction costs of developed property.

(Capozza & Helsley, 1990)	Techne	'on' the project	initiation	Reduce, avoid	(Dis)investment	Option to convert land from agricultural to urban use, explanation for value of sold land and	Household income, rents, land prices.
(Grenadier, 1995b)	Techne	'on' the project	Exploitation	Reduce, avoid	Operating option	Value of various types of lease contracts is determined	Cost of construction, demand for the asset determines the rent.
(Geltner, et al., 1996)	Techne	'on' the project	Initiation	Reduce, avoid	Investment option	Call option to invest, choice over type of land use and density.	Real estate markets determining values of buildings in the city. Distinct markets for various building types (office, apartments).
(Bulan, Mayer, & Somerville, 2009)	Techne	'on' the project	Initiation	Avoid	Investment option	Explanation of the option to defer.	Idiosyncratic uncertainty and market volatility leads to deferral of investments. Competition only has indirect effect when it influences uncertainty.
(Kalligeros, 2003)	Techne	'in' the project	Initiation, operation	Reduce, avoid	Disinvestment option	Optimising the design of corporate facilities in order to enable contraction, application to a specific case.	Inherent value of office space, land value.
(Rocha, Salles, Garcia, Sardinha, & Teixeira, 2007)	Techne	'on' the project	Initiation, construction	Reduce, avoid	Investment option, operating option	Valuations of rent, option to defer and abandon, timing of construction phase. Stage option during construction.	Demand, sale prices, land costs, unsold inventories, regulatory and local government risks (authorisations, occupancy permits, etc.) increase perceived risk to investor.

(Greden & Glicksman, 2005)	Techne	'in' the project	Design	Reduce, avoid	Investment option	Value of option to renovate into office space (switch option).	The market price of renting office space, timing of space need, and amount of space needed.
(Wang & Zhou, 2006)	Techne	'over' the project	Initiative	Reduce, avoid	Investment option	Timing of exercising option.	Demand, rents and construction costs in various types of real estate markets.
(Guma, Pearson, Wittels, De Neufville, & Geltner, 2009)	Techne	'in' the project	Initiative	Reduce, avoid	Option to grow	Value of adding additional floors to a building.	Projected future rents (cash flow) and future lease rates (office space demand) for the building.

2.4.2 Real options in engineering projects

Related to real estate, real options has been a subject of discussion in the engineering project literature. Miller and Lessard (2001) are one of the first authors to plead for the use of real options analysis in large engineering projects, such as in construction, but not to 'price' the risks involved but rather in a qualitative way to recognise, shape and realise real options. Often, this is the only possible way since risks can be uncertain to the extent that they cannot be quantified. Miller and Lessard (2001) propose using real options as a kind of *phronetic* knowledge where risks are framed not as technical issues but as managerial problems. However, Miller and Lessard (2001) found that the management of uncertainty for gain in construction is "buried in intuitive management practice" and a more structured approach is needed to make it more widely available for the description evaluation, improvement of overall management (Ford, et al., 2002, p.344). The origins of a risk determine how it can best be mitigated, which could be through transferring it to actors with appropriate competencies, or by adopting technical or financial measures. The literature on large engineering projects might provide other useful insights with the potential for application in CREM, and therefore we show a representation of the literature on project management and real options analysis in Table 10.

From this literature overview, which is not extensive but provides examples of the types of literature that have been published on the subject, one can conclude that there are some papers that address the *techne* type of knowledge available in the CREM literature. However, additional insights are also available in other sectors on the creation of *phronetic*-type knowledge. For example, the literature on large engineering projects recognises that one has to deal with various, often unpredictable, contingencies.

Bartolomei et al. address a *phronetic* type of knowledge in recognising that a complex engineering system is a socio-technical system that is "designed, developed, and actively managed by humans in order to deliver value to stakeholders" (Bartolomei et al. 2006, p. 2). This description applies equally well to healthcare real estate. Although the engineering projects discussed in this literature are generally larger than CREM healthcare projects, the types of risk faced are similar.

Table 10. Literature on large engineering projects and real options

Literature	Knowledge system	Categories in projects	Phase	Risk mitigation strategy	Taxonomy	Real options	Uncertainties underlying real options
(Bartolomei, Hastings, de Neufville, & Rhodes, 2006)	Phronesis, Quantitative. (Topic: Weapon acquisitions as complex engineering systems)	'in' the project	Initiation	Reduce	Investment option	Identify defer-expand, contract or abandon options.	Social, economic, political and technical influences. For the F-16 aircraft: price of jet fuel, weather, a new surface-to-air threat.
(Alessandri, et al., 2004)	Phronesis, Qualitative. (Topic: Developing laser glass production technology, case study)	'on' the project	Initiation	Reduce, retain	Investment option	Option to abandon, i.e. to not purchase from the high-cost vendor. Option to select among various contractors.	Performance of contractors. Four scenarios were developed. Managers reasoned according to real options without using formal real option language.
(de Neufville, 2003)	Phronesis, Qualitative and quantitative, dependent on real option and available information. (Topic: developing oil field)	'on' and 'in' the project	Initiation	Avoidance	Investment option	Discovering, selecting and monitoring real options.	Technical uncertainties concerning the construction of the wells and the size of the field, market for oil, changing structure of major oil companies.

(de Neufville, Hodota, Sussman, & Scholtes, 2008)	Phronesis and techne, (Topic: deploying a particular aspect of intelligent transportation systems)	'on' the project	Initiation, design	Avoidance	Investment option	Option to phase.	Probability of success, government funding, new environmental or other regulations.
(Ford, et al., 2002)	Techne, (Topic: valuing design strategy alternatives in construction)	'on' the project	Initiation	Avoidance	Investment	Option to grow; develop a project by means of a flexible design strategy.	Construction costs, planning and design costs, estimation of increases and decreases in prices.
(Zhao & Tseng, 2003)	Techne, (Topic: construction of a parking garage)	'on' the project	Initiation	Avoidance	Investment	Option to grow; a strong foundation enabling extra levels.	Demand for extra parking spaces.
(Ng & Björnsson, 2004)	Techne, (Topic: construction of a toll road)	'on' the project	initiation	Avoidance	Investment	Option to grow; to expand the number of lanes.	Market value of toll road, difficult geology.
(Engel & Browning, 2008)	Techne	'in' the project	Design	Reduce, avoid	Investment	Valuation of software systems' architecture and option to upgrade.	Technology advances in components, stakeholders' desires.

Bartolomei et al.(2006) recognise the contextual influence of stakeholders, but also use *techne* knowledge by drawing on decision-support models developed by other authors. Engel and Browning (2008) are the only authors we have found that explicitly use stakeholders' loss of values as a reason to exercise an option. Stakeholder influence is lacking in the literature on large engineering projects, such as in the works of Zhao and Tseng (2003) and Ng and Björnsson (2004), and is therefore criticised by Alessandri et al.(2004). The criticism addresses the assumption of the independence of option holders and of underlying uncertainties. Uncertainties, it is argued, can often be influenced by option holders, such as when a project is behind schedule and the contractor can use overtime to reduce this risk. This is another reason for mapping all types of real options. Further, each participant in a construction project attaches importance to various risks and benefits (Ford, et al., 2002). As such, they argue that options have to be analysed from the viewpoint of a specific stakeholder, and in their work this happened to be the general contractor.

De Neufville (2003) emphasises that, unlike with financial options, when it comes to systems planning and design, there is no menu of available options. Instead of valuing options, one is more concerned with determining when and how to implement possible options. "The primary benefit of a real options analysis may not be project valuation, or quantifiability, but the process of describing and understanding the project and the uncertainty embedded therein" (Alessandri 2004, p.758). De Neufville et al.(2008) use a *techne* type of knowledge to indicate whether a real option would be of value to a project and thus worth investing in, but also state that this knowledge should be used to guide decision making and not viewed as a static fact. Real options can thus be used in decision making in several ways, and clearly not solely as a justification for a certain investment. As such, it is one of several sources of information and adds to the *phronetic* type of knowledge.

Ford et al.(2002) recommend that, when applying real options in large engineering projects, "more research should be done on and the relationship between flexibility in project strategies, flexible corporate strategies, and meeting corporate objectives" (Ford et al.2002, p.350). This is what CREM research tries to achieve. By combining these approaches, improved *phronetic*-type knowledge can be developed that includes both societal and organizational interests as well as technical tools to assist in developing flexible real estate strategies.

2.4.3 Real options in project coalitions and healthcare infrastructure

Project coalitions are an important subject in construction project management. Within a project coalition, the real estate manager often has a coordinating function and is expected to safeguard the interests of the client. The organization of the construction process and other tasks in the design, construction and maintenance of a building make up a large part of a real estate strategy. A project coalition is a means to mitigate uncertainty through agreements between the client and contractors on transferring risks, with flexibility a key issue: who will be responsible for changes in the building or ancillary services? Some authors have proposed using real options analysis in project coalitions and therefore we provide a short overview in Table 11. The limited literature that is available on the application of real options in healthcare infrastructure is also included in this table since most papers propose obtaining flexibility by means of a project coalition.

The literature on real options in project coalitions is, as far as we could determine, confined to the public-private partnership type of project coalition in large engineering projects. Build-Operate-Transfer (BOT) agreements are the most commonly applied project coalition type in public private partnerships (Liu & Cheah, 2009). The reason why real options are mainly applied in public-private partnerships (PPPs) is that these are long-term agreements where the division of risks play a large role and the potential benefit of implementing real options is apparent. The real options approach is seen as valuable since it provides an effective way to divide costs and benefits between the public and private partners. The remunerations defined in a PPP are considered as real options. This should create a contractual incentive to reduce the risks for the contractor and therefore stimulates to invest by the contractor, and to also meet the interests of the public partner by avoiding excessive costs for flexibility (Park, Kim, & Kim, in press).

Although all the papers identified provide a quantitative model for valuing real options, and therefore provide a *techne* type of knowledge, they also relate to *phronetic*-type knowledge since the various authors propose real options as a means to create incentives for private partners to cooperate in PPPs, and thus incorporate values associated with these stakeholders. The mechanism that often results in a lack of trust in PPPs is analysed and the structure of real options is seen as a means to mitigate the negative consequences of that mechanism. The mechanism concerned in the case of a BOT-type agreement is the third party guarantor (TPG), which is a revenue guarantee issued by the government to

the contractor to cover any revenue shortfall during a specific operating period. If the private participant believes the revenue guarantee is insufficient to cover operation and maintenance costs, it will opt out of BOT-type projects (Chiara, Garvin, & Vecer, 2007). In the example given by de Neufville et al. (2008) on a hospital PFI project, using real options provided insight into the flexibility needed to be built in by the contractor in order to provide optimal flexibility to the public partner who would then receive optimal value for money. These provide practical examples of real options 'in' the project. However, a condition for exercising these options, i.e. making use of flexibility, was that the public private partnership needed to shift away from the 'fee-for-service' agreement between client and contractor, which is only focussed on cost reduction, and focus more on value delivery throughout the lifetime of the building. Another attempt to incorporate the practitioner context into the model in order to enhance its practical use was made by Garvin and Cheah (2004) who proposed a simpler method of valuing real options that included calculating NPVs as already done by practitioners. A similar real option valuation method was proposed by Huang and Chou (2006) although this is far more complicated. All these methods aim to define the revenue received by the contractor. While real options valuation models are often presented as if this is the aim in itself, and independent of context, Garvin and Cheah (2004, p.373) emphasise that "the selection of a valuation model depends critically upon the characteristics of a project's variables and that informed judgment remains an integral part of the decision making process". That is, in practice, each real option valuation problem is unique (Bowman & Moskowitz, 2001), and "any general representation can, at best, capture just a few of the most salient common features of the problem" (Miller & Shapira, 2004, p.281).

Table 11. Literature on real options applied in project coalitions and healthcare infrastructure

Literature	Knowledge system	Categories in projects	Phase	Risk mitigation strategy	Taxonomy	Real options	Uncertainties underlying real options
(Park, et al., in press)	Techne (Topic: BOT in water and sewer infrastructure)	'on' the project	Initiation	Reduce	Investment, contract	Revenue support with a minimum revenue guarantee and indirect cash flow support with maximum expense limit.	Revenue, O&M spend, price index tied to the tariff.
(Garvin & Cheah, 2004)	Techne (Topic: BOT in tollroad project)	'on' the project	Construction, operation	Reduce	Investment/ disinvestment, contractual, operational option	Option to defer timing of investment.	Demand elasticity, growth.
(de Neufville, Lee, et al., 2008)	Techne (Topic: PPP in hospitals)	'in' and 'on' the project	Design, operation	Reduce	Investment/ disinvestment, operation option	Option to grow, option to abandon a part.	Changes in demand by demography, advances in medical technology, epidemiological factors, regulation and policy.
(Maseda, 2008)	Techne (Topic: hospital emergency departments)	'in' the project	Design, operation	Reduce	Investment/ disinvestment option	Option to grow; to expand the capacity of emergency departments. Timing of exercising option.	Demand.

(Cruz & Marques, 2012)	Techne (Topic: PPP contract flexibility in hospitals)	'on' the project	Design	Reduce	Contract option, operational option	Option to scale up or down space and resource distribution of ambulatory healthcare services and inpatient treatments, timing of exercising option.	Demand.

2.4.4 Improving option thinking by practitioners

As mentioned, the real options concept is less commonly adopted by practitioners than one would expect given the added value that one can derive from all types of models. This is certainly the case in health care real estate management. To increase the usefulness of the real options approach in architecture, engineering and construction, Ford and Garvin (2009) have suggested some measures. They state that confusion over real option models is heightened by the different assumptions that underlie these models. Often one finds that only one driver of uncertainty is used in ROR models, despite this failing to sufficiently reflect the complexity of construction projects. However, adding more variables results in more complicated models, which will again hinder acceptance. To achieve greater acceptability, models thus need to be improved. Another drawback according to Ford and Garvin (2009) is that ROR models stay far from Architecture-Engineering-Construction project management practice. A measure that should create greater acceptance of ROR models would be to use existing project management concepts, tools and methods when modelling real options. This approach is different from the measure to improve ROR models by means of adding more variables, in that it tries to improve the options thinking skills of practitioners by 1) improving their understanding of and intuition about real options, and 2) providing practical heuristics that reflect both real options theory and practice (Ford & Garvin, 2009, p.67). In this research, we mainly focus on the second measure of improving the options thinking skills of practitioners to enhance the use of the real options concept.

CREM as an analytical framework addresses the various values present in an organization, and as a profession it facilitates these values by means of various real estate strategies (Nourse & Roulac, 1993). Real options need to be analysed in the specific context of an organization, on their ability to be created and exercised, since the conditions to create and exercise them are context dependant. In each situation, the consequences for the various stakeholders can be different, and will differ in each case to the extent that real options can facilitate certain values. In this way, real options analysis, generating a *techne* type of knowledge, can be used to map various values and interests related to real estate and to support decision making over measures regarding flexibility.

2.5 Sensemaking and real options

The literature review above shows that little research has been done on explaining real options reasoning in practice, and even less research on developing heuristics for using real options. Our aim is thus to contribute to research on this subject, and thereby to focus on the use of real options by real estate managers in healthcare projects, including in the development, construction and exploitation of real estate. Conditions and values are needed to create heuristics and to make real options applicable in practice. For this, *phronetic*-type knowledge is needed. Sensemaking is a useful theory when researching *how* practitioners make sense of real options. Sensemaking is a process through which awareness of needed flexibility can be turned into concrete real estate strategies, and "involves turning circumstances into a situation that is comprehended explicitly in words and that serves as a springboard into action" (Weick, Sutcliffe, & Obstfeld, 2005, p. 409). By investigating which arguments practitioners use in selecting certain measures to deal with uncertainty, and how real options reasoning fits within this practice, insight can be gained into the applicability of ROR and, subsequently, heuristics can be developed for use by other practitioners. A holistic approach to decision making through real options is adopted in this research. Flyvbjerg (2001, p.137) states that "phronetic research focusses on both the actor level and the structural level. Actors and their practices are analysed in relation to structures and structures in terms of agency, not so that the two stand in an external relation to each other, but so that structures are found as part of actors and actors as part of structures. Understanding from 'within' and from 'without' are both accorded emphasis". We will examine how uncertainties external to an organization, such as long-term developments in governmental policies, as well as shorter term developments in the organization and characteristics of the decision-makers themselves influence decision making concerning flexibility.

As discussed earlier, interests regarding flexibility differ within an organization. A complicating factor is the uncertain future that is demanding flexibility since interests might change. Therefore, this research focusses on how real estate managers can align these interests in developing a real estate strategy that reflects these mixed interests. Sensemaking (Weick, 1993) is seen as a crucial mechanism in reaching a shared understanding and enabling strategies to be developed and executed based upon that.

Sensemaking is undertaken by individuals in interaction with others, each having their own socially constructed reality based upon their experiences. This is thus very context-

specific, as is the starting point in creating *phronetic*-type knowledge. Sensemaking takes place within a 'flow' of actions in which 'cues' are recognised. Cues are noticeable events that demand further attention because they provide the observer with a sense of cognitive dissonance that requires further investigation in order to mitigate this dissonance. The process through which these cues are noticed, interpreted through the activity of determining what the noted cues mean, and then externalised through concrete activities is called sensemaking. Noticing cues is the result of "shocks' that 'stimulate people's action thresholds to pay attention and initiate *novel* action" (Schroeder, Van de Ven, Scudder, & Polley, 1989, p.123 in: Weick 1995). Further, a shock might consist of several smaller shocks. Change or innovation does not take place at one moment. The two most common states that generate shocks leading to sensemaking are ambiguity and uncertainty.

Sensemaking appears in four forms, two of which are belief driven, divided into arguing and expecting, and two that are action driven, divided into committing and manipulating. Arguing can result in sensemaking by people challenging each other with their beliefs and, in that way, clarifying new ideas. Beliefs can also be embedded in expectations that guide interpretations and affect target events. These beliefs resemble those of action rationality rather than decision rationality, and are more strongly felt and more directive than arguments. Sensemaking in the form of committing starts with an action for which the person is responsible. Action that makes a visible change in the world that requires an explanation is labelled manipulation. The main difference between the two is that commitment deals with one action and manipulation with various simultaneous actions (Weick 1995).

The aim of this research is to determine whether and how following a real options structure when reasoning adds to sensemaking of flexibility. We want to research which aspects of real options lead to increased sensemaking when it comes to decision making over flexibility under conditions of uncertainty.

2.6 Final remarks and conclusions

Healthcare systems worldwide face many uncertainties due to socioeconomic changes, new diseases, technical developments and policy changes. A major policy change in the Netherlands is the marketization of the healthcare system which implies a major leap from hardly any need for strategic real estate management towards very efficient real

estate management. In order to maintain an effective real estate, in the sense that it facilitates all interests in the organization and not just the financial aspect, a Corporate Real Estate Management approach needs to be adopted that aims to match the current and future demands and supply of real estate. Flexibility is an important aspect of real estate strategies in that it enables adaptation in response to uncertainty. Various authors have proposed different methods to develop real estate strategies but these methods fail to provide an oversight of all the flexibility types or explain *how* and *when* this flexibility would be assessed and implemented.

The real options theory could provide a useful framework to assess flexibility. Since we are also interested in the development and construction of real estate, an aspect often absent in the CREM literature, we also included literature on large engineering projects and real options in our literature review. Project delivery systems are also an important factor in the availability of real options and so we include these in our review. We used the knowledge system proposed by Flyvbjerg (2001), which comprises *episteme, techne* and *phronetic* types, to analyse the types of knowledge that have been produced on the various subjects. It appears that technocratic, but also practical, *techne*-type knowledge has been produced on the subjects addressed. Nevertheless, this can be useful in creating *phronetic* knowledge that incorporates the values of the stakeholders involved and which, as such, is always context-specific. Although this knowledge is context-specific, it is possible to derive heuristics which prescribe in a more general way how to act in a certain situation. The concept of CREM provides a framework to create *phronetic*-type knowledge since it considers the interests and thus the values of various stakeholders. The real options concept provides a way of thinking about flexibility in dealing with those future uncertainties, and to assess the consequences of them for the various interests and values found in CREM in the health sector.

Given the problem statement and the findings of the literature review, our research will aim to further investigate the applicability of real options in practice. As a first step, we will create *phronetic* knowledge by carrying out case studies to see whether, why and how real options are already being used or might be used in the future. This should lead to the development of heuristics on the application of real options in other organizations. In this way, real estate management should become more resilient to changes, leading to a more efficient and effective healthcare system.

3

PROJECT COALITIONS IN HEALTHCARE CONSTRUCTION PROJECTS AND THE APPLICATION OF REAL OPTIONS: AN EXPLORATORY SURVEY[3]

Abstract

Objective: Exploring the impact of the type of project coalition on types of flexibility by analysing considered and exercised flexibilities in separated and integrated project coalitions in the design and construction phase and the operations and maintenance phase of a healthcare construction project.

Background: Flexibility in healthcare construction projects is increasingly needed in order to deal with to growing uncertainties. Till now, little research has been carried out on how and to what extent flexibility is incorporated in different types of project coalitions chosen by health organizations.

Methods: An exploratory survey was conducted among health organizations in both cure and care. Questions were asked on the position of the real estate department within the organization, the type of project coalitions chosen and the rationale behind this choice, and the extent to which flexibility in terms of a real option was considered and to what extent it had been exercised in a project coalition.

Results: Integrated project coalitions pay more attention to flexibility: they consider and exercise more types of real options than separated project coalitions. In integrated project coalitions real options for process flexibility is considered more but exercised less than the separated project coalitions. The economic feasibility of real options is higher in integrated project coalitions.

Conclusions: The study shows that real options thinking is already incorporated in real estate management of healthcare organizations, although more flexibility is considered in advance of the project than is actually realized during and after construction.

Keywords: hospitals, care organisations, project coalitions, flexibility, real options

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3.1 Introduction – the need for flexibility in real estate management

Worldwide, healthcare is confronted with many uncertainties, such as changes in populations, in patterns of disease, in opportunities for medical intervention with new knowledge and technology, and in public and political expectations (McKee & Healy, 2002). Due to these changes, healthcare assets need to be flexible. In most western countries, flexibility is becoming a vital strategy due to the increasing healthcare costs and major policy changes that are stimulating marketization, a more business-like operation of health organizations. In the Netherlands, for instance, marketization is seen as a major means with which to limit costs. In 2008, marketization received a fresh impulse with new regulations resulting in an increase in the importance attached to efficient and professionalized real estate management (Bellers, 2008; Raad voor de Volksgezondheid en Zorg, 2006). Real estate decisions involve balancing the flexibility needed to meet an organization's and its users' needs, now and in the future, with controlling time, costs, and quality by not allowing excessive flexibility, to which we refer as Corporate Real Estate Management (CREM).

Real estate decisions have a long-lasting effect while the demand for clinical services will fluctuate during the lifetime of a hospital. Healthcare assets require long-term investments and the risks are inevitably high. For this reason, given the uncertainties surrounding healthcare, flexibility has become an important issue in healthcare real estate management (Blanken, 2008; de Neufville, Lee, et al., 2008; Rechel, et al., 2009). Flexibility in healthcare assets is needed in order to enable easy adaptation to the demands of the changing environment (Kreiner, 1995; Olsson, 2006a; Rechel, et al., 2009; van Iersel, 2005). The way assets are provided has a major impact on future flexibility.

Healthcare assets may be procured in various ways ranging from traditional or conventional procurement towards integrated service delivery. Dewulf and Wright (2009), when discussing procurement systems, showed that project coalitions are an important mechanism for creating flexibility in health organizations. A 'project coalition' concerns the organization of resources needed for a construction project, and the division of tasks, risks and responsibilities between phases and among the parties involved (Winch, 2010). Different phases of a building process are development, construction, maintenance and operation. The project coalition, and the way it is shaped by agreements among the participating parties, determines the extent to which real estate can be adapted and thus the types of flexibilities that can be exercised.

Health organizations may opt to organize construction projects using traditional procurement and construction approaches in so called separated project coalitions (ibid, 2009). In a separated project coalition all subsequent tasks are procured after each phase of a building process requiring a number of separated contracts. The client bears most of the risks and the responsibilities remain in-house. In an integrated project coalition, several tasks are integrated into a single contract between client and external provider of assets. More integrated project coalition forms including the transfer of risks and responsibilities to external providers (such as Public Private Partnerships (PPP) or Design Build Finance Operate Maintain) are argued to be beneficial for health organizations (Van Beek et al. 2010). However, given the mixed experience with PFI schemes in the UK, and the lack of experience in the Netherlands with such approaches, integrated forms of project coalitions are applied less often.

The type of project coalition between the client and the external provider of assets includes mechanisms that provide flexibility, in both the product and the process. This can be enabled by agreements with contractors within the contract (Madhok, 1995) and the way cooperation functions within the coalition. Flexibility can be created through flexible innovations designed by the coalition. Making adjustments within the building during its operational life might also be a task for a project coalition. Further, within the early phases of a construction project, uncertainties are still high (Winch, 2010) and therefore flexibility is important.

Till now, little research has been carried out on how and to what extent flexibility is incorporated in different types of project coalitions chosen by health organizations. This applies to both the design and construction phase of a project, and to the operations and maintenance phase of real estate. It is expected that there will be a difference between separated and integrated project coalitions in terms of types of flexibility considered and actually exercised. Furthermore, it is expected that considered and exercised flexibilities in project coalitions will be different in the design and construction phase of a project compared to the operations and maintenance phase.

The aim of this paper is to explore the impact of the type of project coalition on types of flexibility by analysing considered and exercised flexibilities in separated and integrated project coalitions in the design and construction phase and the operations and maintenance phase of a healthcare construction project. We carried out an exploratory

survey among Dutch organizations involved in cure and care services because there is no information available on how health organizations currently deal with flexibility in their real estate projects. Further, there are no overviews of which project coalition forms are being selected and used and which considerations underpin these decisions. The survey aimed to answer the following research questions:

- What types of project coalitions are chosen for the development, construction, and operation of real estate in both cure and care sectors?
- What is the rationale behind the type of project coalition chosen?
- What types of flexibility are considered within separated and integrated project coalitions and to what extent are they actually exercised within these project coalitions?

To be able to analyse the types of flexibility we applied the real option theory to healthcare real estate decisions (Amram and Kulatilaka, 1999).

In the following section, on the conceptual framework, we elaborate more on the above-mentioned subjects. After the methodology section, which also discusses the layout of the survey and the respondents, the results are presented and the research questions answered. We then conclude with general remarks on the findings and suggestions for future research.

3.2 Conceptual Framework

3.2.1 Types of project coalitions

Since real estate development is not the core business of health organizations, most related activities are outsourced to external parties within a project coalition. We follow Winch's (2010) definition of a 'project coalition' as the organization of all the various supply-side human and equipment resources needed for a construction project, and the division of risks and responsibilities among the stakeholders. Besides the relatively short-term activity of construction, other tasks such as exploitation and maintenance can also be outsourced to external parties within a project coalition through relatively long-term

agreements. Figure 7 depicts the division of tasks in the various project coalition forms seen in modern large construction projects.

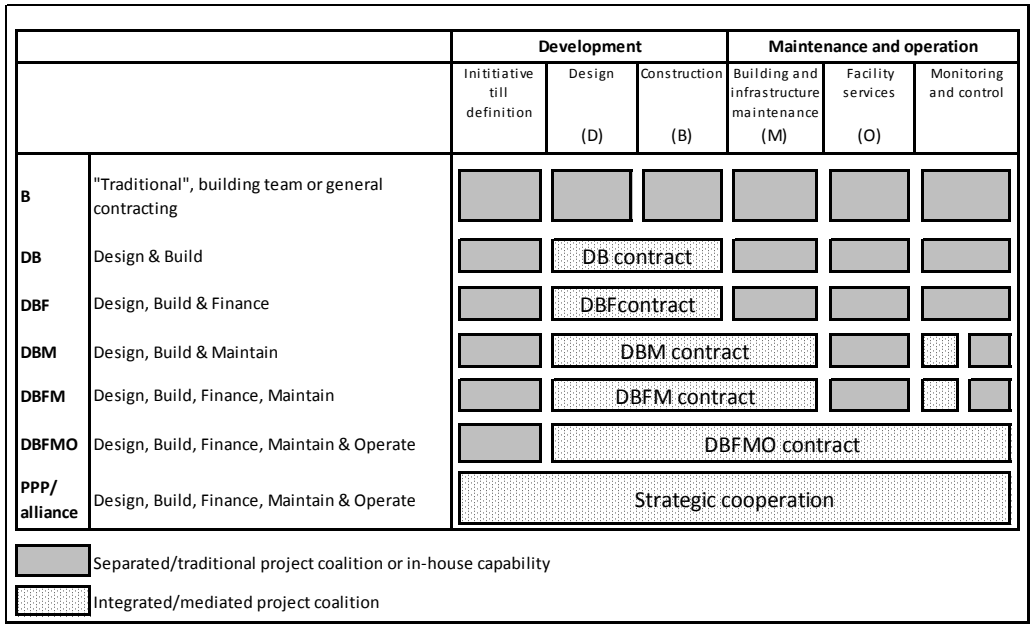

Figure 7 *Division of tasks in the various project coalition forms*

Winch (2010) describes four basic types of project coalition structures: separated, integrated, mediated, and unmediated. The *separated* form of project coalition is often referred to as traditional, in which all subsequent tasks are procured after each phase is completed. Most risks and responsibilities remain with the client. In an *integrated* project coalition, several tasks, covering aspects such as design (D), build (B), finance (F), maintenance (M), and operation (O), are integrated into a single contract, and these can be observed in several forms. Here, certain risks are transferred by the client to the contractor for a given price. In general, the influence of the client on the process is less than when using a separated project coalition. In a mediated project coalition, the client and the contractor together seek solutions and allocate risks to those best able to bear them. Pries et al. (2006) speak of a strategic cooperation when all the DBFMO tasks reside within a single coalition, often organized as an alliance. In a mediated project coalition, the client has more influence over the process than in an integrated project coalition. An unmediated project coalition requires significant in-house capabilities for real estate development and is therefore generally avoided by health organizations. In contrast to the

other project coalitions, clients directly appoint and co-ordinate several contractors and contractors themselves.

3.2.2 The rationale behind type of project coalition selected

Several considerations should be involved in choosing the type of project coalition (Adler, 2003; Hilmer & Quinn, 1994; Kakabadse & Kakabadse, 2000). Van Iersel (2005) distinguishes between three categories of considerations: the external context, the internal context of the organization, and the project context.

In the external context, we distinguish four considerations for choosing the type of project coalition. First, governmental law and regulations might enforce a certain type of procurement procedure including the form of project coalition and outsourcing, and uncertainty regarding policy might also influence the course of a project. Second, politics and society might enforce other policies and other demands on healthcare facilities. Third, trust in cooperating parties plays a role since it is an important factor in successful cooperation between parties (Laan, 2008). Fourth, the availability of competent parties is an important consideration when outsourcing.

Internal considerations such as the organizational structure and culture have an influence on outsourcing policy regarding real estate assets and therefore on the project coalition selected. Further, the financial position of an organization may be important, as might organizational changes such as mergers and acquisitions (Buono, Bowditch, & Lewis, 1985; Kiers, 2011). Finally, knowledge, experience, and capacity will influence decisions on which tasks to keep in-house and which to contract out.

The project context is the third contextual perspective. Common performance indicators such as money, time, and quality cannot be ignored. A client's influence on a project will be less with certain project coalition forms and outsourcing strategies, and a loss of control over critical functions might be considered undesirable. A complex project involves many risks and often a desire for innovative solutions. Therefore, with a complex project, a client may opt for an integrated or a mediated project coalition since these are thought to generate innovative solutions (Eaton, Akbiyikli, & Dickinson, 2006; Winch, 2010). The division of risks in a specific project coalition has also to be considered here since this is related to the coalition form selected.

The internal, external, and project considerations will influence the choice of project coalition type since they offer various potential organizational structures regarding the management of real estate. In this study, the survey provides an indication of considerations that are important in selecting the type of project coalition, in both cure and care organizations, using these three contextual perspectives.

We also investigate the relation between the position of the CREM department in the health organizations and the types of project coalitions selected. Based on research in the services and production industry, Krumm (2001) provides a typology of corporate real estate units having different positions within the organization:

- Centralized real estate department, enabling production and corporate expansion. Here, the main task is to control construction activities, both technically and financially. All activities are kept in-house.

- Decentralized real estate unit, resulting in the establishment of internal service departments to provide services to the users with regard to accommodation. Most services remain in-house.

- Renting rather than owning real estate, often as a consequence of needing to allocate more money to core activities. As a result, services can be outsourced, and corporations increasingly outsource the organization of non-core activities.

- A coordinated corporate knowledge centre, aimed at the external coordination of alliances with service providers and the internal alignment of real estate resources and capabilities to obtain maximum added value for the organization.

We use these categories to provide an indication of the position and development of CREM departments of health organizations.

3.2.3 Flexibility and real options

Flexibility is a broad concept (Olsson, 2006) and various types of flexibility can be recognized and categorized, as for example for healthcare facilities by Carthey et al. (2010). De Neufville et al. (2008) focused on managerial considerations related to flexibility, and distinguished strategic, tactical, and operational product flexibility. Strategic flexibility refers to changing the configuration of an asset to enable long-term

real estate strategies. For instance, a hospital can be designed in a way that an expansion of the hospital can take place incrementally, by leaving sufficient space on the site to meet possible needs (Blanken, 2008, p. 96). Tactical flexibility enables adaptation of the building without changing the overall size and functionality. Operational flexibility involves changing building use on an ad hoc basis. The type of project coalition chosen is an important factor in creating different types of flexibility in both the product and the process. A promising approach for providing insight into and categorizing different types of flexibility is the real options theory (Gehner, 2008; Olsson, 2004; Vlek & Kuijpers, 2005). A real option is defined as a right, but not an obligation, to exercise an option, and derives from the idea of financial options (Black, 1973). Myers (1977) applied options to *real* investments: so-called real options. Real options provide value through the ability to be flexible, a value that increases as uncertainty increases.

Real options analysis (ROA) (Adner & Levinthal, 2004b; Leiblein, 2003) is promising for three reasons. First, real options, as a way of thinking, help real estate managers recognize that uncertainty is not inherently negative, and can even provide value. Second, many uncertainties in health are unpredictable and therefore difficult to quantify. ROA can be used to assess uncertainties in an easy and qualitative way without requiring the competences to use complicated risk analysis tools. Another advantage is that the categorization of real options might simplify communication on flexibility, and the need for it, as well as helping identify appropriate mechanisms that can be mobilized to create flexibility. As such, ROA provides a language on flexibility that facilitates communication between different decision making levels. For example, the project management team of an organization can more easily provide insights into the consequences of certain decisions for the board of the organization.

Based on Fichman et al. (2005), Sommer and Loch (2004), Winch (2010) and Amram and Kulatilaka (1999), the following major types of real options can be recognized in project coalitions: 1) the option to stage, enabling go/no-go moments in a project on whether to continue; 2) the option to abandon, enabling the project to be terminated for reasons such as being no longer commercially rentable; 3) the option to defer, creating flexibility to wait until more information is available and then adapt the project (this is enabled by the stage option and is therefore not included in the survey); 4) the option to grow, in which the initial investment leaves open an opportunity to expand the building, or to shrink it by disposing of parts if not required; 5) the option to scale up or down, creating the

opportunity to capitalize on success by scaling the building up, or downsizing when spaces are not used, or scale up or down the provision of services when demand changes 6) the option to switch, enabling a change of function within the building when in use, or a change in the design in the design phase; and 7) the option to accelerate the process, for example by executing multiple development and construction tasks in parallel. We added a further option of lengthening the duration of a project as a further option to reduce uncertainty by waiting until more information is available. The distinction to the defer option is that some aspects of the project continue while other aspects may be deferred until more information is available or disputes resolved among stakeholders.

De Neufville et al. (2008) distinguish between real options 'on' projects and those 'in' engineering systems, which can be seen as synonymous with process flexibility and product flexibility. Real options 'on' projects relate to the process of creating flexibility and are associated with real options such as to defer, to abandon, to accelerate, and to stage. Real options 'in' engineering systems deal with technical solutions within the products, such as real options to switch, to scale up or down, to grow, and to change the design. These real options can generate operational, tactical, or strategic flexibility as described earlier.

3.3 Research Design

The aim of this paper is to explore the impact of the type of project coalition on types of flexibility by analysing considered and exercised flexibilities in separated and integrated project coalitions in the design and construction phase and the operations and maintenance phase of a healthcare construction project. We conducted a survey among Dutch health organizations and distributed a questionnaire to 76 cure and 148 care organizations. The survey of cure organizations was targeted at those who had attended a conference on DBFMO. Of the potential 76 participants, 62 were from hospitals, and the remainder from other organizations. After excluding all but the first respondent from each hospital, we had 22 useable responses, equivalent to a response rate of 35%. The survey for care organizations covered the largest such organizations in the Netherlands. We contacted 150 organizations (the 50 largest health organizations in each of the elderly care, mental care, and youth care sectors) to ask for contact details of the board member responsible for real estate or the head of the real estate department. This resulted in

contact details for 136 organizations. After a reminder, we ultimately received 23 responses, a response rate of 17%.

The 22 hospitals that did respond to the survey request varied in size, number of employees, turnover, beds, and floor area. Roughly half of the hospitals had an annual turnover in excess of €100 million (see Table 12). Most care organizations cover relatively large surface areas, which can be explained by more space being needed for the living function as against hospital treatment. For this and other reasons, the care sector has many more locations than the cure sector. Most hospitals have only one or two locations, although one did claim to have two main locations and five smaller ones. One hospital with only one location noted that, in the near future, it would have three. In the care sector, on the contrary, most organizations had many locations with various functions.

Table 12. Characteristics of respondents

Floor space (1000 m2)	*Employees*	*Turnover (millions)*	*cure*	*%*	*care*	*%*
> 75	10.000+	> € 500	1	5	0	0
> 75	5.000-10.000	> € 500	3	14	0	0
> 75	5.000-10.000	€ 250 - € 500	1	5	0	0
> 75	5.000-10.000	€ 100 - € 250	0	0	1	4
unknown	5.000-10.000	€ 50 - € 100	0	0	1	4
> 75	2.500-5.000	€ 250 - € 500	1	5	1	4
> 75	2.500-5.000	€ 100 - € 250	6	27	7	30
> 75	1.000-2.500	€ 100 - € 250	1	5	2	9
> 75	1.000-2.500	€ 50 - € 100	0	0	6	26
45-60	1.000-2.500	€ 100 - € 250	1	5	0	0
45-60	1.000-2.500	€ 50 - € 100	0	0	2	9
45-60	500-1.000	< € 50	0	0	1	4
30-45	1.000-2.500	€ 100 - € 250	1	5	0	0
30-45	1.000-2.500	€ 50 - € 100	2	9	1	4
30-45	500-1.000	< € 50	0	0	1	4
15-30	500-1.000	€ 50 - € 100	3	14	0	0
3-15	0-500	< € 50	2	9	0	0
Total			22	100	23	100

In order to answer the research questions, we organized the questionnaire as follows. First, we asked for the function of the respondent in order to be able to value their answers. Further, to indicate the type of organization completing the survey, we asked for characteristics of the organization. Second, we asked for the position of the real estate department within the organization, and what was taken into consideration when selecting the type of project coalition. The third aspect, project coalitions and different types of flexibility, was addressed by asking for the type of project coalition used in one specific project, to be chosen by the respondent, the extent to which flexibility in terms of a real option was considered in the project coalition, and to what extent it had been exercised. The value of a real option was operationalized by asking for the extent to which the economic feasibility of the options was considered and to what extent the economic feasibility was proven. We categorized flexibility types using the real options concept, and the question applied to both the construction and the exploitation phases. Throughout the survey, we asked for explanations of the answers. The questionnaire is shown in Appendix B.

3.4 Results

3.4.1 Types of project coalitions chosen

This section deals with the first research question: what types of project coalitions are chosen in the development, construction, and operation of real estate in both cure and care organizations? Construction and maintenance tasks are outsourced when health organizations are not capable of doing these themselves but the different forms of project coalition determine how much responsibility and risk stays with the client. The project coalition, and the way it is shaped by agreements among the participating parties, also determines the extent to which real estate can be adapted and thus the amount of flexibility. Table 13 shows the project coalitions used by the health organizations in our survey. Most organizations opted for a separated form of project coalition. In the remainder of this paper, we therefore combine all the types of integrated project coalition under the same descriptor of integrated project coalitions and then compare results between integrated and separated project coalitions.

Table 13. Types of project coalitions used by the respondents

	Number	*Percentage*
Separated	27	60
DB	5	11
DBF	1	2
DBM	1	2
DBFM	1	2
DBFMO	3	7
Alliance	1	2
DBM with options for F&O	1	2
BM for technical infrastructure, separated for construction of building	1	2
Unknown yet	4	9
Total	45	100

3.4.2 The rationale behind the type of project coalition chosen

In this section, we deal with the second major question: what is the rationale behind the type of project coalition chosen? We present the external, internal, and project considerations made by health organizations in outsourcing and in real estate management. Next, we investigate the relation between the position of the CREM department in the health organizations and the types of project coalition selected.

3.4.2.1 External and internal considerations in real estate decisions

External and internal considerations influence the way CREM is executed. In Tables 14 and 15, we show which external and internal factors, respectively, were considered the most important in making real estate decisions. Organizations in the cure sector were asked to choose the most important consideration from a list of possibilities, whereas care organizations were asked to indicate the importance of each consideration using a five-point Likert scale. The survey in the cure sector was carried out first and based on the findings we changed the approach for the care organizations so as to gain a more complete overview. The results of the care organization survey were analysed using a Friedman test and the significance of the results is indicated below each Table.

Table 14. External considerations in selecting project coalitions

	Cure		*Care*
External consideration	***Number***	***Percentage***	***Mean n=23***
Market, availability of parties	8	35	2,7
Trust in cooperating parties	4	17	3,3
Politics and society	4	17	2,8
Law and regulations	1	4	3,4
Various considerations: asbestos clean-up, trust in parties	2	8	-
No consideration made	4	17	
Total	23	100	

Note. Care: The mean ranks differed significantly (X^2= 7920.00, df=3, p<=0.00)

Table 15. Internal considerations in selecting project coalitions

	Cure		*Care*
Internal considerations	***Number***	***Percentage***	***Mean n=23***
Knowledge, experience and capacity	6	26	3,8
Finance	5	22	4,3
Organization structure	4	17	3,4
Organization culture	2	9	3,0
Various considerations: finance, merger	2	9	-
Merger	0	0	1,4
No consideration made	3	13	-
Not filled in	1	4	-
Total	23	100	

Note. Care: The mean ranks differed significantly (X^2= 3201, df=4, p«0.00).

In terms of external considerations, the most important consideration according to organizations in the cure sector was the 'market and the availability of parties', while organizations in the care sector identified 'law and regulations' as the most important consideration. There is a striking difference between the care and cure sectors, with only 17% of the cure organizations considering the law and regulations as the most important consideration. A reason for this could be that the requirement to include assets in budgeting was introduced later in the care than in the cure sector.

In the care sector, finance was the most important internal consideration, but not in the cure sector. One reason for its importance in the care sector is the increasing uncertainty surrounding the financing system and obtaining loans from banks. 'Knowledge, experience, and capacity' was given as the most important consideration in the cure sector. This was anticipated given current developments regarding the privatization of real estate and the subsequent need for increased knowledge, experience, and capacity of CREM personnel.

3.4.2.2 Project-related considerations

Several considerations can be important when making CREM decisions related to a specific project (see Table 16). Money and complexity are the most important project-related considerations in cure projects, whereas money and quality are the most important in care. Finance is an important internal consideration, and logically this has impact on the project. Projects in the cure sector are often larger than care projects and so will almost certainly be more complex. The importance attached to quality might be an indicator of the increasing competitiveness in the healthcare sector.

Table 16. Project related considerations in selecting project coalitions

	Cure		*Care*
Project related consideration	***Number***	***Percentage***	***Mean n=23***
Money	5	22	4,4
Complexity	5	22	3,8
Quality	4	17	4,3
Risks (risk allocation)	3	13	4,1
No project related consideration made	3	13	-
Influence client on project	2	9	4,0
Time	1	4	3,8
Total	23	100	

Note. Care: The mean ranks differed significantly (X^2= 11088.00, df=5, p<=0.00)

Respondents were asked to select one project involving their organization and to answer the remaining questions based on this project. Since uncertainties related to financing have been identified elsewhere as obstructing the progress of projects (Plexus & BKB, 2010), Table 17 shows whether finance had been arranged for the projects selected. In fact,

in only half of the organizations had finance been structurally arranged. Reasons for not yet having loans in place were:

- Uncertainties over governmental policy; organizations were waiting for clarification.
- Waiting until problems related to balance sheet values had been reduced by governmental arrangements.
- Negotiations ongoing with banks and/or project developers and guarantee fund for healthcare organizations.
- Ongoing consultations with the Dutch 'guarantee fund for health' which had recently become the sole guarantor of bank loans.
- Costs exceed budget.
- Waiting to finalize strategic real estate plan before arranging finance.

Table 17. Finance arranged for projects among respondents, in percentage

	Yes	*Temporary*	*No*
Cure	20	7	22
Care	29	9	13
Total	49	16	36

3.4.2.3 The position of Corporate Real Estate Management (CREM)

In Table 18, we show the position of the CREM department in the health organizations investigated, and their correspondence with the typologies identified by Krumm (2001). As can be seen in the Table, most health organizations manage their real estate in either a decentralized way, shared among various facility services, or centralize them in a staff department under the board. In most cases, they had no plans to change this. Another finding from the survey is that respondents speak of the independence of CREM departments, rather than describing them in centralized or decentralized terms. For example, staff departments are centrally organized, but in some cases become independent staff departments. When analysing the position of the CREM department in the health organizations and the different types of project coalitions selected there seems to be no relation.

Table 18. Current position of the real estate department within health organizations per type of project coalition

Typology of CREM	*Position of CREM in organization*	*Inte-grated*	*%*	*separated*	*%*	*Un-known yet*	*%*
2	Limited Company					1	20
2	Facility services	3	23	6	22	2	40
2	Line service			2	7		
3 or 4	Division/independen t staff department	3	23	4	15		
3 or 4	Staff department under board	7	54	10	37	1	20
1 or 3	Project organization under board			2	7	1	20
	'Not applicable'/unclear			3	11		
	Total	13	100	27	100	5	100

Only one organization within our study organized its real estate through an independent entity within a limited liability company, although two more were planning to go down that route (see Table 19). Not many organizations were planning to reorganize their real estate but, when they were, they wanted to make the CREM department more independent, preferably as a division. Conversely, a quarter of the CREM departments were in a dependent position (Line service or Facility Services), and more than half of these organizations were not planning to change this. Overall, there does not seem to be any obvious trend in terms of positioning CREM services within the organization.

Table 19. Plans to reorganize real estate per type of project coalition

Typology of CREM		*integrated*	*%*	*separated*	*%*	*unknown yet*	*%*
2	Ltd	1	8	2	8		
3 or 4	Division/independe nt staff department	3	25	2	8		
3 or 4	Staff department under board			2	8		
1 or 3	Project organization under board	1	8	1	4		
	Yes (no specification)	2	17	2	8		
	No (no specification)	7	50	17	65	5	100
	Total	14	100	26	100	5	100

Note. Percentages are rounded off

3.4.3 Flexibility and real options

This section deals with the third major question: What types of flexibility are considered within separated and integrated project coalitions and to what extent are they actually exercised within these coalitions? Using the real options concept, we consider the types of flexibility considered and exercised, in the cooperation between the parties in the project coalition, in the various phases of a project.

3.4.3.1 Real options considered and used in project coalitions in the design and construction phases

Agreements made within a project coalition create process flexibility in the various phases of a project. In the design and construction phase, real options 'on' the project play a large role. When moving to the exploitation phase, the real options 'in' the project become more important. Process flexibility creates product flexibility through agreements on adapting the product when necessary. As such, process flexibility is a condition for exercising flexibility in the product or, as phrased in the theoretical framework, so-called real options 'in' the real estate.

We asked the participants in our survey to evaluate each option, on a scale of 1 to 5, on the extent to which it was considered in advance in the project coalition, and to what extent the option was exercised. A score of 1 means that it was 'not considered/exercised' and a 5 indicates that it was 'to a large extent considered/exercised'. In some instances, respondents only evaluated 'consideration', for example because the project had yet to start. In Table 20, the average scores shown reflect only those instances where a 'mark' was given. From the table, we observe that, on average, the difference between considered and exercised flexibilities is larger in integrated project coalitions than in separated project coalitions. Most organizations do consider flexibility, but the integrated project coalitions consider on average 91% of all the real options, and the separated project coalitions only 71%. The integrated project coalitions had exercised 73% of the real options, and the separated ones only 45%.

Table 20. Average ratings of options for separated and integrated project coalitions in the development and construction phase

	Real options	*Project coalitions*	*Considered*	*Exercised*	*Difference*
Options 'in' the real estate	Switch	Integrated	4,1 (n=13)	3,3 (n=11)	-0,8
		Separated	3,3 (n=23)	2,6 (n=18)	-0,7
	Grow	Integrated	3,5 (n=11)	2,4 (n=9)	-1,1
		Separated	2,8 (n=21)	2,4 (n=18)	-0,4
	Shrink	Integrated	3,5 (n=11)	2,0 (n=9)	-1,5
		Separated	2,7 (n=21)	2,2 (n=18)	-0,6
Options 'on' the project	Defer	Integrated	3,6 (n=11)	1,6 (n=11)	-2,0
		Separated	2,6 (n=17)	2,0 (n=17)	-0,6
	Abandon	Integrated	2,8 (n=13)	1,7 (n=9)	-1,2
		Separated	2,8 (n=22)	1,9 (n=18)	-0,9
	Accelerate	Integrated	2,8 (n=12)	2,0 (n=9)	-0,8
		Separated	2,5 (n=20)	1,8 (n=16)	-0,7
	Lengthen	Integrated	2,7 (n=12)	2,0 (n=9)	-0,7
		Separated	2,6 (n=20)	2,2 (n=16)	-0,3

Note. Rating on a scale of 1 to 5

As Table 20 shows, of the real options, changing the design was, by far, the most considered and exercised in both types of project coalitions, and especially applied in the integrated project coalitions. Changing the design is often a reason to lengthen a project, the option showing the least difference between the extent of it being considered and exercised. On this basis, it seems that health organizations have a good insight into the probability of extending the duration of a project.

The options to grow or to shrink were also widely considered, especially in the integrated project coalitions. In our sample, it seems that the probability of needing to grow or to shrink was equally perceived by the organizations. These options were less often exercised, but still more often than the 'on' the project real options. One reason that the options had not been exercised could be that these options can be exercised later during the operation phase. Before exercising the option to change a design, one might expect the option to defer would be equally considered and exercised since changes in the design often lead to deferral of the project. However, this was not the case.

Given the uncertainties affecting healthcare, one would expect the defer option to be seen as important. Indeed, our results show that it is the most considered after the option to change the design. The option to abandon was less often considered. However, the options to defer and to abandon were both more or less equally exercised, albeit infrequently. In three projects with a separated coalition, the option to abandon was exercised to a significant extent (scores of 4 or 5). This is striking since we would expect boards to be very reluctant to abandon a project because these are often once in a lifetime opportunities to which many interests are connected. This reason could also explain why organizations do not defer that often since deferment has similar negative consequences to abandoning. Separated project coalitions consider and exercise the option to accelerate less often than integrated project coalitions. Notably, one respondent claimed not to have considered this option but then to have exercised it to the maximum extent. It is noticeable that integrated project coalitions consider each real option for process flexibility more, but exercise each option less, than the separated project coalitions.

3.4.3.2 Real options considered and exercised in the operation and maintenance phases of project coalitions

The grow, scale, and switch options are real options 'in' the real estate and are most relevant in the operation and maintenance phase. The scaling up and down, and grow and shrink, options create strategic flexibility facilitate the long-term real estate strategy. In order to keep the questionnaire short, we operationalized the grow and shrink options but not the scaling one. We did this by asking whether the possibility to expand or shrink the building has been considered and exercised in the project coalition. Further, the switch option can provide flexibility on the tactical and operational levels, and this was operationalized by asking whether spaces could be used for other functions or be adapted by means of removable walls for example. We operationalized the value of the real options by asking for the extent to which the economic feasibility of the options was considered and to what extent the economic feasibility was proven. Questions on the economic feasibility of the switch option provided some interesting findings: while the feasibility of this option appeared to be nearly the same when actually exercised as when considered in advance by the integrated project coalitions, the feasibility was much lower in practice than when considered in advance in the separated project coalitions. Where the economic feasibility appeared to be lower than considered in advance, it can be questioned whether the real option had enough value and therefore should have been

invested in. Not all respondents were able to comment on the extent to which an option was exercised or its economic feasibility proven. Organizations that had not yet chosen a project coalition form, or had not completed this part of the questionnaire were excluded from the analysis. The results are shown in Table 21. There is closer agreement between the scores for considering and for exercising the switch option than for the option to grow.

Table 21. Average ratings of options for separated and integrated project coalitions in operation phase

Real options and feasibility	*Project coalitions*	*Considered*	*Exercised*	*Difference*
Option to grow or shrink	integrated	3,7 (n=11)	3,0 (n=4)	-0,7
	separated	3,2 (n=22)	2,7 (n=18)	-0,5
Option to switch function	integrated	3,9 (n=13)	4,2 (n=10)	+0,3
	separated	3,4 (n=22)	3,0 (n=17)	-0,4
Economic feasibility Considered and proven	integrated	3,9 (n=13)	3,8 (n=5)	-0,1
	separated	3,5 (n=22)	2,5 (n=17	-1,0

Note. Rating on a scale of 1 to 5

3.5 Discussion

Through an exploratory survey we have explored the relation between the types of project coalitions selected by health organizations and the real options considered and exercised in the design and construction phase of a project and the operations and maintenance phase.

Our first question was what types of project coalitions are chosen in the development, construction, and operation of real estate in both the cure and the care sectors. Our study shows that two-thirds of the organizations arranged construction projects in the form of separated project coalitions while one-third opted for integrated project coalitions.

Second, we focused on external, internal, and project aspects considered by health organizations as clients in selecting project coalitions and the potential effect of the position of Corporate Real Estate Management (CREM) within these organizations on this selection decision.

Law and regulations form an important external consideration in the care sector. These are changing, and certain competences are required to deal with this. As such, this might be an important factor in selecting cooperating parties for construction projects. However, most organizations opted for the separated project coalition form where more tasks and responsibilities remain with the client. One reason could be that health organizations recognize that the availability of parties is an important factor and see a lack of competent parties with which they could cooperate.

The health organizations surveyed placed the organizational structure in third place when ranking the most important internal considerations in selecting project coalitions. Here, they perceived knowledge, experience, and capacity and finance as being more important. These internal issues are linked to the consideration of issues outside the organization that are seen as the most important, namely the market and the availability of, and trust in, cooperating parties. One can conclude from this that health organizations outsource tasks related to real estate management because of a lack of knowledge within their own organization

Project-related considerations that are viewed as the most important are money, quality, and complexity. Risks and risk allocation, the influence of the client on the project, and time are less important. Therefore, a preference for integrated project coalitions was expected. In result, the high proportion of separate project coalitions is striking given that, with this form, the client in general has more influence and carries more of the risks than in an integrated project coalition.

The different positions of CREM departments as presented by Krumm (2001) are also found in health organizations. Most organizations manage their real estate in a fairly decentralized form. A small trend can be recognized toward CREM departments becoming more independent. This can be achieved in a decentralized way (by creating a limited company) or through centralization (establishing an independent staff department). Nearly one-third of the organizations investigated have their CREM departments decentralized according to the second stage of Krumm (2001). Here, tasks such as design and engineering tasks were outsourced while most services remained in-house. There seems to be no relation between the position of the CREM department within the health organizations and the type of project coalition selected.

Our third question focused on the types of flexibility considered within project coalitions and to what extent they were actually exercised within the various types of project coalitions. Regarding process flexibility in the design and construction phases, it is notable that the integrated project coalitions consider such options more often, but exercise them less, than with separated project coalitions. In other words, in separated project coalitions, the flexibility considered in advance more closely corresponds to the flexibility ultimately demanded. One reason could be that, in integrated contracts, more commitments have to be made, whereas in separated project coalitions the client has the opportunity to reconsider flexibility needs after each phase. It seems that integrated project coalitions, maybe for this reason, pay more attention to flexibility: relatively, they consider and exercise more types of real options than the separated project coalitions. Looking at the extent of the consideration given, the real options 'in' the real estate are perceived as more important than the real options 'on' the project, especially in integrated project coalitions. This reflects a practice in which design changes often occur, resulting in project deferrals, again one of the most considered options.

The difference between the extent of considered and exercised real options is often more negative in integrated project coalitions than in separated project coalitions, but still the difference in economic feasibility between considered and exercised options is more equivalent while in separated project coalitions the economic feasibility of exercised real options is much more negative evaluated than considered real options. It seems that redundancy in real options considered has less influence on the economic feasibility in integrated project coalitions than in separated project coalitions. This is striking since it is expected that costs increase as more real options are considered. Logically, the explanation should be found in the agreements made within the two different project coalition forms.

Considering the options in the operations and maintenance phases, we see that the option to switch function within an existing building is the only option that is more exercised than considered. Besides, this option has been considered and exercised most by both separated and integrated project coalitions. Regarding flexibility in the operations and maintenance phases, there is closer agreement between the scores for considering and for exercising the switch option than for the option to grow. It is apparently easier to estimate the need for tactical and operational flexibility than for strategic flexibility. This

is logical since strategic flexibility concerns the longer term and has greater implications for the building.

The large difference between the economic feasibility of all real options in both the separated and integrated project coalitions is striking. The integrated project coalitions show a strong correspondence between considered and proven economic feasibility.

3.6 Conclusions

The aim of this paper has been to explore the impact of the type of project coalition on types of flexibility by analysing considered and exercised flexibilities in separated and integrated project coalitions in the design and construction phase and the operations and maintenance phase of a healthcare construction project. In examining the real estate strategy within both separate and integrated project coalitions, we focused on the use of different types of flexibility and classified them in terms of real options. The study provided insights into the considerations taken into account by health organizations when selecting the type of coalition. There seems to be no relation between the position of the CREM department within an health organization and the type of coalition preferred.

The results show differences in the use of real options between the two types of project coalitions. The study also shows that real options thinking is already incorporated in real estate management, although more flexibility is considered in advance of the project than is actually realized during and after construction. Integrated project coalitions pay more attention to flexibility: relatively, they consider and exercise *more types* of real options than the separated project coalitions. In integrated project coalitions each real option for process flexibility is considered more but exercised less than the separated project coalitions. In other words, in separated project coalitions, the flexibility considered in advance more closely corresponds to the flexibility ultimately demanded. Looking at the extent of the consideration given, the real options ‘in’ the real estate are perceived as more important than the real options ‘on’ the project, especially in integrated project coalitions. There is large difference between the economic feasibility of all real options in both the separated and integrated project coalitions. The integrated project coalitions show a strong correspondence between considered and proven economic feasibility.

Although some real options are independent of the form of project coalition, we showed that the choice of a certain type of project coalition enables exercising certain real options. Here, more in-depth research into these project coalitions would be useful in generating further insights into conditions for creating, exercising, and valuing real options. Further research on the use of real options to classify and to value estate options would be useful for generating insight into how a flexible real estate strategy can be created to adapt to future uncertainties. Case-studies on consequences and cost-effectiveness of the various real options should facilitate a more informed decision making on which type of project coalition to choose. Despite the exploratory nature of this study, we believe that the findings are of interest to both health organizations, since they can learn from other organizations on how they deal with flexibility and strategic real estate management, and governmental organizations since the study provides insight into the effects of current policies. Contractors might also gain from this study from the insights into the considerations leading up to clients' choices for a specific type of project coalition, and their expectations and experiences with flexibility.

4

REAL OPTION THINKING IN PROJECT COALITIONS IN DUTCH HEALTH CARE: TWO CASE STUDIES OF CONSTRUCTION PROJECTS[4]

Abstract

Uncertainties affecting health organizations inevitably influence real estate decisions since real estate is required to facilitate the primary process in cure and care. Decisions have to be taken when there is little knowledge about the future. Therefore, flexibility is needed in the process of designing, constructing and operating real estate. Real option thinking is an approach to gain greater insight into flexibility. This study aims to analyse whether real options can be recognised in the real estate strategies of health organizations and what real options are provided by various forms of project coalition. The paper is based on two in-depth case studies. The results show that real option thinking can be recognised in the real estate strategies of the two case studies. The choice of certain real options is partly a result of the type of project coalition applied. Further development of real options thinking in real estate management in cure and care creates opportunities to deal with future uncertainties.

Keywords: case study, health care, real estate management, real options thinking, project coalitions

4.1 Introduction

Since the 1980s, marketization has been an important approach to manage healthcare expenditures by national governments. This marketization implies a more business-like

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operation by health organizations, resulting in an increasing importance for efficient real estate management (Bellers, 2008; Raad voor de Volksgezondheid en Zorg, 2006). The main institutional change is the introduction of Competitive Diagnosis Related Groups (DRG's). A DRG includes a budget for both capital investments as for the workload of medical specialists, while the height of this budget is still partly unknown. It is one of many uncertainties influence healthcare organizations, which makes it difficult to choose the appropriate real estate strategy and adaptability to these changing circumstances is needed. Developing real estate strategies, to which we refer as Corporate Real Estate Management (CREM), involves balancing the flexibility needed to meet an organization's and its users' needs, with controlling time, costs, and quality by not allowing excessive flexibility. There is, however, little insight in how flexibility can be incorporated in the real estate strategy of health organizations. A promising suggested approach for providing these insights is the real options theory (Gehner, 2008; Olsson, 2004; Vlek & Kuijpers, 2005). Real options, as a way of thinking, helps real estate managers recognize that uncertainty is not inherently negative, and can even provide value. A real option is defined as a right, not an obligation, to exercise an option, and derives from financial options (Black & Scholes, 1973). Myers (1977) applied options to *real* investments: so-called real options (Amram & Kulatilaka, 1999; Bowman & Hurry, 1993; Dixit & Pindyck, 1994; McGrath & McMillan, 2000; Trigeorgis, 1996). Real options provide value, through the ability to be flexible, which increases as uncertainty increases.

Despite the increasing attention given to real options thinking in project management literature, it has not yet been studied in healthcare real estate management. Besides, as authors such as Ford and Lander (2011) point out, real options models have been applied in practice to a limited extent. It is therefore useful to find out how practitioners deal with flexibility. Therefore, this study is aimed at analysing whether real options thinking can be recognised in two construction projects of health organizations within different contexts. By means of cross-case analysis, the various conditions for exercising real options can be retrieved. While most real option studies on construction projects mostly consider real options applied by the contractor, in this research we mainly look at how real estate managers, i.e. the clients, implement real options in their real estate strategies. If real options are recognized as such, they can be used to gain greater insight into flexibility and also generate more flexibility, in order to mitigate future uncertainty regarding investments in health assets. Since various project coalitions are assumed to provide different degrees of flexibility, we show how two different forms of project

coalition affect the use of real options. The two research questions we answer in this paper are:

1. What categories and types of real options can be recognized in healthcare real estate management and in different project coalitions?

2. What conditions determine whether real options can be exercised?

This paper will first elaborate on the various types of project coalitions and the concept of real options thinking. To analyse what real options are applied in construction projects in both care and cure, we carried out two case studies. We describe those critical events that result in a change in the process of initiating, designing and constructing real estate, and that influence flexibility. In the conclusions, we reflect on the relationships uncovered between the project coalitions selected when investing in health assets and their flexibility in terms of real options.

4.2 Theoretical framework

This section elaborates on the major concepts used in this study. Firstly, different forms of project coalitions are discussed. Following this, the focus is on real options as applied in construction projects.

4.2.1 A typology of project coalitions

The project coalition plays an important role in project management. Therefore, the type of project coalitions is an important mechanism in creating flexibility in the process. According to several authors, flexibility is one of the selection criteria for a certain project coalition or procurement system (Alhazmi & McCaffer, 2000; Chan, et al., 2001; Skitmore & Marsden, 1988). In this section, a short overview is provided of the main characteristics of three types of project coalitions described by Winch (2010) and by Pries et al. (2006): separated, integrated and mediated project coalitions[5] (see Table 22).

[5] Unmediated project coalitions, where the client directly contracts a number of suppliers and coordinates these suppliers, are not discussed. Such a project coalition asks a lot of in-house capabilities of the client, and these are often lacking in health organizations. Property developers are more used to this type of project.

Table 22. Characteristics of different types of project coalitions (Dewulf, Blanken, & Bult-Spiering, 2012; Pries, Keizer, Kuypers, & Mooiman-Salvini, 2006; Winch, 2010)

	Project coalitions				
	Separated			Integrated	Mediated
	Traditional (DBB)	General contractor	Building team	DB, DBM, turnkey	DBFM/O Strategic cooperation
Character-istics	Takes a long time because of separated stages in project	General contractor appoints contractors on behalf of client	Exchange of useful information between contractors	Assignment based on functional I/O technical specifications. Tuning activities between parties. Increased certainty about duration and costs. Incentive for better price/quality ratio.	Considers lifecycle costs.
Flexibility	Client flexibility but at high costs			Less flexibility unless negotiated, with specific costs	Large flexibility for client
Division of risks	Risks and responsibilities with client			Risks transferred to contractors	Risks transferred to parties best capable of bearing them
Type of contracts	Often fee-based			Fixed price	Incentive-based

In a *separated project coalition* an architect, a general contractor or a project team representing the client leads the design team. The architect or general contractor will then select contractors. In terms of flexibility, the client has much control and a lot of responsibility over the process since they procure each contractor separately. The client bears all the risks and the process takes considerable time.

In an *integrated project coalition*, multiple tasks such as design (D), build (B), finance (F), maintenance (M) and operation (O) are integrated into a single contract. Assignments are executed based on functional rather than technical specifications. Risks are transferred by the client to the contractor for a given price. In general, the influence of the client on the process is less than when using a separated project coalition.

In a *mediated project coalition* the client and the contractor together seek solutions and divide risks among those best able to bear them. Pries et al. (2006) speaks of a strategic cooperation when all the DBFMO tasks reside within one coalition. The prime contractor takes on some of the risks associated with budgeting and scheduling through structured incentive contracts. In a mediated project coalition, both design and construction managers are appointed and these will be responsible for managing the trade contractors mobilised for on-site execution. Various terminologies are used management contracting, construction management and design and manage. In a mediated project coalition, the client has more influence in the process than in an integrated project coalition.

The various types of project coalition all have different consequences for flexibility (as shown in Table 22). By applying the real options theory we attempt to give greater insight into the types of flexibility that are available in different project coalition forms. Based on the way project coalitions work, one can derive assumptions on their ability to create real options.

4.2.2 Real options and flexibility in corporate real estate management

Real options add value to the ability to be flexible, and this value increases when uncertainty increases. Real options have the following characteristics (Adner & Levinthal, 2004a; Amram & Kulatilaka, 1999; Bowman & Hurry, 1993; Ford & Sobek, 2005; Hovmand & Ford, 2009; R.G. McGrath, Ferrier, & Mendelow, 2004):

- When a real option is created it requires a certain investment.
- The circumstances have to enable flexibility, otherwise there is no option.
- Different phases can be recognized in the application of real options (see Figure 8).
- Since uncertainty increases the value of a project through having real options, uncertainty should be seen as an opportunity rather than a risk.
- The difference of the outcomes of a reference strategy without options and the strategy with real options is the value of the real option. These outcomes can be different than in monetary terms. Performance measures have to be determined on which the decision to invest in a real option is based. The real option should be exercised at a certain point otherwise the possibility exists that it can expire.
- Certain uncertainties determine whether an option is needed. The development of this uncertainty determines whether the options should be exercised or not.

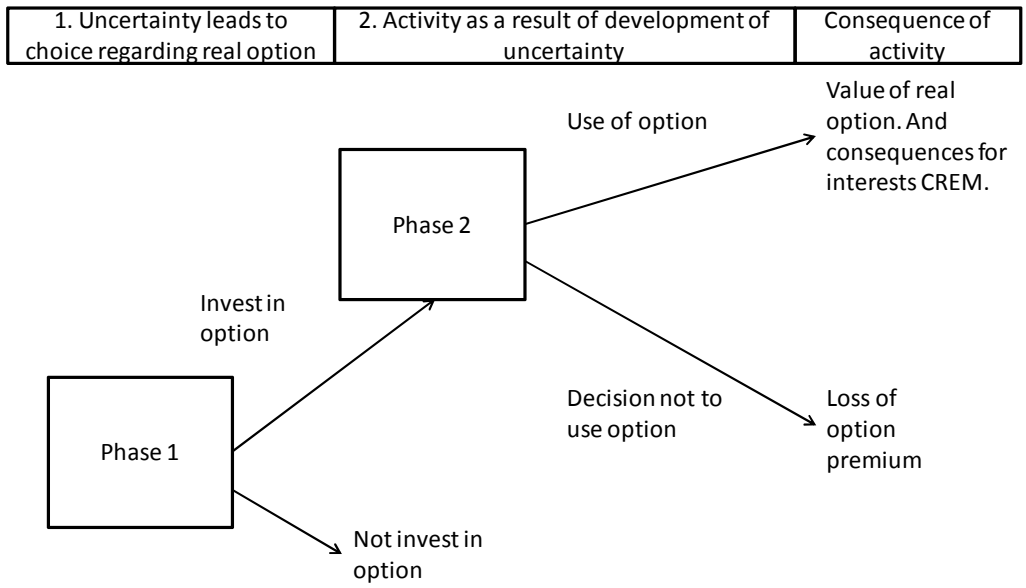

Figure 8 *Phases in the working of a real option (Based on: Adner & Levinthal, 2004b)*

In determining whether an investment should be made, real options provide greater value to an uncertain project than other valuation techniques, such as the Net Present Value (Alessandri, et al., 2004). Some authors argue that real options can also be used as a way of thinking to obtain insight into how current actions can create opportunities for future flexibility (Alessandri, et al., 2004; K.D. Miller & Waller, 2003; R. Miller & Lessard, 2001; Triantis & Borison, 2001; Winch, 2010). Real options can be categorised based on their field of application and in the way they appear. In IT product development, Benaroch (2001) identifies technology options. In project management, De Neufville et al. (2008), identify real options 'in' the project and 'on' the project. Real options in the project are technological solutions that create flexibility while real options 'on' the project create flexibility in the process of project development. Parallel to the last type of real options, Ford and Sobek (2005) introduced the term managerial real options to emphasise the non-monetary and decision making aspects of real options, which is also the focus in this research. Many areas have been subject to research on the potential use of real options, such as project management in large engineering projects including infrastructure and irrigation (Ford & Bhargav, 2006; Ford, et al., 2002; Michailidis & Mattas, 2007; Miller & Lessard, 2001; Roger Miller & Lessard, 2007; Ng & Björnsson, 2004; Smit & Trigeorgis, 2008), project management in ICT (Fichman, et al., 2005; Hilhorst, 2009) corporate strategies (McGrath & McMillan, 2000), natural resources (Cornelius, Van de Putte, &

Romani, 2005; Luong & Tauer, 2006), R&D (Pennings & Lint, 1997) and modular design (Baldwin & Clark, 2000). However, as pointed to by various researchers, the application stays behind its' potential use (Garvin & Ford, 2012; Lander & Pinches, 1998; Triantis, 2005). Real options are recognised as valuable also in the area of real estate, although mainly in computational terms where only the market value of real estate is assessed. Real options are then mainly approached from an investors perspective, while in corporate real estate management the primary aim is to facilitate the primary process, where many other interests and uncertainties are involved (Durmisevic, van der Voordt, & Wagenaar, 2009; van der Zwart, 2011). Besides, most researches only deal with one particular real option instead of multiple options in one project. A related field of application is area development, but also here only few types of real options are recognised (Mayer & Somerville, 2000). The same counts for the application of real options in project coalitions (Garvin & Cheah, 2004; Liu & Cheah, 2009). As stated by Ford and Bhargav (2006), many real option models consider only few uncertainties while projects in health are often very complex. It is recognised that project managers use many forms of flexibility in construction projects that can be structured as real options (Ford & Bhargav, 2006). In addition, construction projects in health are different from most other large construction projects since these have to take place in close cooperation with the users. Most real option researches on construction projects aim to support decision making of project managers of the contractor, while in this research we look from the perspective of the client who has to develop real estate strategies. Our study is aimed at analysing the use of multiple options in real estate project management in both cure and care organizations.

Following the taxonomy of Amram and Kulatilaka (1999), the real options can be categorised based on how they create flexibility. The taxonomy consists of investment and disinvestment options, timing options, contractual options and operating options. Investment and disinvestment options may significantly change the asset configuration by using scaling up, scaling down and growth options. Timing options, such as to delay or accelerate, also fall under investment and disinvestment options. Contractual options reflect contract terms that change the risk profiles faced by asset owners: the contingency adaptability in a project coalition (Luo, 2002). Since all types of options can be defined in contracts, they are all to an extent contractual options. Operating options relate to options linked to an asset in use, such as a switch option. A service can also be stopped (the option to abandon), or scaled up or down, and grow or shrink. The operating option can also be

applied to the project development in which inputs of e.g. (sub)contractors and outputs (changes of the design during the design phase) can be changed.

In table 23 the various types of real options are described with examples of application in construction projects. Fichman et al. (2005) notice that combinations of real options exist. The select option is a seventh option which is recognised by Winch (2010) as an important real option to take into account in developing the strategy for the project, based on the selectionism concept of Sommer and Loch (2004). The select option implies that options are being developed in parallel from which can be chosen when conditions are better known.

Table 23. Types of real options and examples of application in construction projects

Type of real options. Amram and Kulatilaka (1999).	**Real options** e.g. Trigeorgis (1993a) Sommer and Loch (2004), Fichman et al. (2005)	**Project management** (De Neufville 2008)	**Examples of application in real estate construction projects in health**
Waiting-to-invest option	Defer	'on' the project	When there is uncertainty on governmental regulation, the project might need deferral
Growth option of a market	Growth, switch function	'in' the project	Other demands can necessitate switch function of expansion/shrinking of the real estate
Flexibility options	Growth, scale up and down, switch function	'in' the project	When demands of the organization change: expand the building, scale up or down and switch function
Exit options	Abandon	'on' the project	When finance cannot be obtained, the project should be able to abandon
Learning options	Select	'on' the project	Select multiple architects to obtain knowledge on the best one
Irreversible investments	Stage	'on' the project	A construction project is irreversible. By staging the project after each stage a go-no go point is implemented

Although researches show that many decision making can be structured according to the real option concept, Triantis (2005) showed that the use of real options stays behind its' potential use. In order to bridge the gap between theory and practice, Triantis (2005)

proposes five challenges. One of these is that real option models should be more users friendly. Triantis (2005) suggests that the development of heuristics should aid the further dissemination of real options application. The findings are synthesised in a framework which can be used by real estate managers to analyse their own situations. In this way, a heuristic is created that real estate managers can apply to their own situations. We focus on the various categories of real options applied and their conditions. We assume that understanding the various aspects of real options is a prerequisite to gain insight in flexibility needed and eventually expand their use by valuing real options quantitatively. However, this is not necessarily a progression since the way real options are used depends on their purpose (Triantis & Borison, 2001). As suggested by Liu and Cheah (2009), when having defined the real options, the important decision making moments and their consequences, practitioners can optionally use other models such as binomial trees. The use of other methods such as scenario planning can complement ROA, as proposed for example by Miller and Waller (2003).

4.3 Method

Referring to Triantis (2005), Ford and Lander (2011) also emphasize the importance of knowing how practitioners perceive and value flexibility. By investigating the practice of real estate managers in health, which is a still unexplored research area regarding real options, we investigate whether real options reasoning is also used in this field and how it can be made explicit for improved risk management. The aim of the research therefore is to create more understanding of decision making in health organizations related to flexibility. For this, a process study approach is applicable, along with a critical incident analysis, since each decision which is an investment or exercising of a real option, influences the process and therefore amounts to a critical incident. The two exploratory, in-depth and longitudinal case studies provide most information on the practice of dealing with real options, and the conditions for creating and exercising these. In this section we elaborate on the process vs. variance theory approach, and describe how we conducted our case studies.

4.3.1 Methodology: Process vs Variance research design

In this research, we want to answer the question of *how* real options are created and exercised during the development of a construction project. As such, the process theory

approach is very suitable (Van de Ven, 2007). The philosophy of science from which perspective we view our research is critical relativism. This implies an objective ontology, which means that we see reality independent of our cognition. The subjective objectivism underlying this perspective implies that researchers can observe reality from different perspectives and various theories explain reality (Van de Ven, 2007). The process theory approach is different from the variance theory approach as explained by Mohr (1982). In variance theory, the causal effects between variables are explained statistically whereas, in process theory, the process is more fine-grained and narratively analysed by identifying all events, activities and choices, on various levels, that influence the process. Furthermore, the time aspect is important in process theory since the entities acting on events change over time, as do the variables used in the research: namely, flexibility, uncertainties and real options. However, when generalising events to the real option theory, we structure this according to the variance approach in which if-then relations are shown. The narrative description of the specific context and conditions of the various real options provide richer information in order to enable better translation to specific contexts and the 'real' world. *Incidents* and *events,* and the distinction between them, in process theory can be seen as analogous to *variables* and *constructs* in variance theory. Langley (1999) argues against artificially separating variables and events, and for using both elements in research. We follow this by referring to flexibility, uncertainties and real options as variables, which are then reflected in incidents and events. Whereas incidents are directly observable activities, events occur on a more abstract level and might well have a longer duration. In our research, we define a critical event as a development with a relatively long duration that influences the direction of a process. For example, a policy change is a lengthy development which influences decision making in an organization. Critical incidents are shorter events, such as a decision being made or a report being written. Here, we are interested in incidents that have an influence on the course of the project and relate to flexibility. When collecting process data, we therefore attempted to document as fully as possible the sequence of events that were pertinent to the processes being studied (Langley, 1999).

From these events, we distilled those events which could be identified as falling within the concept of real options. In the case studies, we chronologically described each incident, the development that motivated that incident, and the consequences in terms of flexibility.

4.3.2 Case study research

The value of an individual case study is that phenomena can be qualitatively described with greater nuance on their development than would be possible using a quantitative methodology (A. H. Van de Ven, 2007; Yin, 2009). Each construction project has its own stakeholders and interests, and therefore its own dynamics. This makes every case unique and therefore also valuable since they can point at gaps in existing theory (Siggelkow, 2007). In the analysis of the case studies we make use of the structured strategy description tool by Ford and Bhargav (2006) and Johnson et al. (2006) in which the real options recognised in the cases studies are presented according to the characteristics of real options described in section 4.2.2. The characteristics for the specific real options in the cases are the asset that should be flexible, the driver of performance uncertainty, reference strategy (strategy without an option), alternative strategy (with option), signal for changing strategy (investing in real option), conditions for strategy change (change is investing in real option), actions required to obtain or retain flexibility, action required to change strategy (option premium) and the decision rule for changing the strategy. The framework is based on the approach of Ford and Sobek (2005) who describe decision making in the form of real options and value flexibility as the difference of outcomes between the strategy with and without the real option. We added the expiration of the real option since this is also an aspect of the real option concept.

4.3.2.1 Development of an elderly care building

The first case study is referred to as Utopia, the contrived name of a building which is being redeveloped and forms part of the real estate portfolio of a large welfare organization. The welfare organization, called Ibis in this story, offers a range of welfare, living and care services. It is in the top ten of Netherlands' largest care organizations, with around 2.250 full-time equivalents. At the start of the project in 2005, Utopia was owned by Parrot which merged in 2008 with Crane to form Ibis. The case project consists of a large building complex existing of two parts: one for intensive elderly care, and a part for people with somatic disorders. The building parts were respectively built in 1977 and 1994. The plan was to demolish and newly built the former part, and renovate the second part. This was the point of departure of the project since 2005. During the design process, the idea arose to build in addition a unique wellness centre for special target groups. Duota, the real estate organization of Ibis, decided for a separated project coalition because they had experience with this type of project coalition. Several developments were not

considered in advance by the organization and resulted in changes in the design. These developments were a merger, a new board of Ibis, new insights on healthcare concepts and the consequences of marketization. In 2005, this marketization received a new impulse through a policy change, often referred to as the 'new regime', which introduced a new system of compensation. Under the old regime, health organizations received full compensation for their infrastructure costs based on a calculation, with a permit from the *Bouwcollege*[6] serving as a bank guarantee. Under the new regime, health organizations are fully responsible for the funding and upkeep of their real estate. For a long time, the height of the compensation for capital investments remained unclear.

The main internal stakeholders within the development project were Duota, the real estate organization of Ibis and responsible for the project management of Utopia, the direction of Duota, the board of Ibis and working groups of Ibis participating in determining the list of requirements and the patients of Utopia. Contractors are a consultancy firm participating in the project team, the architect and technical advisors. Other external stakeholders were a housing company which provided temporary housing and Pointcare, which was another health organization that would rent space in the new Utopia and thus also participated in defining the list of requirements. Since both Pointcare and Ibis provided different types of care, they expected mutual learning by this cooperation. The municipality was involved since it had to approve the design. The fire department was involved because of fire safety regulations.

4.3.2.2 Development process of a hospital

Manor is the second case study in this research. It is a regional hospital with around .500 full-time equivalents and an interesting case since it is the first Dutch hospital finances its' construction project on own risk and account. In addition, it fulfilled the design and construction of the new hospital in a record time. In that sense, it is the opposite of the Utopia case. Asbestos problems in the old hospital made renovation too expensive. In January 2006, the board made its final decision to build a new hospital. Given the need to demonstrate financial credibility towards financers and guarantee providers, the board

[6] The Bouwcollege (Netherlands Board for Healthcare Institutions) was a governmental institute established to effect the law related to healthcare provision. Prior to its demise in 2010, its tasks included determining performance indicators for building construction in healthcare, providing permits with relevant conditions for construction projects, and advising the Ministry and health organizations. Preceding any permit provision, the Ministry had to agree that the building construction was necessary.

put a tight deadline on completion, namely January 2010. When finance was approved by the bank, based on this business plan, also the budget was fixed. A tight budget necessitated more bed capacity within less space. A consultancy firm investigated the occupancy of spaces in the old hospital in order to determine the needed surface areas of the new hospital. By means of splitting up the design process of the skeleton and the interior, the process could be accelerated. An innovative working concept of front- and back-offices requiring adaptation of the working process was implemented.

Because of experience of another construction project by the same hospital, the board member responsible for real estate, decided to choose a mediated project coalition with a general contractor who was contact person for all contractors. Procurement of subcontractors was undertaken using a competitive dialogue because this would in the opinion of the project team yield a more suitable subcontractor. A project manager from a consultancy firm was appointed to guide the process, called the process manager in the case study. Maintenance of the building would also be done by the contractor.

The main internal stakeholders were the board, the medical staff who have a large say in Dutch hospitals because of their autonomous position, personnel represented by health managers and the patients represented by a patient organization. All stakeholders were either represented in the project management or had a say in the process during working conferences. Different steering committees and advisory groups were composed during different stages of the process. The points of departure were stated in a business plan of the organization, formulated with the assistance of a consultancy firm. External stakeholders were people living in the neighbourhood, having influence on the design by being represented in a sounding board. The municipality was involved because of urban planning issues. The hospital swapped land and had to discuss water related issues with the water board. The province was involved since they financed an extra branch of a roundabout increasing the accessibility of the hospital.

4.3.2.3 Common factor in cure and care projects: the role of the board

It is clear from the case studies that the organizational vision is an important factor which determines the need for staging, deferral and even abandoning of the project. Large differences can be observed between Manor and Utopia. Manor developed a business case, where in the development process each specialism defined its needed surface. During this process, a new working concept with back- and front offices was being developed while

the planning was kept strict. In contrast, during the merger, Ibis was more concerned with management of the organization because of financial problems and switching of the board, rather than the Utopia construction project. This led to unpredictable decision making and uncertainty on the organizational vision of all stakeholders. Although both projects seemed urgent because of expiring permits, this sense of urgency was far more visible in the Manor case than the Utopia case. One reason could be that Ibis assumed that care can be delivered on a temporary location, which is not the case in the Manor case. The role of the board was crucial and determined the course of the projects in both cases.

4.3.3 Validation of the research

We obtained data by attending project meetings of the Utopia project. We analysed minutes from meetings in the past and other documents such as contracts and reports from different consultancy firms and governmental organizations. The Manor case was investigated retrospectively. We interviewed two project team members of Manor and three team members of Utopia and asked them for clarification if data was missing. If things were unclear or if data was missing to fill in critical incidents, we asked members of the project team for clarification. For triangulation the members of the project team checked the report with main critical incidents. Process data were analysed using Visual Mapping Strategy tools (Langley, 1999). Additional advantages of this strategy on top of those gained from narrative approaches are that the tools "allow the presentation of large quantities of information in relatively little space, and they can be useful tools for the development and verification of theoretical ideas" (Langley, 1999, p. 700; Miles & Huberman, 1994). We used 'Nvivo' (QSR International Pty Ltd, 2010) to code critical incidents found within the information sources. The mapping of these critical incidents was used to verify our findings during a workshop in which the participants could reflect and comment on our findings.

Although the two organizations operate within different health sectors (cure and care respectively), they face similar uncertainties which justifies our comparison. Another difference in the size and budget of the two projects. The ground area of the Manor project is about double that of Utopia, and the required investment approximately one-third greater. However, since the results show that these were not decisive factors in aspects such as the speed of the process, we believe our comparison remains valid.

The comparison focusses on the approaches used in the definition and design phase since the construction phase has yet to start in the Utopia project. However, since most uncertainties occur in the definition and design phase, and most changes in the design take place here, this phase is the most informative for our research.

4.4 Results

The findings of real options in the case studies are systematically described according to the structured strategy description tool by Ford and Bhargav (2006) and Johnson et al. (2006), Preceded by a short description of the critical incident that can be recognised as a real option, we structure the various aspects of the real option in a Table. The various aspects we describe in the matrix are the uncertain performance measure which is the uncertain outcome of an investment, the driver of performance uncertainty which is the main uncertainty(-ies) that determine the outcome of the investment, the reference strategy which is the strategy without an option, and the alternative strategy, which is the strategy with an option. The difference of these last two determines the value of the real option. Other aspects described in the Table are the signal for changing the strategy which means the critical incident that determines whether to invest in the real option, the conditions for investing in the real option, actions required to obtain or retain flexibility, action required to change strategy which is the exercising of the option, the expiring of the real option and the decision rule for changing strategy. For each case, three real options are analysed in the way just mentioned. Because of space limits, we could not discuss all real options in detail. Therefore, we present three real options per case elaborately, and other real options are discussed in section 4.5.

4.4.1 Real options in the Utopia case

4.4.1.1 Option to grow-switch-scale

Although not the whole terrain around Utopia was planned to be used for Utopia in 2005, Ibis decided not to sell the remaining part. This is an option to grow, switch and scale, described in Table 24. The reason for this option was because several issues were still uncertain in the decision making of Ibis. First, uncertain was whether Ibis would develop houses and do this independently, or whether Ibis would hand this over to developing companies or housing corporations. The target groups for which the houses would be

built was still uncertain in 2005 as well. The (future) capacity of the terrain was also dependent on the capacity of other buildings of the real estate portfolio of Ibis. The long term housing plan, in which this was defined, needed an update, depending on all kinds of external trends. Another uncertainty was cooperation with other health organizations who perhaps wanted to participate in the development and accommodate patients in the new Utopia, resulting in a larger project. The lay-out of the future real estate was another uncertainty, depending on the vision of the town-planning professional and a new market research. But also new developments in vision on providing healthcare in general reflected on the design and thus the available space needed. However, keeping the terrain would also imply additional costs and selling would reduce the costs of the Utopia projects. The traditional strategy therefore was to sell the terrain. The alternate solution was keeping the terrain and wait until more information would be available. The performance measurement that could be used was the available space needed when deciding to build houses for a certain target group. The value of this measurement that justified switching to the alternate strategy can be defined as the profits gained from exploiting the terrain in contrast to selling it. In order to have the flexibility the terrain should not be sold. To change strategies, the terrain will be developed.

Table 24. An option to extend or change the function of the Utopia case

Uncertain performance measure	Available space needed in the future
Driver of performance uncertainty	Vision of organization on development of houses, cooperation with other health organizations, new ideas on health provision and corresponding design, capacities of other projects of the Ibis real estate portfolio
Reference strategy	Sell land
Alternative strategy	Keep land
Signal for changing strategy (investing real option)	Decision made on developing houses, need for extra houses based on long term housing plan, cooperation with other health organizations etc.
Conditions for strategy change (change is investing in real option)	Having the land in ownership and retaining the land should provide added value related to town planning and the eventuality of developing other activities.
Actions required to obtain or retain flexibility (option premium)	Retaining land. Because not selling it, these incomes cannot be subtracted from the investment costs and also maintenance costs increase, which can be seen as the option premium
Action required to change strategy (exercising option)	Developing the terrain
Decision rule for changing strategy	IF (the demand for care or incomes) > (investments in developing area) THEN (expand real estate) ELSE (sell area)
Expiration of real option	If there is no demand for land or more development it is not profitable to put or call the option. However this is very unrealistic

4.4.1.2 Option to defer-stage-abandon

Several uncertainties made it questionable whether the final design delivered by the architect would meet the requirements of the organization. These were the height of the remuneration for capital costs and life cycle costs, which were not yet defined, the correspondence of the design with the vision of the organization and with new insights in health concepts in general in the Netherlands, marketability of the design and concordance with town planning visions. There existed two strategies which are described in Table 25: first to continue with the project and the second to defer and obtain more information on the uncertainties.

By opting for a separated project coalition, each phase in the development and construction process was separately procured and ended with a go/no-go decision to be taken by the board. The performance measure was whether the uncertainties mentioned above were acceptable. The signals to change the strategy were the many uncertainties foreseen. To create the real option, a separated project coalition should have been used,

which means separated assignments for each phase and agreements with the contractors on changes in the process. Conditions that justified changing the strategy and thus investing in this option were the height of uncertainties. If it was clear that uncertainties would not be resolved in a short amount of time, it was valuable to invest in the stage option, also enabling to defer or abandon. The management of the organization should estimate the height of this threshold. Although it seemed well considered to choose for a separated procurement strategy, this was more a result of the experience of the real estate company. Other project coalitions could have had other advantages. Weighing the two types of project coalitions was therefore a weighing of several advantages and disadvantages, among which was the real option created by the separated project coalition. This was difficult to grasp in quantitative terms. For example, when one had invested more in the definition phase, the design was probably more according to the vision of the organization. Investing more in the definition phase by the client was often incited by a mediated project coalition. The project could have benefitted by reducing some uncertainties already earlier in the process in this way.

Table 25. An option to defer, stage and abandon the project in the Utopia case

Uncertain performance measure	Work delivered by contractors and project team after definition, conceptual and final design phase
Driver of performance uncertainty	External uncertainties: construction costs, government policy (are remunerations sufficient to let the real estate be rentable and demolish the old building or not). Internal uncertainties: organizational strategy is not clear (yet) which is partly dependent on the market situation of apartments and other services and new concepts in the health sector
Reference strategy	Continue the project with the same contractors
Alternative strategy	Abandon the project, change the design, continue with the project, and change contractors. Costs associated can be an extra risk for client but creates more flexibility for the client to decide later on matters
Signal for changing strategy (investing real option)	Many uncertainties foreseen in financing and lay out of real estate
Conditions for strategy change (change is investing in real option)	Estimated height of uncertainties such as the outcomes of health concepts, construction costs, government policy. If the organization considers these to be too high, it is valuable to invest in the option. It is dependent on managerial capabilities to determine the conditional threshold.
Actions required to obtain or retain flexibility (option premium)	Separated project coalition, procure every phase separately which costs time and money
Action required to change strategy (exercising option)	Obtaining more information to be evaluated in go-no go decision moments
Decision rule for changing strategy	IF (external uncertainties) ≠ (outcomes of project phases) THEN (have a separated project coalition) ELSE (mediated)
Expiration of real option	When the uncertainties are resolved, there is no need anymore for an option and therefore the option loses value.

4.4.1.3 Option to select

When, in 2010, the board wanted to defer the design process, the project group proposed a parallel development of a conceptual design for a wellness centre alongside a conceptual design for a 'normal' health centre in order to speed up the process. This was necessary for several reasons: first, by deferring the project, the working groups that cooperate in the design lost commitment. Second, for fire safety reasons, the project could not be deferred much longer. Third, time is money. One advantage of deferral was that the value of real estate on the balance sheet diminished. However, it was decided not to invest in this option and instead use a stage option: the project team would continue with designing the residential part and defer the wellness concept. The ability to defer was the condition for changing the strategy, thus investing in this option. When this level was

reached depended on managerial decision making. The structure of the real option is presented in Table 26.

Table 26. Designing in parallel: option to select in the Utopia case

Uncertain performance measure	A 'normal' health centre or a wellness centre
Driver of performance uncertainty	Lack of clarity of organizational vision
Reference strategy	Develop only one design or invest in a phase option to enable deferral
Alternative strategy	Develop two designs in parallel
Signal for changing strategy (investing real option)	Degree of lack of clarity on the organizational vision
Conditions for strategy change (change is investing in real option)	Maximum level of ability to defer. This depends on among others the loss of commitment from stakeholders and expiration of permits. When this level is reached is quite arbitrary and depends on managerial competences to estimate this
Actions required to obtain or retain flexibility (option premium)	Defer the construction phase. Make agreements with contractors on further deferral and eventually develop two designs
Action required to change strategy (exercising the option)	Assign the architect with another design. Managed by the project team and in cooperation and consultation with working groups on the design and to develop another working concept which is necessary when choosing for the wellness centre
Decision rule for changing strategy	IF (degree of lack of clarity on organizational vision) > (max. level of ability to defer) THEN (develop two design in parallel) ELSE (Develop only one design or invest in a phase option to enable deferral)
Expiration of real option	If organizational vision is resolved, there is no need for the option anymore

The critical incidents of the Utopia case from which the real options are derived are presented in Appendix C.

4.4.2 Real options in the Manor case

4.4.2.1 Option to grow-switch-scale

The challenge in the Manor case was dealing with the obsolescence of the hot floor of the hospital and the uncertainty on developments around the building. The hot floor with high technologies would become earlier obsolete than other parts of the building. Therefore, the building would have a comb structure which enables to build a new hot floor on another part of the comb, and demolish the old one without obstructing the primary process. For that purpose, more space would be needed around the hospital. This space was created by the old hospital besides the new one which would be demolished, and by exchanging land with the municipality and the water board to create optimal

space. In this way a real option was created, described in Table 27. A good relationship with these parties made exchanging more easy. Another uncertainty was whether additional functions were needed and desirable around the building, and which functions that would be. To retain flexibility to build a new hot floor and to eventually develop other functions, the land should not be sold. This again is dependent on external uncertainties such as governmental regulations, demography and developments in health. To evaluate whether the additional investments have to be done, there should be certainty on these uncertainties and a declaration of intention of possible parties that might settle on the terrain and the expected profitability of these activities. Another condition to enable construction of a new hot floor on another spot without obstructing the primary process, is the lay-out of the building.

Table 27. Creating sufficient space: real option to grow/switch/scale in the Manor case

Uncertain performance measure	Obsolescence of hot floor or other developments on terrain. Governmental regulations, demography, developments in health
Driver of performance uncertainty	The hot floor becomes earlier obsolete, or functions should switch or additional functions are needed as a result of developments in health and governmental policy
Reference strategy	Sell land
Alternative strategy	Keep land and exchange with municipality
Signal for changing strategy (investing in real option)	Foreseen preliminary obsolescence of hot floor or even whole building. And eventually other complementing activities in area
Conditions for strategy change (change is investing in real option)	Investments on terrain: Clear demand, clarity on governmental policy, profitability of other activities on the terrain. A condition for the replacement of the hot floor on another spot is the so called 'shell model'[7]
Actions required to obtain or retain flexibility	Retain land and exchange a part with the municipality. Maintaining good relations with the municipality is a condition
Action required to change strategy (option premium)	Demolish old part or whole building and redevelop or develop other activities on terrain
Decision rule for changing strategy	IF (the demand for care or incomes) > (investments in developing area) THEN (expand real estate) ELSE (sale area)
Expiration of real option	If there is no demand for land or more development it is not profitable to put or call the option. However this is very unrealistic

[7] The 'shellmodel' (College Bouw Zorginstellingen, 2007a) distinguishes both specific and marketable parts in the building, which makes it easier to dispose of some parts and increasing the cost-effectiveness of the building.

4.4.2.2 Option to accelerate

Because of the economic situation and the loss of guarantee from the government it was difficult to obtain loans from banks. However, when the loan was provided, the hospital wanted to finish the project as fast as possible without extension of the project, in order to keep credibility towards the bank. In addition, the project needed speeding up because of safety reasons in the old hospital that contained asbestos. The option to accelerate was created by investing in front of the project by determining a list of requirements and the business plan that remained the unchanged starting points during the course of the project. One tried to keep strictly to the planning, which was enabled by a transparent decision making procedure. This limited the flexibility of both the project management and the users of the building (medical staff, personnel and patients) but speeded up the process. Proposed changes by the users were implemented in the design if they did not violate the starting points. Otherwise clear arguments were provided why it was not possible to implement the changes. Four conditions were necessary to create this option: Firstly, the attitude of medical specialists and employees was a determinant. According to the project manager, the medical staff had been rejuvenated and was forward looking which enabled innovations. The atmosphere remained positive and criticism constructive. Besides, all interests were represented in the project team who promoted the project among their interest group. Secondly, because all interests were represented in the project team, short lines were created which enabled fast decision making. Champions among the health managers increased support for the new building and new working concepts as well. Thirdly, the new building was seen as an opportunity to adapt to changes and to trigger off the new way of working. Finally, the new regime (see Section 4.3.2.1) had urged the employees for rapid progress and change in the working processes, and this smoothed the process. External stakeholders, which were inhabitants in the surrounding, were dealt with in a supportive way as well. By involving these stakeholders early on, their comments could be considered in the design and, through this, support created. Consultation with other external parties such as municipality, bank and health experts also increased mutual trust and understanding and therefore the speed in the process. The option is described in Table 28.

Table 28. Invest in decision making process: option to accelerate in the Manor case

Uncertain performance measure	Funding of new hospital
Driver of performance uncertainty	Opinion of banks on business case
Reference strategy	Project process for development at normal pace
Alternative strategy	Accelerate the process by investing in fast decision making process
Signal for changing strategy (investing in real option)	Commitment from bank
Conditions for strategy change (change is investing real option)	Attitude of users, all interests represented in the project team enabling fast decision making and promotion towards all interests of project, new building as opportunity for new way of working, sense of urgency with stakeholders and a forward looking attitude of medical specialists and employees, champions among health managers trust, frequent communication and consultation (bank, municipality, health experts). The mediated project coalition also facilitates a fast process because of close cooperation between all contractors and client.
Actions required to obtain or retain flexibility	Determining starting points. Creating transparent decision making procedure. Create project team representing all interests of organization.
Action required to change strategy (option premium)	When the starting points are fixed, they do not change during the design process. These are described in the list of requirements and the business case. This means investing in front of the process in commitment of stakeholders
Decision rule for changing strategy	IF (finance of new hospital) > (opinion of banks on business case) THEN (accelerate the process) ELSE (keep process at normal pace)

4.4.2.3 Option to select

Contrary to common practice in Dutch health projects, the project manager of Manor advised selecting contractors using a public procurement process, to be followed by competitive dialogue. It is assumed that the dialogue would increase mutual understanding of visions and ways of working, which would improve cooperation, and the ultimate outcome of the project, beyond that which would have been achieved when selecting only on price. Moreover, a better allocation of risks between the parties would be achieved through working in a dynamic way during the price-making process. Other reasons to invest beforehand in selection are less complexity and renegotiations during the execution stage of the project (Hoezen, 2012). In order to have competition, sufficient parties need to subscribe, and this creates the option to select, presented in Table 29.

Given the positive economic situation in 2008, only three parties subscribed but, nevertheless, the results of the negotiations were seen as positive.

Table 29. Competitive dialogue: option to select in the Manor case

Uncertain performance measure	Outcomes of negotiation in competitive dialogue
Driver of performance uncertainty	Difference in option on way of working between client and contractor which might result in bad cooperation. Examples are creating too much noise and inconvenience for patients
Reference strategy	Selection based on price
Alternative strategy	Public procurement followed by competitive dialogue. Selection based on process in which not only price is valued. Mutual knowledge increases, and it is expected that this results in a better risk allocation since it is known better who can best bear these risks
Signal for changing strategy (investing real option)	Complexity is large (if it was not complex it would be easier to just select based on price)
Conditions for strategy change (change is investing in real option)	Enough and competent contractors
Actions required to obtain or retain flexibility	Setting out tender, doing dialogues
Action required to change strategy (option premium)	Invest time for dialogues, paying a premium for preparation by subscribers
Decision rule for changing strategy	IF (complexity of project is large) AND (minimum number of potential subscribers with potential) THEN (put out tender for competitive dialogue) ELSE (select based on price)
Expiration of real option	Date stated in tender

The critical incidents of the Manor case from which the real options are derived are presented in Appendix D.

4.5 Case study analysis

Different options can be recognized in both cases. The analysis of the two cases considers the conditions under which real options can be invested in and exercised. First, we indicate the most important conditions for all the real option types, using the taxonomy of Amram and Kulatilaka (1999); investment- and disinvestment, timing and contractual options. Secondly, we address the role of different project coalition types in exercising real options. As a synthesis of our findings, we present in Table 30 a framework in which

we propose the relationships between project coalition types, real options and conditions for creating and exercising real options[8].

Table 30. Framework showing the relationships between project coalitions and real options plus their conditions involved in the two case studies

Taxonomy of options	Type of real options	Real options	Project coalitions		Conditions
			Separated	Mediated (DBM)	
			Utopia	Manor	
Investment- and disinvestment options	Growth-switch-scale	Retaining enough space	++		Having the land in ownership and retaining the land should provide added value related to town planning and the eventuality of developing other activities.
	Growth-switch-scale	Creating enough space		++	Investments on terrain: Clear demand, clarity on governmental policy, profitability of other activities on the terrain. A condition for the replacement of the hot floor on another spot is the so called 'shell model'.
	Defer-stage-abandon	Phased procurement and contract with contractors	+		Estimated height of uncertainties such as the outcomes of health concepts, construction costs, government policy. If the organization considers these too high, it is valuable to invest in the option. It dependent on managerial capabilities to determine the conditional threshold.
	Stage-abandon	Contract with management contractor		+	Contract term, low urgency, availability of other comparable parties. Communication to maintain commitment with project and credibility of organization.
	Select	Competitive dialogue procedure in procurement		++	Enough and competent contractors.
	Select	Invite multiple interior- and landscape architects	++		Dissatisfaction with current architect. Lack of vision on project by organization so creativity should come from outside.
	Select	Designing in	++		Maximum level of ability to defer. This

[8] We also investigated the consequences on the various stakeholder - interests but these were not included in this paper. The results are assimilated in a Figure which we present in Appendix J, together with the reasoning which has led to the Figure.

		parallel			depends on among other the loss of commitment from stakeholders and expiration of permits. When the maximum level is reached is quite arbitrary and depends on managerial competences to estimate this.
Timing options	Accelerate	Definition of points of departure Planning process. Stakeholder management Decision making procedure		++	Attitude of users, all interests represented in the project team enabling fast decision making and promotion towards all interests of project, new building as opportunity for new way of working, sense of urgency with stakeholders and a forward looking attitude of medical specialists and employees, champions among health managers trust, frequent communication and consultation (bank, municipality, health experts). The mediated project coalition also facilitates a fast process because of close cooperation between all contractors and client.
Contract-ual options	Stage/ accelerate	Construction of skeleton, design of interior		+	Consortium, cooperation of contractors.
Operatio-nal options	Scale up/-down, switch of functions	Design, Working process		++	Adaptive capabilities of users. Availability of (external) parties that might use parts of the building.

Note. Legend: ++ = real option not necessarily consequence of project coalition. + = inherent in type of project coalition

4.5.1 Real options analysis

4.5.1.1 Investment and disinvestment options

Growth-switch-scale option: Irrespective of the project coalition type chosen, both organizations in our study retained space around their new buildings to be able to develop other activities, i.e. a growth option, or to have space to replace one part of the building during its lifetime. The investment is in keeping the land rather than selling it. The main *condition* for investing in this option is having the ownership and opportunity to keep the land. Another *condition* is a cooperative attitude from other stakeholders such as the municipality, since they will have to approve any changes in the zoning plan or are a party to an exchange of land (as in the Manor case).

Defer-stage-abandon option: Utopia created this option by choosing for a separated project coalition. In this way, Utopia created a lot of flexibility in the development

process. A *condition* for exercising this option is the availability of sufficient time and the short-term urgency to complete the building is low. Communication is an important *condition* for mitigating the negative consequences of employing this option and thus helps to maintain the value of the option. In the Utopia case, patients and their family members remained uncertain over the outcome which could negatively influence the image of the organization. This view is subscribed to by Fichman et al. (2005) who state that the abandon option can carry intangible costs related to loss of credibility and morale. Communication on the Utopia project was perceived as problematic due to reasons of deferment: the board was considering strategic issues and did not wish this to be generally known.

Select option: The option to select can be recognised in both cases as well: in the case of Utopia by suggesting to design two different plans in parallel; and in Manor through a public procurement of contractors. In the Utopia case, the condition for the select option was the maximum level of ability to defer. If the urgency of continuing with the project was greater than the advantages of having more time to decrease uncertainty on the final design, one should have made a decision and continue with only one plan. However in this case the board decided to continue with neither of the two strategies, and do not develop any plan at all, exercising the defer-stage-abandon option again. Regarding the select option of Manor, a *condition* was that sufficient competent contractors should be available to select from. In this way, the project team of Manor invested in selecting a contractor not only based on price, but also on other aspects.

4.5.1.2 Timing options

Option to accelerate: Whereas Utopia deferred the project to deal with uncertainty, Manor tried to accelerate the process by investing in a transparent and well-considered decision making procedure. One c*ondition* for this fast trajectory was having a competent team with an appropriate constitution that represented the main interests of the organization on the strategic level: in the Manor project, major representatives were a board member, a director of facility management and housing, a cost controller and a member of the medical staff. In addition, the client organization had a say in the process. This make-up of the project team created short lines and enabled fast decision making. Having involved health managers who promote the new building, and its implications for adapting the organization, and the involvement of the board are other major *conditions*. The speed of the process also helped to keep users involved. Another *condition* is the

involvement of stakeholders and, related to this, trust between project management and stakeholders. This is an important *condition* since the speed of the process limits the opportunities for feedback to users such that not all details can be discussed.

Communication is also a *condition* for using the accelerate option as it creates support. In both our cases, the project owners kept in frequent communication with external stakeholders such as the municipality in order to maintain trust which is important for cooperation. The cases differed in the amount of communication with internal stakeholders, although this was to an extent due to the two projects being in different phases.

4.5.1.3 Contractual options

Option to accelerate: Manor developed different aspects in parallel to prevent a slowdown and to create time to consider aspects that needed further development. This was enabled by having a mediated project coalition where all the advisors worked closely together in a consortium. Since this cooperation was stated in a contract, one can speak of a contractual option. A condition for such cooperation is that the different team members are able to cooperate. This was checked during a test period with the management contractor and eventually was decided to continue.

Stage option: Contractual options mainly mitigate the negative consequences of uncertainty. Contractual terms related to uncertainty contingencies cover the division of risks if a client wants to make adaptations, and terms on how to resolve conflicts. The stage options described above are also stated in the contracts: Utopia included a term in their contract with the architect and advisors such that, after each phase, it had the ability to choose whether or not to continue with the contractors. Manor could determine whether the management contractor would continue after the design phase. There were no countermeasures as compensation for the possible loss of the assignment by the architect or the contractors. Further, when the same architect and advisors were appointed in the re-launch trajectory of the Utopia project, they even reduced their prices.

Switch option: In the Manor project, the contract stated that adaptations could be made to the design to a certain extent by the client, and that in the same time efforts should be made to reduce construction costs by both the management contractor and the subcontractors. A *condition* that enabled such cooperation through contractual terms was good contracting and negotiating skills. External *conditions* also played a role, such as the

situation in the market: the availability of competing parties, and the attraction of such project coalitions to contractors were essential, and there was a limited number of competent contractors. Using the stage option also implied certain risks for the contractor, and a *condition was* therefore that the contractors were willing to bear these risks.

4.5.1.4 Operating options: option to switch and scale

Switch and scale option: A commonality between both organizations is that they wanted to adapt to rising costs by reducing space and optimizing the working process during the building's exploitation phase. Both organizations were puzzling over how to find a balance between having enough space to carry out the primary process and the long-term cost-effectiveness of the real estate. For this reason, both had invested in the switching option by creating flexibility to change functions and scale certain functions up or down and, in the Manor case, by investing in developing the new policlinic concept in order to match the new layout to the working process. Although both organizations had invested, Manor had invested more than Utopia in the option to switch functions and scale up or down: adaptations in the design enable the exchange of functions, such as standardization of the distance between supporting walls, and the possibility to divest of some parts. Uncertainty over the healthcare to be provided has been high and therefore the option to switch was attractive and profitable. Utopia perceived less uncertainty and therefore adopted only the scaling option: adapting apartments to more or fewer occupants. The option was more a consequence of the organizational strategy than the type of project coalition selected.

An important *condition* was having cooperative employees since adopting the new policlinic concept necessitates adaptations to the working process.

4.5.2 Real options and project coalition types

The study shows that a separated project coalition mainly provides stage options and options related to that, such as stage-switch, scale and defer-stage-abandon. These options were all used to mitigate the consequences of uncertainty by providing more time to obtain information in order to reduce uncertainty, and to adapt to uncertainties.

4.5.2.1 The role of the separated project coalition

Within the category of contractual options, the stage option is the contract term that divided the risks resulting from the stage option within the investment/disinvestment

options category, realised by the separated project coalition. Risks existed for the contractor who was not ensured of being contracted for following phases. The stage options also had negative consequences for other stakeholders, such as patients and clients that faced uncertainty on the progress of the project and therefore lost commitment. The client risked loss of credibility of both internal and external stakeholders. Therefore, a condition to exercise and keep the value of this option was to mitigate these negative consequences by keeping stakeholders informed and formulating the right contract terms.

4.5.2.2 The role of the mediated project coalition

The mediated project coalition mainly showed options to accelerate. Several conditions enabled the exercising of these options, such as the close cooperation between architect, advisors, building contractor and client. Other important conditions were the efficient decision making procedure, efficiently planning the process and appropriately managing stakeholders and attitude of stakeholders. In this way uncertainties were decreased, as well as by determining and fixing the points of departure for a great deal at the start of the development process.

The mediated project coalition contained a switch option within the contract, enabling changing the design. Risks are placed with the (sub)contractors who were obliged to decrease construction costs. One stage option was included after the design phase, in order to evaluate the management contractor. Although not created yet, the organization of Manor was considering outsourcing more services, which might involve a real option to scale up and down the provision of services. Since outsourcing of services becomes increasingly important in health care we mention it here.

4.6 Conclusion and discussion

The main objective of this research was to discover whether real options thinking is already being applied in healthcare-related building project coalitions. and based on two in-depth case studies we provided some examples of real options and their conditions to be created and exercised. By showing what flexibility, in terms of real options, is being used in project coalitions, we provide a framework that can be used to gain insights into, and generate greater flexibility in, project coalitions and construction projects in the health sector.

It is shown that flexibility and thus real options are more valuable to one stakeholder than to another, as concluded by Olsson (2006a). Exercising the stage, growth and switch options mainly creates flexibility for the board and for other strategic functions in the client organization such as regional directors and financial controllers. These options create opportunities to develop ideas, and reduce uncertainty by obtaining additional information. Conversely, deferment and abandonment options often affect personnel and clients in a negative sense. Loss of commitment can result in even more delay. Therefore Manor tried to retain support among all stakeholders. Perhaps this is a larger issue in the cure than in the care since the medical specialists can be a large obstructing factor.

Other investment/disinvestment options 'on' the project which can improve realization serve the interests of project management since realization is their responsibility, but the organizational strategy can be better changed and implemented by means of flexibility as well. Investment/disinvestment options 'in' the project are more long term solutions and can adapt to changes in the primary process, serving the interests of both the users and the organization. These operational options, such as standardisation of the lay-out of the hospital, should reduce costs in facility management because of more optimal use of space and easier adaptations. Changing functions within a building during the operational phase involves an organizational decision, one often motivated by financial issues. Therefore, those responsible for managing the organization and its assets are mainly interested in such options. The care case invested to a lesser extend in the switch option than the cure case. Translating to real options reasoning, in a hospital more functions can be expected than in care organizations. As a result, the real option is less valuable in the care case and logically not invested in more than needed. More privacy for patients and clients is an important trend and therefore considered in both cases to increase marketability of real estate and thus creating a switch option.

Independent of the project coalition applied, both organizations had invested in both a strategic growth option and switch options in order to adapt real estate to a changing organization as the project developed. Striking is the difference between the two cases in the speed of the process although both organizations have to resolve uncertainties and make decisions. Nevertheless, in the care case was chosen for a separated project coalition, providing a lot of flexibility to resolve uncertainties and because it was a known approach but in the cure case delay was not allowed. Since most uncertainties are related to the organizational vision which mainly has to be determined by the board, and also is

being shaped during the development process in a construction process, a critical factor is the involvement of the board in this process. When these issues are resolved earlier in the process, also project coalitions that are in theory faster and more efficient, such as mediated and integrated project coalitions, can be applied. The most obstructing factor is often the decision making by the board. However, we are aware that hospitals face often once in a lifetime construction projects and most care organizations have a large portfolio with many projects. It might not be feasible for the board to be intensively involved in all projects, but perhaps one additional board member should be assigned to participate in project teams. This is in line with the increasing recognition of real estate being an important strategic asset in the organization.

In this paper we have shown that the health organizations in our study reason according to real option thinking in their real estate management to deal with uncertainties, although they do not use the real option concept consciously. It confirms that, as in many other areas, real options thinking can be applied in real estate management in health. However, it is also one of the sectors that does not use real options tools like Triantis (2005) described. This research created more understanding on how practitioners deal with flexibility and real options, which is one step to make real options thinking applied in practice, as suggested by Triantis (2005) and Ford and Lander (2011).

Many literature only deals with just one real option applied, where this research shows that many types of real options can be recognised in one project, among which are even combinations of real options. Although some real options are independent of the form of project coalition, we show that the choice of a certain type of project coalition enables or rules out certain real options. Further, whether it is valuable to invest in or later exercise a real option, depends on various conditions. Based on the findings of this study, a framework has been developed. This does not prescribe what form of project coalition to choose, but provides knowledge on current practices. Other health organizations can apply this knowledge to their own contexts to guide them in decision making. Besides, the strategies might be useful for other sectors as well, such as schools and private businesses.

A limitation of this research is that only two types of project coalitions were analysed. In addition, the case studies provided the opportunity to describe some real options elaborately, which prevented other real options to be described. Therefore the resulting framework is not exhaustive. Literature shows advantages of integrated and mediated

project coalitions. Within these two types of project coalitions, other *relational project delivery arrangements* have been distinguished (Lahdenperä, 2012). More case studies should be done which use these other project coalition types in order to complete Table 27. More in-depth research on consequences of the various real options should facilitate a more informed decision making on which type of project delivery to choose. Our case studies had not yet reached the construction and operation phase or just reached this phase, therefore some real options such as related to technical flexibility, could not be evaluated. Hence, it would be useful to follow these projects further or do case studies on projects which are in a more advanced stage. Finally, in the spirit of engaged scholarship, the results should be tested whether the conscious application of real option thinking supports real estate managers in thinking about flexibility and choosing the most appropriate project coalition type.

Acknowledgements

The financial support of this research by the organizations that participated in this research and the reviewers for their constructive comments is gratefully acknowledged.

5

TOWARDS A DECISION SUPPORT TOOL FOR REAL ESTATE MANAGEMENT IN THE HEALTH SECTOR USING REAL OPTIONS AND SCENARIO PLANNING[9]

Abstract

Purpose - Uncertainties affecting the future of health organizations inevitably influence real estate decisions since real estate is required to facilitate the primary health process. The purpose of this study is to develop a decision support tool that supports health organizations in defining what flexibility they need to consider in developing a real estate strategy to adapt to future uncertainties.

Design/methodology/approach - The research is conducted from a design science perspective. By addressing the needs of real estate managers in healthcare, research relevance is ensured, and applying scientific knowledge when developing the tool achieves rigor. Furthermore, the tool was tested and evaluated by means of a workshop and interviews before and after the workshop.

Findings - Major elements of the developed decision support tool are real options that describe flexibility and its consequences for corporate real estate management, and the backcasting scenario planning method. Application of the tool created mutual understanding and improved insights in the future design of the hospital to be built.

Societal implications - The application of the tool by health organizations can increase the professionalization of real estate management and also improve the match between current and future supply and demand of real estate, adding to the overall effectiveness and efficiency in healthcare.

Originality/value – This is the first tool developed that uses the real options approach to provide real estate managers in healthcare with a systematic insight into the various types of flexibility that will be required in the future.

[9] This chapter has been published as: Reedt Dortland, M. van, Voordijk, H., Dewulf, G., (2012). Towards a decision support tool for real estate management in the health sector using real options and scenario planning. *Journal of Corporate Real Estate, 14*(3), 140-156. doi.org/10.1108/14630011211285816. An earlier version of this paper has been presented at the Lowlands Health Economists' Study Groups (LolaHESG) 2012, May 24, Almen, The Netherlands.

Keywords: healthcare real estate, real options, scenario planning, backcasting, decision support tool, health care, real estate

5.1 Introduction

Healthcare provision is changing rapidly due to demographic changes, financial pressures, medical/technological developments, and policy changes. Given the ageing population and consequent budget pressures, there will be strong pressure for more efficient healthcare systems. Governments and healthcare providers all over the world are looking for ways to cope with booming healthcare costs, and at the same time decrease governmental budgets.

To address these challenges, governments have introduced competition among healthcare providers. Marketization in the health sector is seen by some as essential to limit costs. In various European countries, marketization has received a new impulse, with new policies encouraging a more business-like operation in health organizations, resulting in an increasing importance being attached to efficient and professional real estate management. This implies a need for the strategic management of real estate, where the current and future demands within the organization are considered from the viewpoints of the asset owner and the asset user: the investor and the operator. New partnerships have to be developed among healthcare providers, building companies, and financers.

An important issue within these partnerships for healthcare real estate management is flexibility, necessary because of the uncertainties surrounding future healthcare demands (Blanken, 2008; de Neufville, Lee, et al., 2008; Rechel, et al., 2009). Flexibility can be enabled through technical solutions, design flexibility, flexibility during the construction process, or in the use of the building. Despite this need, no tool has been developed that provides real estate managers with insight into the various types and the amount of flexibility that is needed in the various phases of a project, both now and in the future. A promising approach to providing a more differentiated insight into how flexibility can be created, its value, and its consequences is the real options theory (Adner & Levinthal, 2004a, 2004b; Gehner, 2008; Vlek & Kuijpers, 2005). Given the many uncertainties influencing healthcare, a combination with scenario planning forms a useful complement. This has already been proposed, such as by Miller and Waller (2003), but not yet applied in the

context of real estate development. We have opted for the backcasting method since this facilitates the development of strategies (Dreborg, 1996), including ones that would be appropriate for real estate management.

The aim of this paper is to develop a decision support tool that is both rigorous and relevant. Rigor is achieved by conducting the research from a design science perspective (van Aken, 2005). Hevner et al. (2004) developed a design framework based on this paradigm that we apply in this research (see Figure 9). The decision support tool has relevance since it should support health organizations in defining what flexibility they need to adapt to future uncertainties. In the next section, we go deeper into the design framework. Following the various aspects of the framework shown in Figure 9, we then describe the organizational needs in Section 5.3, after which the applicable knowledge will be discussed in Section 5.4. In Section 5.5, the developed decision support tool, based on the established knowledge base, is presented and tested. We then conclude the paper with a discussion of the testing, evaluation, and implementation of the decision support tool in the healthcare field and recommendations for future research.

5.2 Research method

5.2.1 Design science

The aim of design science is to design technological rules that are solution-oriented (Romme, 2003; van Aken, 2005). Technological rules can be formulated as “if you want to achieve Y in situation Z, then perform something like action X” (Van Aken, 2005, p. 23). The concept of the rule should be well grounded in research, but be applicable in different contexts. Field-testing can provide supporting evidence.

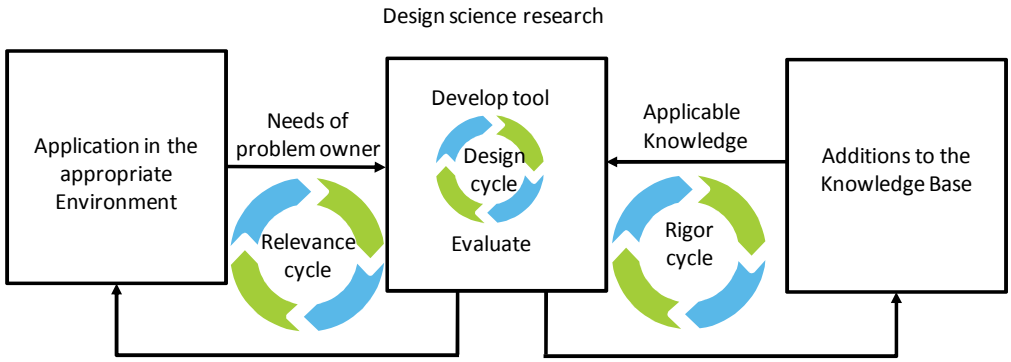

Figure 9 *Research framework (after Hevner, 2007; Hevner et al., 2004)*

In the research framework of Hevner et al. (2004), the environment defines the application domain of the tool to be developed, and includes the people, the organizational and technical systems, and the problems and opportunities (see Figure 9). By addressing these needs, the research achieves relevance. The knowledge base consists of the foundations (theories, methods, experience, and expertise). By applying this scientific knowledge, rigor is ensured. These two areas form the basis of the tool to be designed. Finding a solution involves a professional or researcher, in conjunction with the problem owner, and follows the regulative cycle of Van Strien (1997). This cycle roughly consists of defining the problem, planning the intervention (diagnosis, design of alternative solutions, and selection), applying the intervention, and evaluating the effect (van Aken, 2004). By applying and replicating the tool in different cases but in the same context one accumulates supporting evidence which continues until 'theoretical saturation' (Eisenhardt, 1989; van Aken, 2004) has been obtained. When this point of saturation has been reached, the tool development process stops. A first test of the tool developed was done by means of a workshop, interviews before and after the workshop and by observations during the workshops. This resulted in various design propositions to improve the tool. These propositions are important since they recognize both driving and blocking mechanisms (instances where the design propositions will succeed or fail). These mechanisms are important when it comes to translating the propositions to other contexts (Van Aken, 2004).

5.3 Needs of the problem owner: flexibility in providing care facilities

As outlined in the Introduction, the provision of healthcare is changing rapidly due to developments which are to an extent predictable, such as demographic changes, and sometimes very uncertain such as medical-technological innovations and policy changes. However, the buildings and the services provided within them are expected to support the core public service at all times. Strategic facilities management focusses on aligning buildings and ancillary services with the needs of the core business (Dewulf, et al., 2000). The extent to which the core services will change due to changing demands for clinical activities is unpredictable. The core business of a hospital, the clinical services, is changing rapidly, and therefore the need for flexibility has become increasingly important. This implies a need for greater flexibility in real estate strategies: in order to meet current and future supply and demand. Increased flexibility for a building's client often implies greater risk for the contractor, and this will be factored into the pricing. Therefore, excessive flexibility should be avoided since the costs might outweigh the benefits. Further, flexibility can have mixed and even opposing consequences for the various stakeholders within an organization. In order to have the knowledge to determine what types and how much flexibility to negotiate for, greater insight is needed into the types of flexibility, when to use them, and how to create and exercise flexibility.

Flexibility is a broad concept (Olsson, 2006a) and various types of flexibility can be identified. In this study, the categorization of flexibility in real estate management in health developed by the Dutch *Bouwcollege*[10] is followed, namely: 1) financial flexibility - such as short-term rent contracts and marketability of real estate; 2) organizational flexibility - using all spaces in an optimal way; 3) process flexibility - in which the organization gains flexibility by staging the decision making process; and 4) product flexibility - in which technical applications facilitate building flexibility. Blanken (2008; based on Yun, 2007) added flexibility on strategic, tactical, and operational levels. Strategic flexibility enables changes to the configuration of an asset to enable long-term real estate

[10] The Bouwcollege (Netherlands Board for Healthcare Institutions) was a governmental institute established to effect the law related to healthcare provision. Prior to its demise in 2010, its tasks included determining performance indicators for building construction in healthcare, providing permits with relevant conditions for construction projects, and advising the Ministry and health organizations. Prior to any permit being given, the Ministry had to agree that the building construction was necessary.

strategies. Tactical flexibility enables the building to be adapted without changing the overall size and functionality, while operational flexibility has a low impact on time such as changing furniture.

Different types of flexibility, or real options, can often be obtained by making certain investments. As such, there is a need for a decision support tool that considers the various types of real options. The tool should add to the professionalization of real estate management in healthcare and to greater cost effectiveness within healthcare in general.

5.4 Applicable knowledge

The knowledge base used in designing the decision support tool draws on both theory and practice. In this section, we discuss the theoretical concepts underlying the decision support tool. In subsection 5.4.1, we go deeper into the concept of flexibility by applying the real option theory. Following this, subsection 5.4.2 elaborates on scenario planning and the specific applicability in this research of various methods.

5.4.1 Flexibility and real options

A promising approach for providing insight into flexibility is the real options theory. A real option is defined as a right, not an obligation, to exercise an option, and the idea derives from financial options (Black and Scholes, 1973). Myers (1977) applied options to *real* investments: so-called real options (Amram & Kulatilaka, 1999; Dixit & Pindyck, 1994). Real options provide value through the ability to be flexible, and the value increases as uncertainty increases. Triantis and Borison (2001) suggests various ways of applying real options: as a way of thinking, as an analytical tool, and as an organizational process. We argue that using real options, as a way of thinking and as a basis for real option analysis, is the most promising application in a healthcare context for three reasons. First, real options, as a way of thinking, can help real estate managers recognize that uncertainty is not inherently negative, and can even provide value. Secondly, since many uncertainties in healthcare are unpredictable and therefore impossible to quantify, ROA provides a method to assess uncertainties in an easy and qualitative way that does not require competence in handling complicated risk analysis tools. The other advantage we highlight is that the categorization of real options forms a practical tool to identify the types of flexibility needed and the mechanisms that can be mobilized to create this flexibility. In

this way, ROA provides a language of flexibility that facilitates communication between different decision making levels. For example, the project management team of an organization can more easily provide insights for the board of the organization into the consequences of certain decisions.

Although research show that practitioners often unconsciously reason according to the real option concept, real option models are only limitedly applied. Authors such as Triantis (2005) argue that real option models should be more user-friendly and that, to improve risk management practices, the gap between unconsciously and consciously using real option thinking should be closed. Triantis (2005) suggests that the development of heuristics would aid the further dissemination of real option applications and eventually lead to the use of more advanced real options tools, such as those already applied to real estate management and design by Greden and Glicksman (2005). The tool we develop describes heuristics for using a combination of backcasting and real options that should make real options more applicable in practice. Table 31 describes the various types of real options with examples of their application in construction projects based on Amram and Kulatilaka (1999), Fichman et al. (2005), Sommer and Loch (2004), and Winch (2010). Amram and Kulatilaka (1999) provide a taxonomy of real options within which we can place the abovementioned real options. The taxonomy consists of investment and disinvestment options, timing options, contractual options, and operating options. Investment and disinvestment options may significantly change the asset configuration by using scaling up, scaling down, and growth options. Timing options, such as to delay or to accelerate, also fall within investment and disinvestment options. Contractual options reflect contract terms that change the risk profiles faced by asset owners: that is, the contingency adaptability in a project coalition (Luo, 2002). Since all types of options can be defined in contracts, they can all to an extent be seen as contractual options. Operating options relate to options linked to an asset in use, such as a switch option. A service can also be stopped (the option to abandon), or scaled up or down, and can grow or shrink. The aim of the tool is to identify several real options that can qualitatively be applied in an organization. Several pieces of research have already investigated the use of real options in real estate development, although this has often concerned only one or two types of real options. Nevertheless, these applications are a useful complement to the proposed tool, as an elaboration on how to proceed with quantifying these real options. Examples concern the real options to switch (Greden and Glicksman, 2005) and to grow

(Guma, et al., 2009). De Neufville et al. (2008) made a distinction between real options 'in' and 'on' the project. The former deals with technical solutions in the building whereas the latter points at flexibility in the process of developing the project. Referring to the former mentioned classification of flexibility, financial- and process flexibility are provided by real options 'on' the project, while product flexibility is provided by real options 'in' the product. Organizational flexibility might concern both types of real options.

Table 31. Types of real options and example applications in construction projects

Goal of real options (Amram and Kulatilaka,1999)	**Types of real options** (Trigeorgis,(1993a) Sommer and Loch,(2004) Fichman et al.,(2005)	**Real options 'in' and 'on' the project** (De Neufville et al., 2008a)	**Examples of applications in healthcare real estate construction projects**
Waiting-to-invest option	Defer	'on' the project	If there is uncertainty on governmental regulation, the project might need deferral
Growth option of a market	Growth, switch function	'in' the project	Other demands can necessitate the switch function or expanding or shrinking the real estate
Flexibility options	Growth, scale up and down, switch function	'in' the project	When organizational demands change: expand the building, scale up or down, or use the switch function
Exit options	Abandon	'on' the project	When finance cannot be obtained, it should be possible to abandon the project
Learning options	Select	'on' the project	Select several architects to obtain knowledge on the best one
Irreversible investments	Stage	'on' the project	A construction project is irreversible. By staging the project, a go/no-go moment is provided after each stage

5.4.2 Scenario planning methods

Scenario planning is a management tool, developed by the RAND corporation in the 1960s, used to develop strategies for uncertain futures (Schoemaker, 1993; van der Heijden, 1996). Scenarios are plausible descriptions, not predictions, of the future that highlight critical sources of uncertainty that an organization should be aware of and adapt to

through strategy development. A strategic decision is defined as "a decision that forces the organization to ponder its very existence, independence, mission, and main field of activity'' (in Godet, 2000; Lesourne, 1994, p.6). Scenarios can be developed according to two schools of thought: the qualitative 'intuitive logics' or the quantitative 'probabilistic modified trends' (Bishop, Hines, & Collins, 2007). For several reasons we have opted for the first approach. First, because we distinguish between risks and uncertainties and, according to the definition of Knight (1921), uncertainties, unlike risks, cannot be predicted and therefore cannot be quantified. Here, the focus of our research is to improve the ability of health organizations to adapt to uncertainties since these are currently often excluded from strategies because they are difficult to assess. Second, because research has shown that descriptive scenario planning is the most useful approach in strategy formation for an organization (Schoemaker, 1993).

We follow the categorization of Börjeson et al. (2006) when describing the various scenario planning methods. This typology is divided into three categories of scenarios, each with two types: 1) predictive scenarios with forecasts and what-if types; 2) explorative scenarios with external and strategic types; and 3) normative with preserving and transforming types. Since we explicitly do not set out to predict the future because of the unpredictability of the uncertainties influencing health, the predictive scenarios are not used in this study. The exploratory scenario category can answer the '*what can happen?*' question. These scenarios are more descriptive, and the aims can be to raise awareness, to stimulate creative thinking, or to gain insights into the ways societal processes influence one another (van Notten, et al., 2003). As already noted, two types of explorative scenarios exist: external scenarios and strategic scenarios (Börjeson et al., 2006). External scenarios incorporate issues that are beyond the influence of the organization whereas strategic scenarios deal with the possible consequences of actions taken within the organization. Exploratory scenarios are mainly useful in terms of strategic issues: where the scenarios can help to develop robust strategies that resist the consequences of possible future situations (Van der Heijden, 1996). Since health organizations face many external uncertainties, external scenarios are especially useful. However, the question remains as to what these contextual scenarios specifically mean for the provision of healthcare, and accordingly for the layout of an organization's real estate. The third scenario type, normative scenarios, might be useful in describing how a certain future can be reached.

Normative scenario studies are useful in developing a strategy in which envisaged future targets can be met. Of the normative scenario options, transforming scenarios are more relevant than preserving scenarios here since the former aim to describe how a future situation can be reached when the current system is changing. We are currently witnessing changes in the healthcare system, and can expect more of such drastic changes in the future. One method for developing strategies to reach a future situation is known as backcasting. This is an approach that involves reasoning back from a desired image of a future situation to identify those changes that are required to create this image. The term was introduced by Robinson (in Dreborg, 1996; Robinson, 1982) who, in a later publication, defined backcasting as follows (Robinson, 1990 in: Dreborg 1996, p. 814):

> The major distinguishing characteristic of backcasting analysis is a concern, not with what futures are likely to happen, but with how desirable futures can be attained. It is thus explicitly normative, involving working backwards from a particular desirable future end-point to the present in order to determine the physical feasibility of that future and what policy measures would be required to reach that point.

When applied to real estate, the question becomes what flexibility is needed to achieve potential future layouts given the current layout. Various methods have been proposed for backcasting (Börjeson et al., 2006; Dreborg, 1996).

According to Van Notten et al. (2003), various scenario types can legitimately be used in a single study. Therefore, for the development of our decision support tool, we use external scenarios, to describe the possible future contexts in which health organizations will act, and transforming scenarios to develop a strategy to reach this future situation. Within the several scenario types, various techniques can be applied in the three phases of scenario development: generating, integrating, and consistency. The Delphi method is often used to collect views and ideas regarding elements of the future (Börjeson et al., 2006), and we apply this to identify uncertainties with a low probability but a high impact. These are important in scenario planning since predictable uncertainties are often already incorporated in organizational strategies (Evers, et al., 2002). This distinction is depicted in Figure 10.

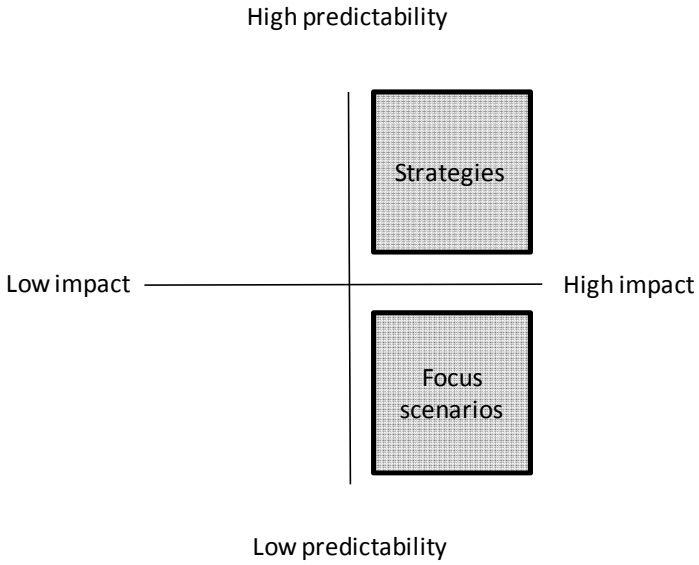

Figure 10 *Mapping strategic choices (Evers et al., 2002)*

5.5 Developing the decision support tool

Following the research framework presented in Figure 9, we combine the various concepts and methods from the knowledge base described in the previous section to develop a decision support tool. The purpose of the decision support tool is to gain insight into the flexibility needed in healthcare real estate in the form of real options. Knowledge on the real options needed and their implications in terms of the interests of the organization and potential investment is useful when negotiating with contractors. The eventual tool is presented in Figure 11 and, in this section, we explain and test the various stages of the decision support tool by means of a workshop, interviews before and after the workshop and by observations during the workshops.

The first stage of the tool consists of discussing the contextual scenarios, which are developed in advance by means of interviews with experts. The subject of these interviews is developments influencing health organizations. By means of a Delphi survey consensus is created on the height of the impact and the degree of uncertainty of the various trends[11]. In the second stage, the participants of the workshop define future

[11] See Appendix F

situations of their organization and real estate within the contextual scenarios developed. Commonalities within these future situations have to be determined, which will be then the desired future situation. Within the third stage, the workshop participants develop a strategy including flexibility in terms of real options, in order to reach this desired future situation. Before and after the workshop the participants are interviewed to test their knowledge on the real option concept, and to check their opinion on the usefulness of the workshop. We also ask for recommendations to improve the workshop.

The tool was tested by means of a workshop, interviews before and after the workshop and by observations during the workshop in a Dutch hospital. This test resulted in several design propositions to improve the tool. The workshop included nine people, of which five were employees from the hospital involved in the new construction project or maintenance of real estate. They represented various interests in the organization since they fulfilled the following functions: construction coordinator, technical service employee, healthmanager, member of patient council and head finances. The current hospital was built in 1975 and during the course of time extended. It was a regional hospital with loyal patients who choose not to go to larger hospitals in the surrounding larger cities. However, the management fears that this situation will not hold much longer, also because these larger cities are constructing new and appealing hospitals and the current hospital is obsolete and inefficient. The initiative for the new hospital already dates from 2007, but because of problems with financing the project, construction has still not started. In the same time, various new developments forced the hospital organization to rethink the design of the new hospital. During the time that the research took place, the project was still postponed since all strategies to obtain financing failed.

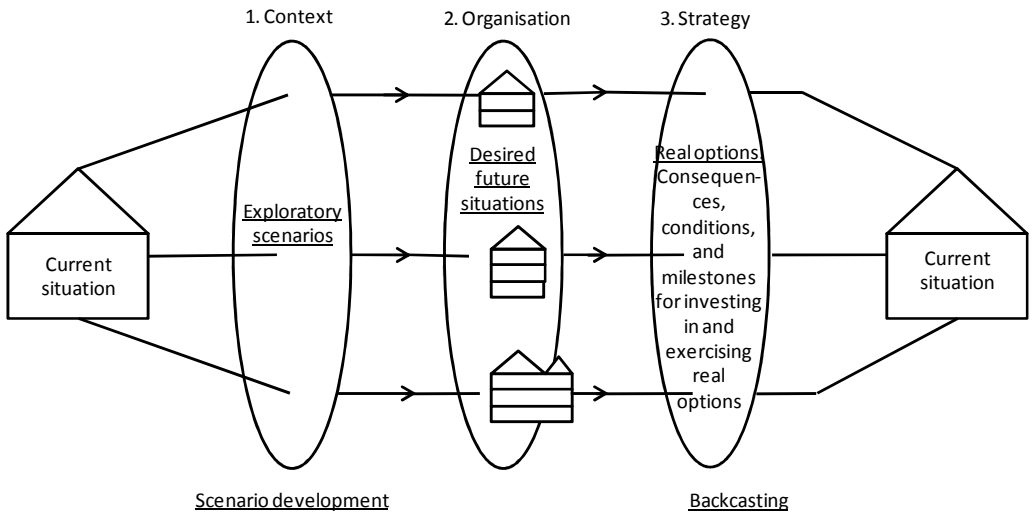

Figure 11 *Three stages of the decision support tool (adapted from Kok, van Vliet, Barlund, Dubel, & Sendzimir, 2011)*

5.5.1 Stage 1: Discussing exploratory scenarios

Broadly speaking, three steps can be identified in developing scenarios: first – identify major concerns about future developments; second - focus on the discussion of key uncertainties and driving forces; and third - develop the actual scenarios (Kok, Patel, Rothman, & Quaranta, 2006).

In the first step, we interviewed key people in healthcare and in real estate management of participating organizations. According to Slocum (2003), the scenario team should comprise decision-makers (whose mandate or competence is relevant to the focal issue or question), and also cover a broad range of functions, areas of expertise, (political) perspectives, and creative thinking. In this case board members and project managers of the hospital and an elderly care organization, and a researcher from a research institute were interviewed. We asked these respondents to give their opinions on the predictability and impact of uncertainties which are 'general environmental' and include the following areas (Miller, 1992); political, governmental policy, macroeconomic and socio-economic/demographic, see Appendix E. The health sector is another source of uncertainty, for example because of the upcoming of new technologies, medicines and treatments. We also asked for trends within the organization, which might have a large influence on the organization. By means of a Delphi survey using an online survey tool, a ranking of most influential and unpredictable developments had been identified and used

to develop scenarios to be presented and discussed in the workshop (see Table 32). More predictable trends such as demography were incorporated as well since these have a high impact and make the scenarios more plausible. Two extreme, but plausible, scenarios plus one trend scenario in which the future health organization might operate were developed.

These scenarios were contextual scenarios of environments: short descriptions of future external developments, with differing economic situations being the most distinguishing factor. The scenarios were further bounded by the lifetime of the building, which is set at around 30 years. The economic situation as the overarching theme of the scenarios since it has a very large impact, including on the other driving forces within the scenarios. For example, the ability to obtain loans from banks is heavily governed by the economic situation. The European situation is seen as the other key dimension and represents both demographic and institutional developments. In choosing these two main dimensions, a balance is struck between overly complicated scenarios and capturing the complexity of today's problems (Grossmann, 2007). These two dimensions are used as a 'backbone for scenario development', i.e. they form a framework within which various scenarios can be developed (van't Klooster & van Asselt, 2006). The scenarios were presented, discussed, and refined in a workshop.

The aim of the tool is that it will be institutionalized in the organization and that health organization employees, as described in van der Heijden (1996), will be able to make such scenarios themselves in the future since, by their very nature, uncertainties change.

Table 32. Main trends in each scenario

Trend scenario Remaining average recession in the Netherlands	Scenario A Economic bloom, European integration	Scenario B Economic recession, European segregation
Increasing healthcare costs	Health costs increase in Europe	Large income differences in and between regions
Ageing of population, diseases of civilization	Large demand for Dutch health care from the whole of Europe	Brain drain of doctors and personnel, healthcare worsens, competition of other countries
Gradual introduction of marketization. No focus on prevention	European health system. More cross border healthcare. More marketization. Less prevention	Health is stripped off. More government control on healthcare provision. Focus on prevention
More competition and patient oriented	Importance of patient orientation	Low efficiency: low level of cooperation of healthcare providers
Innovation in construction industry Bad market for offices	Advanced construction and medical technologies. Focus on life cycle costing	Low construction costs, high maintenance costs. Low level of innovation
Lack of personnel	More efficiency: less personnel needed because of technology	Difficult to obtain loans from banks
More attention to life cycle costs	Scaling down is trend, locations in living areas, healthcare home delivery	Clustering of functions on outskirts of the town
More outsourcing of service tasks	Pill against dementia	Less diseases of civilization because of 'crisis menu' (people have less money for unhealthy food)

5.5.2 Stage 2: Visualizing future situations within the contextual scenarios

Since health organizations adapt their primary process to various developments, and real estate needs change within this process, different facilities are required under different scenarios. In our approach, participants in the workshop were asked to define desirable real estate futures given the different contextual scenarios. A floor plan of existing functionalities was used to visualize the current situation and facilitate thinking on the future situation, see Figure 12. The areas (in square meters) given over to various functionalities were also provided. The workshop participants were asked to think about

the influence of the possible scenarios on the types of functions and floor areas needed in the future. Various scenarios resulted in different views on the future real estate. The aim of the workshop was that the participants would find commonalities between these future pictures and in that way define a future situation of their real estate that is an adaptation to the various plausible scenarios. This future picture is not only dependent on various types of healthcare that will be provided in the hospital and thus the primary process, but also on other interests in the organization and the importance which is assigned to these various interests. For example, if healthcare expenses increase and in the same time less means are available to provide healthcare, there will be more focus on cost reduction than on patient orientation, resulting in a less luxury and spacious hospital.

Figure 12 *Floor plan of first floor of the Mountain hospital (the top left drawing is part of the new design)*

5.5.3 Stage 3: Real options applicable to reach future situations

Using backcasting, and reasoning backwards from the desired future situations, the mismatches with the current situation could be identified along with the types of flexibility needed. For example, if the participants expect more space to be needed for certain functions then technical flexibility to expand the building is required. Similarly, if functions change within the building, the technical infrastructure should also change. This requires both technical flexibility to adapt and also process flexibility over the maintenance of the building. If maintenance is outsourced, then the contract with that external party should include a term that enables the adaptation of the building. In applying the backcasting approach, the third stage enables a better determination of which real options are applicable for reaching future situations within the contextual scenarios envisaged. The third stage involves the following steps:

1. Define the difference between the ideal future picture and the current situation.

2. Determine which types of real options are necessary to enable the required flexibility. Here, the concept of real options is discussed in advance of the workshop and a list of real options and their potential consequences are provided.

3. Assess which quality dimensions are most important in each phase of the project: 1) impact; the influence of the build to forms and materials, internal environment and identity and character, 2) build quality; the quality of the construction and its' performance and 3) function; implying factors such as use, access and space (Gann et al., 2003). Determine those real options required to achieve the most important dimensions of quality. By ranking the importance of each dimension in a certain project, the client is better able to determine which real option is most suitable, or should be prioritized when it comes to investment.

4. Define conditions that are necessary to enable investing and exercising real options. Can milestones be recognized among these conditions?

5. Identify the real options and milestones that are required in the strategies of *all* the potential scenarios. These constitute robust real options and milestones, and together should constitute the real estate strategy.

6. Compare the consequences of the chosen real options for all the stakeholders under all the various scenarios. Choose the real options with the highest value, i.e. the most benefits for all stakeholders and the fewest negative consequences.

Based on these steps, real options are identified and presented using the format of Johnson et al. (2006) and Ford and Garvin (2009). An example of a real option identified in the workshop of the first test of the tool is shown in Table 33.

Table 33. Presentation of a concrete example of a real option in the workshop

Main uncertainty	Additional specialisms want to take seat in the hospital, or extra patients come to the hospital.
Potential strategies	Investing in an extra strong foundation for eventually an extra floor, or doing nothing.
Consequences	If the demand increases or space for an additional specialism is required, than an additional investment should be done to build an extra floor. If there had not been built an extra strong foundation, than the hospital should be extended elsewhere, with consequences of inefficiency as in the old hospital. What is it worth to invest in an extra strong foundation? What are possible costs and benefits?

5.6 Discussion and conclusion

Following the research framework presented in Figure 9, a decision support tool has been developed for identifying the flexibility needed in a project so that it can adapt to future uncertainties. In this final section, we will briefly reflect on the workshop in which we tested the tool and present various design proposition for each stage which we derived from experiences in the workshop and the suggestions done in the interviews.

We developed the scenarios quite elaborately. However, since health organizations often have a lack of time and money to do this exercise extensively by themselves, we would like to propose a simpler approach:

Proposition 1: When there is lack of time to develop scenarios simpler scenario types with only two driving forces on two axes is an effective starting point for discussion on consequences for real estate.

In the second stage, there was a rich discussion on the future of the hospital but this was less reflected in a concrete picture of a hospital in the future which made it more difficult to do the backcasting exercise. One participant mentioned that a better preparation by the participants would generate more discussion since people could have thought of it beforehand. To improve consecutive workshops we propose the following:

Proposition 2: In order to stimulate the participants to think of a future situation of the real estate, an overview with floor areas has to be provided in advance with a clear assignment, in order to provide participants time to prepare and generate more input in the workshop

According to the participants, concrete examples of real options were very useful to get an idea on how to apply the approach and to generate new ideas. In addition, participants in the test workshop thought that it was easier to think of costs and benefits of real options 'in' the project than real options 'over' the project. However, the idea to weigh strategies with and without a certain real option in order to see whether investing in flexibility and to which amount, was thought to be useful by most participants. This resulted in the following proposition:

Proposition 3: when there is no or little knowledge on the concept of real options, concrete examples of real options should be handed out in advance of the workshop in order to provide participants to generate a more equal knowledge base among the participants and generate more input in the workshop

Various project-specific conditions determine which real options can be used. The aim of the real option analysis and backcasting approach is merely to create a useful way of thinking. When the approaches are internalized in the mindset of people, then ideas can arise outside of official meetings (see also Godet, 2000). This is termed 'second loop learning' by Argyris (1996).

Since most interests of corporate real estate management were represented in the workshop, the workshop in itself created more mutual understanding. It appeared that brainstorming about real options was beneficial for an improved design of the hospital. Therefore, such a workshop is especially useful in the initiation- and design phase of a construction project.

In addition, developing a similar decision support tool for contractors, or encouraging the participation of contractors within a workshop for a health organization, could be beneficial. The latter would create mutual understanding and trust between clients and contractors, and improve their cooperation, an idea proposed by several authors who recognize trust as an important factor in project success (Laan, 2008; Ring & Van de Ven, 1992). Further, based on their specific knowledge, contractors could then make useful inputs in an early stage by highlighting the limitations and opportunities of certain real options. The proposed approach could also be applied in real estate projects in sectors other than healthcare.

In this research, we have developed and tested a decision support tool by applying a design science research method based on the framework of Hevner et al. (2004). In this way, rigor has been ensured in the research. Relevance is claimed since the tool supports healthcare real estate managers in defining required flexibility. The design propositions derived in this research should be tested in other workshops for further improvement. By applying the tool, health organizations can increase the professionalization of their real estate management and improve the match between current and future real estate demand and supply, so adding to the effectiveness and efficiency of healthcare in general.

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6

SENSEMAKING OF REAL ESTATE MANAGEMENT USING REAL OPTIONS AND SCENARIO PLANNING[12]

Abstract

Healthcare across the world is facing many uncertainties. In Dutch healthcare, a recent policy change forces health organizations to deal more efficiently with their real estate, and this increases the need for more flexible real estate strategies. In order to support real estate managers in incorporating flexibility when decision making, we have developed a tool combining scenario planning and real options. Scenario planning enhances sensemaking of the consequences of future uncertainties, and real options should support addressing flexibility in decision making through weighing the pros and cons of flexibility measures. We evaluate the sensemaking process by applying the tool to a hospital, to a forensic clinic and to a mental and elderly care organization. Data collection took place through interviews and workshops. The identity and characteristics of the workshop participants and the different institutional environments of the organizations were found to influence the sensemaking process. The tool proved to offer a useful means to make sense of abstract uncertainties that influence an organization, aspects which are normally outside the scope of real estate managers. The real options approach, as a way of thinking, offered a more structured way of balancing the costs and benefits of strategies to deal with future uncertainties.

Keywords: real estate management, real options, scenario planning, sensemaking

6.1 Introduction

The provision of healthcare is changing rapidly due to demographic changes, financial pressures, medical-technological developments and policy changes. Due to the ageing population and consequent budget pressures, there will be a strong need for more efficient

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healthcare systems. Governments and healthcare providers all over the world are looking for ways to cope with booming healthcare costs in a time of decreasing public budgets.

To address these challenges, governments have introduced competition among healthcare providers. Marketization in the health sector is seen as essential to limit costs. In various European countries, marketization has received an impulse with new policies demanding a more business-like operation of health organizations, resulting in an increasing importance being given to efficient and professionalized real estate management. This implies a need for the strategic management of real estate in which current and future demands within the organization are met such that they optimally facilitate the primary process. One measure that has stimulated the professionalization of real estate management is the introduction of Diagnosis Relate Groups, which have been introduced in various countries in different forms. In the Dutch cure sector, these are in the form of DBCs (Diagnose Treatment Combinations, sort of DRG) that contain a budget for capital costs such as real estate. 'Production' thus becomes necessary to obtain adequate financing for real estate investment. In the care sector, various health packages (ZZP) have been introduced which are related to the amount of health care that one needs and there is a related budget for housing (NHC).

New partnerships have to be developed among healthcare providers, building companies and financiers under the new healthcare system. An important issue within these partnerships in healthcare real estate management is flexibility, necessary because of the uncertainties surrounding healthcare (Blanken, 2008; de Neufville, Lee, et al., 2008; Rechel, et al., 2009). Flexibility can be enabled through technical solutions, with flexibility during the construction process or in the use of the building. However, no method or tool has yet been developed that provides real estate managers with insight into making strategic decisions about the various types and amount of flexibility that is needed in the various stages of a project, both at the time and in the future. A promising approach to provide a more differentiated insight into how flexibility can be created, its value and the consequences is the real options theory (Gehner, 2008). A real option is defined as a right, not an obligation, to exercise an option, and the idea derives from financial options (Black & Scholes, 1973). Myers (1977) applied options to *real* investments: so-called real options (Adner & Levinthal, 2004b; Amram & Kulatilaka, 1999; Dixit & Pindyck, 1994; McGrath, et al., 2004). Real options provide value through the ability to be flexible, and the importance increases as uncertainty increases.

Despite the wide range of potential applications of Real Options Analysis (ROA), in practice, as illustrated in the literature, its application lags behind its potential use (Ford & Garvin, 2009; Lander & Pinches, 1998; Triantis, 2005). The literature on real options tends to focus on the quantitative valuation of real options whereas studies among practitioners show that practitioners often use real options intuitively and as a way of thinking (Busby & Pitts, 1997). Apparently, as Weick (1995) in his sensemaking studies indicated, accuracy is less important than plausibility. Applying real options to architecture, engineering and construction projects, Ford and Garvin (2009; 2012) identify barriers and make recommendations to overcome them. These barriers and recommendations are mainly addressed to project managers of contractors who are executing work directed by the organization's upper management. However, project managers in health organizations often act on a higher level in the project organization at a time when the assignment has still to be defined. Project managers are mediators between the contracting organization and the client (the health organization). They face similar issues as the project managers of contracting organizations, but they have to deal with a range of interests in the health organization when determining the assignment, and their mandate extends over a far longer period than those of project managers in architecture, engineering and construction projects. Most of the literature on the use of real options focusses on the method itself, whereas we are more interested in *how* real estate managers use real options as a way of thinking and *why* they perceive this as valuable or not.

Real options can be seen as a way to proactively deal with uncertainty. When real options are used quantitatively, the volatility of the underlying uncertainty determines the value of the real option. However, in our research, we focus on managing flexibility that addresses uncertain developments that are hard to predict and that have a large impact, making them difficult to quantify. Probabilities can be estimated, but if real options are used as a way of thinking, quantification becomes unnecessary. Real options are then used to stimulate practitioners to think more strategically about flexibility, and provide an indication of the type and extent of flexibility that is needed. Scenario thinking is useful in structuring and guiding thinking on plausible futures: by recognizing plausible futures, a more resilient real estate strategy that is able to adapt to various organizational goals can be developed. Various types and techniques of scenario planning exist (Bishop, et al., 2007; van Notten, et al., 2003) but one approach, that is institutionalized in businesses such as Shell, (see Van der Heijden 1996), is most commonly used. In this approach, contextual

and descriptive scenarios are developed, after which one determines the consequences of these contexts on the organization. The next step is backcasting, where one depicts an ideal future real estate layout that is adapted to future uncertainties. Subsequently, one reasons backwards in order to develop a strategy that prescribes how to reach that future situation. Real options are used here as part of the strategy. This combination of real options thinking with scenario planning was suggested by Miller and Waller (2003) who applied it to the option to invest. We extend this method by applying both contextual and backcasting scenarios, and considering multiple real options. In addition, our research helps fill the knowledge gap of how practitioners develop strategies based on scenario planning (O'Brien, 2004).

We use the sensemaking concept as a theoretical perspective to analyse how real estate managers and other stakeholders make sense of real options. Sensemaking is the process needed to turn awareness of needed flexibility into concrete real estate strategies, and "involves turning circumstances into a situation that is comprehended explicitly in words and that serves as a springboard into action" (Weick, et al., 2005, p. 409). Consequently, the aim of our study is to develop an understanding of how real estate managers make sense of future uncertainties and whether real options as a way of thinking could enhance sensemaking of flexibility measures that could be applied to cope with these uncertainties. We pose the following research question: Does scenario thinking and real options enhance the collaborative sensemaking of a health organization's multiple stakeholders in dealing with future changes and developing a flexible real estate strategy to adapt to these changes?

Given the many uncertainties facing health organizations, their various stakeholders should determine what this means for their organization and which types of flexibility are needed. Flexibility is a very broad concept that can have different meanings when looked at from different perspectives (Olsson, 2006b). Therefore, we first consider what people mean by flexibility, and thus which frame of reference they have with regard to flexibility. Since sensemaking is expressed by language, definitions are important. Most research focusses on the process of sensemaking, and the substance of sensemaking, i.e. the content, is mostly overlooked (Weick 1995). Having a discourse may enhance collaborative sensemaking since it will stimulate shifts in parties' flexibility frames, potentially allowing them to align these frames through interaction. In order to facilitate this process, scenario thinking is a useful complement of real options analysis in enhancing sensemaking.

Scenarios are a shared representation of how the organization might look like in the future, and function as a common framework for people to gain an understanding of how they should deal with that future, in case that future should happen. At the very least, it will help them foresee different events allowing them to be better prepared and more adaptable.

In order to answer the major question presented above we organized three workshops. There were three elements to each workshop: participants developed contextual scenarios; then they determined the consequences for the organization and consequently for its real estate; and finally they determined which real options were suitable to reach this future situation through reasoning backwards, i.e. backcasting. The results of the three workshops in different health organizations are presented in this chapter. Interviews were held before and after each workshop with the participants to investigate whether the workshop induced sensemaking. We analyse whether sensemaking has taken place in terms of the sensemaking concept described by Weick (1995).

This paper is structured as follows. First, in the theoretical framework section, the basic characteristics of sensemaking are related to concepts of scenario thinking and real options. Next, in the method section, we elaborate on the operationalization of sensemaking through real options thinking and scenario planning, which we then addressed in interviews both before and after the workshop. The outcomes are presented in the results section, along with findings from the workshops themselves. An evaluation of the workshops is presented in the subsequent section. We conclude with recommendations for the application of real options in healthcare real estate management.

6.2 Theoretical framework

By means of sensemaking, individuals give meaning to the events and actions in an organization. The sensemaking concept as expounded by Weick (1995) has several features that are grounded in identity construction: identities are “constituted out of the process of interaction” (Weick 1995, p. 20), and thus depend on an individual’s social environment, which individuals also shape themselves. Sensemaking is ongoing, focused on and extracted by cues, and driven by plausibility rather than accuracy.

In this section, we elaborate on these features to analyse whether and how sensemaking takes place. Firstly, sensemaking takes place within a flow of actions in which *cues* are recognized. Meaning is given to these cues through framing. *Frames* influence how people act and how they make sense of the cues. "The content of sensemaking is to be found in the frames and categories that summarize past experience, in the cues and labels that snare specifics of present experience, and in the ways these two settings of experience are connected" (Weick, 1995, p. 111). Weick argues that meaning is created when a person is able to construct a connection, or *theory of action,* between past moments of socialization (i.e. frames) and cues, which then leads to belief-driven sensemaking.

In this section, we will describe the various sensemaking elements in more detail and how these features can be related to real options and scenario thinking in this research. Table 34 summarizes the various features used to study the sensemaking process by means of real options and scenarios.

Table 34. Characteristics of sensemaking and elements indicating sensemaking by real options and scenario thinking

Sensemaking aspects	Elements of sensemaking with real options	Elements of sensemaking with scenario thinking
Cues	Recognise future cues in scenarios, and future decisions to be made to create real options in strategies	Future cues with consequences for scenario development
Frame: Theories of action	Real options recognised in past decisions/events Shared perception of need for flexibility Measures taken for flexibility Structured thinking with real options	Consensus on current uncertainties and future evolvement in scenarios; cause –effect of uncertainties on organization
Belief driven sensemaking	Arguments used with regard to flexibility measures and real options	Arguments and way of reasoning with regard to scenarios and strategy development in backcasting.

6.2.1 Cues

Sensemaking by individuals takes place in interactions with others, each with their own socially constructed realities based on their experiences. Sensemaking takes place within a 'flow' of actions in which 'cues' are recognized. Cues are seen as noticeable events that

require further attention because they provide a sense of cognitive dissonance by the observer and therefore need further investigation in order to mitigate this dissonance. Sensemaking implies the noticing of cues, interpreting them, determining their meaning and then externalizing these interpretation through concrete activities. People can absorb a certain number of cues but, when a threshold is reached, they experience a 'shock' which initiates the sensemaking process (Schroeder, et al., 1989 in: Weick 1995). Further, a shock might consist of several smaller shocks. Change or innovation does not take place in an instant from one moment to another. The two most common sensemaking occasions that generate shocks are ambiguity and uncertainty.

The workshops held are noticeable events (i.e. cues) which create ambiguity by showing that the organization is insufficiently prepared for potential future situations. They might even create a shock which results in action to deal with the uncovered ambiguity. 'Cues' within the workshop, i.e. arguments or things that are being said, challenge the participants' understanding of what real options and flexibility are. The introduction of the real options concept is also a cue. Since the participants' current frameworks are unsuited to giving meaning to a certain cue, the framework is adapted, by means of sensemaking of the new concept, to a revised framework in which the real options concept fits. When it comes to scenario thinking, past cues have meaning for future developments and are, in that sense, used for scenario thinking. According to early literature on sensemaking, scenario thinking seemed less appropriate for the sensemaking concept since sensemaking was assumed to occur retrospectively. However, Wright (2004, 2005) wondered what advantage sensemaking could have for future action if retrospection is its fundamental characteristic. Gioia et al. (2002) argue that making sense of the future is possible by looking 'retrospectively' at events that need to happen to reach a future situation. This idea was also proposed by Boland (1984) and it is often referred to as 'future perfect thinking'. Boland found that people gain a better understanding of actual past events if they have an understanding of what had been done in an imaginary future. Weick (1995) also recognized that this implies that "sensemaking can be extended beyond the present. As a result, present decisions can be made meaningful in a larger context than they usually are and more of the past and future can be brought to bear to inform them" (Weick 1995, p.29). Concluding this section, we define cues related to real options thinking as elements of past events that respondents notice and recognize as real options, such as investments that create a real option. Also, future events that the workshop participants

identified as actions to create and exercise real options are cues. As related to scenario thinking, cues are elements of events that respondents observe as having an impact on the organization as are the identified potential future developments that form part of scenarios.

6.2.2 Frames

Frames (Goffman, 1974) are "the means by which managers make sense of ambiguous information from their environments" (Kaplan, 2008, p. 729). Within these frames, "cues are noticed, extracted and made sensible" (Weick 1995, p. 109). Framing is the term used for labelling the meaning that individuals attach to events, which is influenced by their context and experiences. The frame influences how individuals act: they make a map of events, with the causes and effects in which they have a role, interpret these and take action based on that map (Drazin, Glynn, & Kazanjian, 1999). Another explanation of frames is that they "enable people to locate, perceive, identify, and label occurrences in their lives and world" (Snow, Rochford Jr, Worden, & Benford, 1986, p. 464). As such, frames are the substance of sensemaking. Weick (1995) suggests different vocabularies to describe how people make sense, i.e. what their frames and cues are. Frames are more abstract than cues, and a cue makes sense within a certain frame and, because of this, a connection between these two is made. For example, perceiving real estate as a commodity to create profit, or as a means to facilitate the primary process are two different frames. A cue will then be a concrete action, such as adapting spaces to accommodate more or fewer people.

Weick's concept of theories of action is the most suitable vocabulary to describe these past and present moments and their connections for our research. Theories of action are global ideas on how people think that A leads to B, and are associated with statements such as if-then, which can be applied to reasoning with real options. We focus on how people develop strategies by means of real options and scenario planning. Strategies are plans to reach a certain goal, and thus cause-effect relationships are important. Adopting the real options concept as a way of thinking implies, for most organizations, a shift in their theories of action since it is an uncommon approach. Sensemaking thus has to occur in order to change the frame. Within our workshops, we tried to influence sensemaking by presenting the structure of real options thinking, clarified by drawing examples from practice, derived from casestudies in earlier parts of this research. Sensemaking can be

synonymous to adopting the new theory of action for real options. We evaluate whether structured thinking involving real options is understood and occurs in practice.

Sensemaking through the use of scenarios occurs if participants in a workshop are able to agree on how certain plausible futures might evolve, i.e. which cause-effect relationships might happen. Once consensus has been reached on this future frame, scenario thinking aids in another aspect of sensemaking. Framing is an important concept in sensemaking since decisions cannot be made independently of their context. The contextual scenarios function as the frame in which decisions have to be made. The plausible futures guide participants in making sense of their potential need for flexibility in the future, what type of flexibility this is and how it can be created. By means of backcasting, participants deduce which future cues need to take place in order to change from the current organization and accompanying real estate layout to the future real estate layout.

6.2.3 Belief-driven sensemaking

According to Weick (1995), sensemaking appears in four forms: two forms being belief-driven, namely arguing and expecting, and two action-driven, namely committing and manipulating. Arguing might result in sensemaking since people challenge each other with their beliefs and in that way clarify new ideas. Beliefs can also be embedded in expectations that guide interpretations and affect target events. These beliefs resemble beliefs of action rationality rather than of decision rationality, and are more strongly felt and more directive than arguments (Weick, 1995).

Beliefs are embedded in frames and influence what people notice and how events unfold. Believing is seeing, and events unfold in a certain way because people believe it to be that way - it is a self-fulfilling prophecy. Thus actions have to follow belief in order for the desired event to happen. Therefore, in our research, we would like to know if there is a shared belief on the important decisions to be taken over real estate in which flexibility plays a role as a means to deal with uncertainty. This is the starting point for belief-driven sensemaking of flexibility.

Sensemaking is the human ability to deal with unforeseen outcomes of events. Scenario thinking recognizes that the future is uncertain, but at the same time that the future is not completely random and therefore should not be ignored (Michel Godet & Roubelat, 1996). Scenarios are not predictions as such, but multiple plausible and socially constructed

alternatives in the form of narratives "that integrate predetermined events with critical uncertainties in creative ways to encourage managers to challenge their assumptions in a safe and risk-free hypothetical environment" (Schwartz, 1996 ; van der Heijden, 1996 in; Wright, 2005, p. 87). Godet and Roubelat (1996) propose using multiple imaginary futures to make people aware of important future phenomena and interrelationships and then to act upon these by taking risks while maintaining an interest in the human consequences. "Prospective sensemaking therefore is indicated as involving both an attitudinal and task response that involves acts of exploration and interpretation in an imagined future" (Wright, 2005, p.91). Sensemaking is, in most cases, approached as a natural capacity that should be developed, whereas Wright (2005) emphasizes scenario thinking as a tool to confront existing mental models and therefore create shocks to stimulate sensemaking. One of his recommendations is to focus in future research on how scenarios enhance sensemaking and strategizing. Burt and van der Heijden (2008) propose evaluating futures studies using three elements identified by Vickers (1995): how people perceive reality, how they value this reality and which strategies and instruments they identify as suitable to eventually alter this reality. According to Vickers, judgments on these aspects result from sensemaking, which process we now describe.

Action-driven sensemaking in the form of committing starts with an action for which a person is responsible. "Once it becomes harder to change the behaviour than to change the beliefs about that behaviour, then beliefs are selectively mobilized to justify the act" (Weick, 1995, p. 156). Manipulation is an action that makes a visible change in the world that affects others and that requires explaining to them. The main difference between the two is that commitment deals with a single action whereas manipulation involves various simultaneous actions (Weick, 1995). We cannot investigate action-driven forms of sensemaking since the actual action of investing in and exercising real options does not occur within the workshops.

6.3 Method

In this section we describe the methods we have applied. Through a workshop, we applied the tool as developed in Chapter 5, containing the methods of real options thinking in combination with scenario planning. The theoretical pattern derived from the sensemaking concept is confronted with the empirical data (Yin, 2009). Since sensemaking is an ongoing process, it would be expected that the thinking about real options and

scenarios changes. In order to 'measure' changes, the participants were interviewed before and after the workshop to test whether the real options concept and scenario thinking was helpful and aided sensemaking of thinking about future uncertainties. In other words, the focus is on both the *process* and the *content* of sensemaking. The *process* of sensemaking deals with questions on whether people make sense of flexibility measures to deal with future uncertainties through real options and scenario planning and, if this is true, how and why they do this. First, participants have to make sense of these methods, i.e. understand what the purpose is and how they work. The *content* of sensemaking deals with the question as to whether the workshop delivers useful insights for the participants. In this section, we first describe the operationalization of the sensemaking features which were addressed in the interviews both before and after the workshop. Next, we present the set-up of the workshops and a description of the workshop participants.

6.3.1 Ex ante and ex post interviews

To test whether sensemaking took place, we held interviews with the participants both before and after the workshop. In addition, we used the information provided in the ex ante interviews as input for the workshop. We opted for semi-structured interviews rather than surveys because interviews provide room for clarification of the answers and for greater insight into the sensemaking process, which is difficult to grasp from surveys. Further, this approach would increase the likelihood that the researchers would receive responses.

6.3.1.1 Cues

Cues are noticeable aspects of events which interfere with people's current frames and beliefs. As such, a cue mobilizes people's sensemaking activities in order to make meaning of these events and eventually take action. Certain events could plausibly happen again in the future, or evolve in a certain way, but how and to what extent is uncertain. During the workshop, we discussed scenarios and the consequences these might have on the organization. In the first workshop we presented scenarios developed by the researchers. Since these were not applicable in the other two workshops, we asked and discussed with workshop participants before the other two workshops key uncertainties which they thought would have a large impact on the organization if they evolved in a certain way. In this way, we sought to create appropriate scenarios. This evolved that before the second workshop we discussed main uncertainties and in the third workshop we used the

"seven-question approach" which originated from the Institute of the Future and has since then been further refined (Amara & Lipinski, 1983; Burt, 2007). The questionnaire is presented in Appendix E. The seven questions are:

- If you could pose three questions to a clairvoyant, what would you ask?
- If you are the clairvoyant and you answer your own questions and the future will turn in the positive direction that you want, how will you answer your own three questions?
- If the future turns out negatively, how would you answer your questions?
- Which important events from the past (good or bad) have to be remembered as lesson for the future?
- Which important decisions with long term consequences does the organization currently have to make, decisions which have to be taken in the coming months/next year?
- Which constraints do you experience inside/outside your organization that limit you in your function?
- If you leave the organization, what do you hope that you will be remembered for?

6.3.1.2 Frames

Before the workshop, we asked the participants for their definition of flexibility to see to what extent they agreed on the meaning assigned to flexibility, and consequently whether this frame corresponded to those of the other participants. A similar question addressed how one perceived the need for flexibility. After the workshop, we asked the participants whether they now defined flexibility and the need for it differently as a result of the workshop. A frame can be described as a theory of action: how people think that one should act in order to reach a certain goal. Therefore, we asked about measures that had already been taken to create flexibility in order to investigate the current theory of action regarding flexibility. In the interviews prior to the workshop, the participants were stimulated to think about measures taken to deal with demographic, technological and policy-related trends. We also asked for specific flexibility measures with regard to finance, technology and the building process.

Real options thinking is another frame, and the structure of the real options concept provides a theory of action on how to approach decisions regarding flexibility. When used

as a concept in language, the various types of real options should be clear. Real options can be applied both in the process and the product (de Neufville, Hodota, et al., 2008), i.e. 'on' and 'in' large engineering projects, a description that fits many healthcare construction projects. Real options 'on' projects are focused on accelerating or deferring projects whereas real options 'in' engineering systems focus on optimizing the technical design (de Neufville et al. 2008b, p. 42). Types of real options are presented in Table 35 with concrete examples applicable to healthcare real estate management.

Table 35. Types of real options

Types of real options e.g. Trigeorgis (1993a), Sommer and Loch (2004), Fichman et al. (2005)	**Project management (de Neufville, Hodota, et al., 2008)**	**Examples of application in healthcare real estate construction projects**
Defer	'on' the project	When there is uncertainty over governmental regulation, the project might need deferral
Growth, switch function	'in' the project	Other demands can necessitate use of the switch function to expand/shrink the real estate
Growth, scale up and down, switch function	'in' the project	When demands on the organization change: expand the building, scale up or down, or switch function
Abandon	'on' the project	When finance cannot be obtained, it should be possible to abandon the project
Select	'on' the project	Select several architects to obtain knowledge and identify the best one
Stage	'on' the project	A construction project is irreversible. By staging the project, a go-no go moment is created after each stage

Before one is able to make sense of flexibility measures *with* real options, one should first understand the concept and thus make sense of the concept real options. To make people aware of the concept, we provided information on real options before the workshop, and we asked respondents before the workshop which real options they could assign to investments they had done. These statements do not cover all potential options but provide examples to stimulate thinking on real options. The questionnaires used before and after the workshop are included in Appendices H and I. In the third ex post

interviews we changed to open questions on real options to challenge the respondents more, see Appendix I. Before and during the workshop, in order to clarify the concept, we provided a framework of the real options concept. Ultimately, if this framework became internalized within the practitioners' way of thinking, it would, as a result of sensemaking, become a theory of action. After the workshop, we asked the participants whether the structuring of real options in the proposed framework made sense and would be used in the future. Finally, we presented the participants with statements on the availability of certain real options and the consequences these have on stakeholders. After the workshop, we came back on these topics by asking the respondents to reflect on various statements. We used a Likert-scale of 5 to have a better ability to compare results. Besides we obtained the same information in a structured and comprehensive way on various subjects among the various participants. Operationalization of the sensemaking properties measured in interviews before and after the workshop are presented in Table 36.

Table 36. Sensemaking features measured in interviews prior to and after the workshop

Interview topic	Measure prior to the workshop	Measure after the workshop
Cues	Key uncertainties influencing the organization as a result of past events	Which uncertainties have not been sufficiently considered in construction project(s)?
Frame: theory of action	Consequences of future uncertainties and past events Need for flexibility Flexibility measures taken Real options (reasoning) already unconsciously applied[13]	(Shared) perception of need for flexibility Statements on the use of scenario thinking and real options thinking Statements on the applicability of real options Intended use of real options as a result of the workshop
Belief-driven sensemaking		Arguments used in workshops and interviews

6.3.2 Workshops

We conducted workshops with three health organizations, each workshop containing three stages as illustrated in Figure 13. Each health organization had one or more ongoing real estate projects and was struggling to cope with the current developments in healthcare. It was expected that the workshops would assist them in raising awareness of the consequences of current developments on their real estate and in determining suitable flexibility measures in their real estate strategies such that they could adapt to future uncertainties. Observation of the workshops is an important part of the casestudy research since belief-driven sensemaking takes place by means of arguments, which are observed by the researchers. This process is narratively described in the results section. Except for the employees of the organization concerned, an external expert and two or three researchers participated in the workshops. The researchers were both observer and workshopleader. In addition, observations in the workshop can be confronted with statements of respondents in the ex post interviews. In this way the data can be triangulated. The next section describes the set-up of the three stages in the workshop in more detail.

[13] The workshop participants were not familiar with the concept of real options prior to the workshop. It is meant here that people use real options without defining them as such.

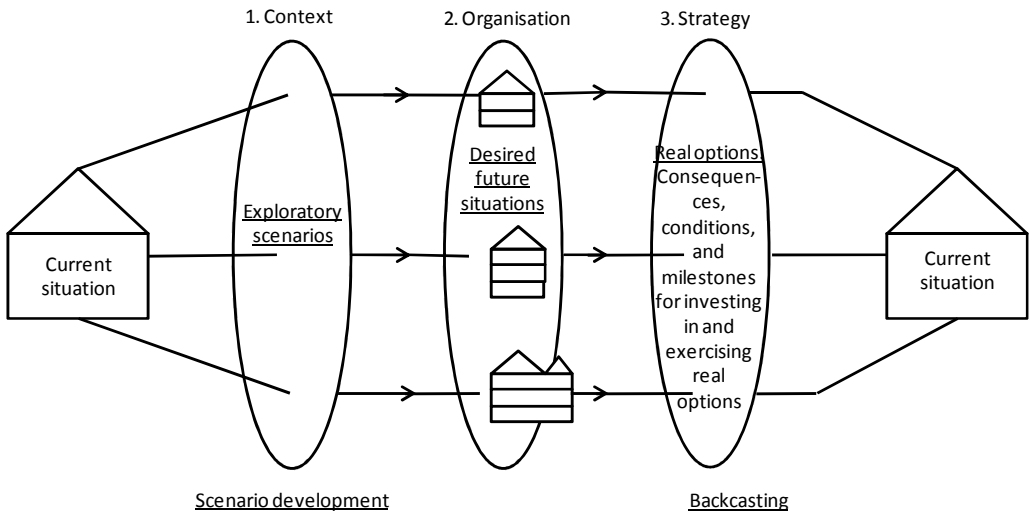

Figure 13 *Workshop stages*

6.3.2.1 Set-up of the workshops

The *first stage* of the each workshop consisted of discussing contextual scenarios. Scenarios developed by the researchers served as input to the first workshop stage. In the second and third workshop, the results of the earlier interviews where respondents elaborated on their perspective of which developments will influence the organization are used. Sensemaking takes place through discussion and arguing in order to create scenarios upon which consensus is achieved. Plausible scenarios on which participants agree thus become shared frames of how the future might look and based on which strategies should be developed.

In the *second stage*, the participants of the workshop defined future situations of their organization, e.g. a change in the provision of healthcare under the different scenarios. The participants also determined the consequences for the layout of their real estate as a result of the different outcomes for the organizations. They evaluated whether this implied adaptation of the current situation, and hence the need to develop real estate strategies that provided for these adaptations. Commonalities within these future situations had to be determined, which would then be the desired future situation.

Within the *third stage*, by means of backcasting and real options, a strategy was developed incorporating flexibility measures to reach the desired future situation. In an analogy with sensemaking, a shared meaning was created among participants, with their frames of

reference now overlapping. This belief-driven sensemaking process should result in an action in response to the sensemaking.

Partly due to lessons learnt by the researchers during the workshops, each workshop was slightly different, see Table 37. In the first workshop at the hospital, we used scenarios previously developed with health experts but not with participants of the workshop. We assumed the scenarios to be applicable since they were focussed on healthcare in the cure sector. We listed key uncertainties as determined by experts and created consensus among the experts on the predictability and impact of these uncertainties by means of a Delphi survey. These scenarios were short narratives, described on a PowerPoint slide, and the workshop participants agreed to their validity. In the second workshop, held in a forensic clinic, the researchers developed scenarios based on key uncertainties that were mentioned by the participants in the interviews prior to the workshop. Although the scenarios were based on input from the participants, these raised much discussion among the workshop participants after presenting the scenarios in the workshop. More details on this discussion are provided in section 6.4.2. In order to develop scenarios which the participants could agree upon, we chose to use only two main uncertainties on two axes[14]. In the third workshop, in the elderly care organization, we divided the ten participants into two groups who each developed scenarios.

[14] This follows the so-called straightforward method suggested by (van't Klooster & van Asselt, 2006).

Table 37. Differences in the approaches among the three workshops

	The hospital	The forensic clinic	The mental and elderly care organization
Scenario development	Researchers presented earlier scenarios developed with experts from the cure and care sectors using a Delphi survey.	Researchers presented scenarios developed based on uncertainties mentioned by respondents. Then scenario axes with only 2 dimensions were developed in the workshop.	Scenario axes with 2 dimensions were developed in the workshop. List of uncertainties mentioned by the participants handed out to support scenario development.
Reason	Assumption that scenarios would be applicable – to save time in the workshop.	Ambiguity and uncertainty on feasibility of scenarios. Creating ownership of scenarios.	Experiences in previous workshop.
Awareness raising of real options in advance[15]	Statements with examples including a real option.	Statements with examples including a real option.	List with types of real options discussed.
Reason	Thought to be easier for the respondents.	Thought to be easier for the respondents	Less straightforward and more challenging for respondents. List allows more examples.
Structure of real options presented in workshops	Simple structure with uncertainty, consequences and possible strategies.	Simple structure with uncertainty, consequences and possible strategies.	More detailed structure with all aspects of real options reasoning.
Reason	Researchers believed clarifying basic idea of real options would be sufficient.	Researchers believed clarifying basic idea of real options would be sufficient.	Researchers expected this to enhance sensemaking of the real options concept.

6.3.2.2 Participants of the workshop

Most participants had a long history of working in healthcare and often in the same organization, see Table 38. In the hospital workshop, the construction coordinator and a staff member from technical services were the only participants with direct responsibility for real estate. Conversely, except for the controller[16], all five participants from the real estate department of the mental health organization had technical or real estate backgrounds. Given their long working history in healthcare, they had considerable

[15] See Appendices F and G for the questionnaires

[16] The controller is not included in Table 35 since it was unknown in advance that she would participate in the workshop and therefore she was not interviewed before the workshop. Since there was no ability to compare the results ex ante the workshop, nor was she interviewed after the workshop.

knowledge of the primary process. In the forensic clinic case, both the participants had a non-technical background, the service centre manager for example having graduated from a hotel management school. They both had started to specialize in real estate while working in the organization. This was also the management policy of the organization; one needed to know the primary process before starting a facilitating function. In most cases, the knowledge of the participants was sufficient for them to think on both abstract and strategic levels, which is needed to translate strategic issues in real estate into concrete consequences.

Table 38. Characteristics of workshop participants

	Function	Experience in healthcare (years)	Experience in organization (years)	Role	Role in decision making on real estate projects
Hospital	**Health entrepreneur**	24	2.5	Responsible for strategic and financial areas of the hospital's oncology enterprise	Advises on requirements of real estate
	Staff member technical service	8	8	Responsible for daily maintenance	No direct role
	Construction coordinator	20	9	Responsible for management of construction of new hospital	Part of steering group on project
	Patient council			Representative of patients, as real estate in portfolio	No direct role, gets informed on state of affairs
	Controller	9	9	Head of finance and control	Calculating financial consequences, documenting, conversations with banks
Forensic clinic	**Project manager**	14	3	Real estate project manager of overarching organization, advisor to local real estate managers in developing lists of requirements, calculating consequences of renovations for real estate. Process management	Supporting the board's decision making by calculating consequences of various scenarios for real estate, making business cases
	Manager service centre	?	17	Guiding small renovations and adaptations, responsible for technical service	Not involved in decision making; board takes responsibility and gives notice
elderly care	**Manager maintenance**	20	13	Maintenance of buildings, responsible for safety	Maintenance plan for buildings. Responsible for buildings after delivery

Project manager real estate	25	4	Project management from initiative to delivery. Focus on technical measures	Evaluating list of requirements using constructional knowledge
Director department real estate	26	18	Involved in health developments and decisions with regard to housing. Developing real estate strategies on the portfolio level	Aligning organizational needs with real estate on a strategic level
Project manager real estate	18	18	Project management. Tries to implement innovative concepts such as cradle-to-cradle	Practical, day-to-day real estate management but within strategic frame
Staff member portfolio management	2	2	Mapping real estate portfolio for long-term real estate strategy	Supporting decision making

6.4 Results

In this section we describe the outcomes of the interviews before and after the workshops to evaluate whether sensemaking had taken place, and also the observations and findings of the workshops themselves. Table 39 shows the responses to these statements posed after the workshop which assess both the content of the workshop and the methods used.

6.4.1 The hospital

The first workshop involved a regional hospital which was built in 1975. Over time, the building had been extended on all sides and had now become obsolete and inefficient. The hospital has loyal patients who choose not to go to larger hospitals in nearby larger cities. However, the management fears that this situation will not hold for much longer, to an extent because these cities are constructing new and appealing hospitals. The initiative for a new local hospital dated from 2007 but, due to problems with financing the project, construction had not started. At the same time, various new developments were forcing the hospital organization to rethink the design. During the period that the research was taking place, the project was still being delayed as all the strategies to obtain finance had failed. A construction coordinator is in sole charge of managing the real estate, while a service centre is responsible for maintenance and technical support. Participants with various functions within the organization participated in the workshop and they were all, to some extent, involved in the new project.

6.4.1.1 Interviews before the workshop

In interviews prior to the workshop, respondents agreed that *measures* to create flexibility were very necessary and they could offer various examples. Ideas aimed at adapting to future uncertainties and to increase efficiency were mentioned including financial, technical and organizational measures. The respondents seemed to view flexibility measures as being closely related to sustainability measures since they also mentioned waste reduction and energy saving measures. In addition, they also considered a flexible attitude by users towards new developments to be necessary. The extent of the required flexibility was difficult to predict given rapid technological trends: for example, an x-ray department had to be renovated three times within eight years. An organizational measure that was intended to be introduced in the new hospital was the introduction of medical teams that walk through the building and visit patients rather than receive patients in consultation rooms. Technical solutions mentioned were demountable walls and easily accessible technical installations and uniform ceilings which enable adaptations, expansion and allow a change of function. Flexibility in the process was less often mentioned.

Before the workshop, it appeared that all respondents, except for the construction coordinator who disagreed, believed that real options were feasible, or at least adopted a neutral standpoint, but they were not sure whether this flexibility was actually created. They were not uniformly positive on the consequences of this for the primary process. The time to defer had passed since it would reduce the patient stream. In addition, there was no option to abandon: the hospital would go bankrupt. The hospital had the authority to expand, which is necessary to be able to invest in innovation if they think this will be profitable. The controller stated that since the hospital is on the edge regarding finances, additional expenditure on expanding the real estate would have negative consequences for the primary process.

Table 39. Post-workshop statements on the applicability and knowledge of real options and scenario thinking

	Hospital					Forensic clinic	Mental health and elderly care organization				
Statements	Health entrepreneur	Staff member Technical service	Construction coordinator	Patient council	Controller	Project manager real estate	Manager maintenance	Project manager real estate	Director department real estate	project manager real estate	Staff member portfolio management
1. Scenario thinking is a good method to estimate the future need for flexibility in the organization	4	4	5	5	4	4	4	4	4	4	5
2.The workshop gave more insights into types of flexibility that can be used	2	4	2	5	3	2	4	2	3	2	4
3. The workshop made me think more on how the future organization might look like	5	4	4	2	4	2	3	2	2	2	5
4.Flexibility has value which increases when uncertainty increases	4	4	4	2	2	-	5	4	4	4	5
5.The concept of real options gave me more insight into types of flexibility which can be used	2	4	2	2	4	2	4	3	4	5	4
6.The concept of real options made me think (more) on the conditions necessary to create and exercise real options	3	4	2	2	4	4	4	3	3	3	4
7.The workshop made me think (more) about the costs and benefits of flexibility	4	4	4	3	2	2	3	3	3	4	3
8.The workshop made me think (more) about tuning rather than maximizing the flexibility needed in the future	2	4	2	4	4	2	4	2	3	3	3
9.The workshop made me think (more) about the consequences for various stakeholders when exercising real options	4	4	4	4	4	2	3	4	3	3	4
10.Real options are a necessary means to communicate on flexibility between various stakeholders within the organization and cooperating parties when designing a new	4	4	5	4	4	4	4	2	4	4	4

building											
11.Real options are a necessary means to communicate between parties when constructing a new building	4	4	4	4	4	4	4	4	4	4	4
12.Real options are a necessary means to communicate between parties when operating a new building	4	4	5	4	4	4	4	4	4	4	4
13.I think that the use of real options would make negotiating over flexibility with contractors easier	3	4	2	5	4	4	4	4	3	3	-
14.The use of scenario thinking and real options is complementary	-	4	4	4	4	4	4	4	4	2	5
15.The workshop did not bring any new ideas in relation to the future of the organizations and flexibility	2	2	2	2	2	2	4	4	4/2	4/2	2
16.Flexibility has been considered too little in the plans for the new developments	1	2	3	2	3	2	2	2	2	3	1
17.There is too much flexibility in the plans	1	2	3	2	2	2	2	2	2	2	3

Note. Legend: 1= I totally disagree, 2 = I do not agree, 3 = neutral, 4 = I agree, 5 = I fully agree

6.4.1.2 The workshop

During the *first stage* of the workshop, the scenarios shown in Table 40 were presented and discussed with all the participants. They agreed on the validly of all the scenarios, although they observed that the role of insurance companies was missing. These companies have a large influence on the types and volume of healthcare that the hospital is allowed to provide. In addition, they stimulate mergers between hospitals even though the government states that mergers do not increase efficiency. These opposing opinions generate uncertainty as to what future policies will be. The innovations in the construction industry and the difficulty in obtaining loans from banks creates uncertainty over how to deal with sustainability and efficiency and how to achieve these: "Offices, for example, were efficiently built in the 1970s, but they appeared to be too small and were inflexible. Now you see that these are no longer being used. In Amsterdam, new offices are big and impressive, they are always full and never for rent. Therefore it seems that building spacious is more marketable, but this is not allowed by financers." The

participants also recognized that certain material choices are more sustainable but more expensive and that, because of financial reasons, the hospital is forced to choose cheaper solutions. As a result of the discussion, one uncertain development was added, namely the influence of health insurance companies.

Table 40. Descriptions of the three scenarios discussed in the hospital workshop

Trend scenario **Continuing mild recession in the Netherlands**	**Scenario A** **Economic boom, European integration**	**Scenario B** **Economic recession, European segregation**
Increasing healthcare costs	Health costs increase in Europe	Large income differences in and between regions
Ageing population, issues with diseases linked to modern society	Large demand for Dutch healthcare from the whole of Europe	Brain drain of doctors and personnel, healthcare worsens. Competition from other countries
Gradual introduction of marketization. Lack of focus on prevention	European health system. More cross-border healthcare. More marketization. Less prevention	Poor healthcare provision. More government control on healthcare provision. Focus on prevention
More competition. Patient-oriented	Importance of patient orientation	Low efficiency: low level of cooperation among healthcare providers
Innovation in construction industry. Poor market for office buildings	Advanced construction and medical technologies. Focus on lifecycle costing	Low construction costs, high maintenance costs. Low level of innovation
Lack of personnel	Greater efficiency: fewer personnel needed because of technology	Difficult to obtain loans from banks
More attention to lifecycle costs	Scaling down, locations in residential areas, home delivery of healthcare	Clustering of functions on outskirts of towns
More outsourcing of service tasks	Medical solution to dementia	Fewer diseases linked to modern society because of 'crisis menu' (people have less money for unhealthy food)

In the *second stage* of the workshop, the consequences for the organization and its real estate were discussed. We presented an overview of the current division of functions and allocated square metres and asked what the consequences of the scenarios would be for this. The participants believed that in all three scenarios the number of beds will decrease and the areas for nursing would relatively increase, while areas for supporting services will be located outside the hospital. Such developments are rapid, as are cultural changes

within the organization: “now it is no longer an issue that offices are outside the terrain, whereas five year ago this was unthinkable”. The various scenarios elicited arguments to support the current organizational strategy with regard to these developments, such as the increasing importance of e-health: “We invest little in e-health. Perhaps this is bad and reality will overtake us but, with the new construction in sight, we don’t do it”. Another participant stated that “probably e-health will be combined with nursing. This will result in less outpatient movements but there will be more monitors which will require additional square metres”. Another argument was that the organization was opting for the “room-service” concept in which patients have more personal contact. This might be less efficient in terms of personnel, but will speed up the healing process and thus be beneficial for the organization.

The workshop leader asked the participants for likely friction points in the consequences for the hospital with regard to departmental locations. The measures had been thought about from various standpoints. The construction coordinator stated that “changes can be accomplished fast in software-related solutions when the infrastructure is well installed”. According to the health manager, “we will thematize healthcare. The number of square metres is all right, but the solution lies in clustering different types of healthcare in another way. Clustering around specialists will no longer happen, this has been accepted by the specialists now. In addition, the beds will not be allocated to specialists; on the contrary, they will move within the hospital to the various patients.” Concluding, the second stage made clear that the hospital already had determined that the developments result in a decrease of the total surface and that more services will be outside the hospital. A strategy to accomplish this strategy was being developed. The second stage of the workshop was therefore an exposition of considered measures to accomplish this strategy.

The *third stage* of the workshop included the development of strategies that would enable adaptation of the current situation to reach the future situation. It appeared that the hospital already had considered many of the consequences of the scenarios and strategies in the plans for the new hospital. These were already discussed in the first two stages of the workshop, as illustrations of scenarios and the consequences for the organization. For instance, the problem over obtaining finance already exists. The construction coordinator explained: “we are more focussed on the primary process now. Earlier, more functions belonged to the primary process. Now, functions such as pharmacy, lab, human resources are called support.”

We also presented participants with examples of types of real options, see Table 41. The aim was to stimulate them to think in terms of real options by running through the list and considering whether these options would be useful as a strategy to deal with the consequences of future scenarios. The option to grow had been already invested in through the stronger foundations built to allow an additional floor. However, the controller argued that the growth option will not be exercised since a need to shrink is much more plausible. The option to phase was thought to be a sign of bad leadership despite the workshop leader mentioning instances where the option would be applicable. We discussed the various options, which were either deemed to be possible, not possible, or used. An example was the option to select by inviting multiple contractors. When discussing the implementation of such a strategy and determining milestones, various important issues were raised on which the hospital should make a decision: "The perception is that the hospital is becoming emptier. Instead of diseases and treatment, it is shifting to behaviour and health. Is healthcare currently the right approach or should it be different? Are treatments being executed because it is part of a ritual or is the hospital really the best place to perform treatments?" Events such as cooperating with other organizations demand choices as well: "If we will merge with the surgery in X, then a shift in patient care will occur. How will that look like? Will there be a separate entrance with a red carpet for the patients or surgeons from X?" The workshop leader tried to stimulate discussion on weighing the costs and benefits of flexibility measures, when stating that standardization creates flexibility but is costly. This was confirmed: "yes, for example, door widths are a consideration of efficiency and space. If the door is wide, the bed can enter easily, but there is no space for a cupboard". Finally, there was discussion on the fact that one should decide which activities the hospital should retain and which abandon. Concluding, in stage 3 of the workshop, issues which puzzled the participants were expressed and questions with open answers. These triggered some of the participants to investigate further.

Table 41. Presentation of an example of real options reasoning in the workshops with the hospital and with the forensic clinic

Uncertainty	Additional specialists who might want to be based at the hospital, extra patients
Possible strategies	Investing in foundations for an additional floor, or doing nothing
Consequences	If demand increases or a specialism is added, additional investment is needed in an extra floor. If additional foundations are not built then expansion elsewhere will be needed. What is it worth investing in this foundation? What are the potential costs and benefits?

The evaluation of the workshop resulted in various reactions. Some saw it as confirmation that they were on the right track. However, the construction coordinator was triggered by some issues raised during the workshop which he had not previously considered with regard to the treatment and logistics of certain patients and doctors.

6.4.1.3 Interviews after the workshop

The opinions of the participants on the definition of and need for flexibility were not changed during the workshop, nor did they come into line with the definitions of other participants after the workshop. The one exception being the vice president of the patient council, who was more convinced of the need for flexibility based on new insights gained during the workshop. During the ex post interviews, as reflected in the scores in Table 39, all the respondents agreed on the usefulness of the scenario thinking method in estimating the need for future organizational flexibility. The workshop triggered all the respondents to think more about the consequences for various stakeholders when exercising real options. Also the concept of real options was valued positively as a means to communicate about flexibility within a project, but less so as a means for negotiation. It was also evaluated poorly as a means to gain greater insight into types of flexibility as the participants believed that they already sufficiently considered flexibility, and also knew enough measures to create it. As such, no additional ideas beyond the ones mentioned before the workshop were generated. The participants also saw little added value in real options as a way to determine the conditions needed to create and later exercise real options. The construction coordinator, who was the one most involved in the project, was the most negative on the use of real options. Nevertheless, the participants all found the

method useful as a means to exchange opinions on the project and the consequences of scenarios. They also saw the real options concept and scenario planning as complementary.

6.4.1.4 The sensemaking process

The uncertainties in the scenarios developed, as events with cues that influence the organization, were recognized by the workshop participants although they felt that the researchers had missed on important uncertainty. The participants seemingly shared the same frame of reference with regard to future uncertainties and plausible scenarios, and the cues contained therein. There was little discussion on different opinions although the controller stated that there was too much preoccupation with expansion which she argued was not a realistic issue. In general, arguments were advanced to show that one was already consciously taking measures to deal with future uncertainties. All the participants agreed that ideas were triggered by issues they heard in the workshop and had not thought about. As such, belief-driven sensemaking took place more as a result of information exchange than through arguing. Theories of action with regard to flexibility measures that had been mentioned in the interviews resurfaced in the workshop where they were exchanged with the other participants. The interviews might therefore have helped the respondents to become acquainted with the subject of the workshop. The same was seen with the real options concept.

Overall, existing theories of action with regard to flexibility in the construction process were more related to technical measures than to measures in the process. It was apparent that, during the long preparatory phase for the new hospital, a clear strategy for the future had been developed based on demands for real estate and new developments in the primary process. The theories of action with regard to flexibility differed among respondents. Each participant used the frame of their own individual function to make meaning of how one creates flexibility and which types of flexibility are important. The participants had a shared belief before the workshop that various real options, as presented in the workshop, were considered in the project, but this was disputed by the construction coordinator. However, sensemaking did occur in the workshop since the participants agreed on concrete examples of real options. Further, it made sense to them that the consequences for stakeholders should be more considered when including flexibility measures. As potential new theories of action, both scenario planning and the real options concept were positively evaluated.

6.4.2 The forensic clinic

The second workshop was held in a forensic clinic which had merged with a large organization that owned 600 real estate locations. The overarching organization had recently started to establish an expertise centre on real estate development. Each location had an own service centre manager, responsible for maintenance and small renovations and adaptation, who is backed up by a service centre. The two participants in our workshop were the real estate project manager, who in effect is the one-person real estate department of the overarching organization, and a service manager from a clinic that was in need of renovation. The organization's aim was to professionalize the service centres and disband the overarching expertise centre as a cost-saving measure. Over time, the clinic has developed a specific concept that was closely linked with the building's layout, but this concept had become difficult to maintain as a result of a new policy regarding the healthcare system and safety norms established by the Ministry of Security and Justice. Of the three care types represented in the workshops, forensic care was the last to be confronted with the consequences of the marketization policy. Previously, there had been no strategy or business case underlying real estate decisions. Organizational and cultural changes were required as a result of the policy change, and new managers from outside the primary process were appointed to achieve them.

6.4.2.1 Pre-workshop interviews

Flexibility was *defined* in terms of technical measures that enable functions to be exchanged among spaces, and in the phasing of the construction process. Most projects are organized within a building team where contractors are involved at an early phase in order to find better building solutions. Flexibility in the contract is needed since the design might change as a result of exceeding the budget. According to the project managers, it is not possible to exchange functions and target groups within the clinic's building because of the high level of safety required. The way that stakeholders are involved in the design process and the decision making process influences the speed and the flexibility of the design process. The duration of a 'project' ranges from two months to four years. Measures undertaken to deal with trends are all related to reducing exploitation costs. The most common financial flexibility measure, to rent or let real estate, is difficult because of the safety aspects and therefore less appropriate unless potential renters or letters are similar organizations. Organizational measures are hard to implement since the organizational culture is attached to the current method for

providing forensic care which demands considerable space. Developing flexible working space would also require a cultural change.

In advance of the workshop, the service centre manager thought that all *real options* were possible, and without consequences for stakeholders, although the project manager argued the opposite for a few of the options. However, there is a general agreement among the respondents that deferral is not possible without consequences for stakeholders since they desire renovation. Related to the option to defer is the option to stage. In the forensic clinic investigated, this option is incorporated by having go-no go decision moments. This is very important since construction processes are arranged in an opportunistic way, and many things change during the process. The option to speed up is not an option in the construction phase since it would imply unacceptable risks, and it is generally a challenge to finish projects on time. The option to change the design through discussion with the architect is both desirable and available. The option to abandon is possible because of the flexible planning. Time is saved when the project team works with the same architect when a building needs renovation. The option to select is also employed by inviting multiple contractors to tender. The manager of the service centre stated that the option to grow was possible, although the project manager was more hesitant because of a lack of space, although there might be options to expand upwards.

Uncertainties that are considered important include political trends: recently, political parties have been more in favour of penalties, whereas the verdict 'placement under a hospital order[17]' in a forensic clinic is viewed as treatment with the aim of returning the accused back to society. Politicians were claiming that being sentenced to a long-stay clinic amounted to life imprisonment. Since lawyers and judges are against this sentence, placement under a hospital order as a verdict has been imposed less often resulting in fewer patients and the risk of vacancies in forensic clinics. Patients are also becoming older and frailer by staying longer in the clinic. A recent uncertainty is that the clinic also has to now deal with insurance companies, since the system is being linked with the mental health sector. Whereas in the old regime, when it came to mental health, the government provided guaranteed remuneration in the cure and care sectors, in the case of

[17] If the off ender of a serious crime has a psychiatric illness or disorder, the court may hold that he or she is not – or only partly – accountable for committing that crime. In that case, the court may order that this person be placed under a hospital order (*TBS – ter beschikking stelling*) (Custodial Institutions Agency, 2013).

forensic care this was provided by the Ministry of Security and Justice. Since the Ministry of Security and Justice is the major client for the forensic organizations, an uncertain factor was that the ministry's budget was still unknown. The ministry was also developing separate norms for housing which were still unclear. Prognoses of these norms were used in calculating likely remunerations, but these norms were insufficient to fund the specific healthcare concept that the clinic has developed. "Extramuralization" is another trend, with the overall aim of the healthcare system becoming to keep people living at home and receiving healthcare there as long as possible. Health organizations are also constrained by agreements they have made with health offices on the number of treatments they are allowed to provide. Consequently, because of new insights, policies regarding marketization might again change. Uncertainties also exist within the organization itself: users cannot agree on their primary process and therefore demand maximum flexibility. Users are unaware of the financial consequences of investing in maximum flexibility, such as the need for safety glass throughout the entire building.

6.4.2.2 The workshop

Based on these uncertainties, we developed scenarios, detailed in Table 42, that were then presented at the workshop. These scenarios were provided to the respondents in advance of the workshop, as well as information on real options.

Table 42. Scenarios presented in the workshop with the forensic clinic

Trend scenario	Scenario A "The Punishment Society"	Scenario B "The Treatment Society"
Fewer patients due to decrease in use of placement under a hospital order (TBS)	Placement under a hospital order is abolished: people are instead sentenced to life imprisonment	Shift from mental care to placement under a hospital order: more target groups for the clinic
Gradual introduction of marketization, uncertainty over remuneration for housing	Extramuralization of mental care is reversed	More marketization: one will have to negotiate with health offices and the Ministry of Health
Increasing competition	Competition over other target groups	Less competition
Strict application of Ministry of Safety and Justice's rules on real estate	Performance indicators based only on money	Room for applying own vision to real estate
Patients become older and frailer	Harshening of society: people reject clinics in the city	Medication to treat aggression is discovered
Increased chain care; cooperation between care providers	Enduring economic crisis	Economic growth: more financial means but land becomes more expensive
Innovation in the construction industry	Construction costs are low	Construction costs rise
More attention to lifecycle costs	Much competition in construction industry	Little competition in construction industry

In the *first stage* of the workshop, we discussed the proposed scenarios, which raised much discussion and ambiguity at first: "If you ask what influences forensic care this is difficult because I don't know what the purpose [of the exercise] is. Do you want to know it purely from the standpoint of forensic care, and which issues are important, since that influences us. This is a turbulent market. If you relate it to construction then the current climate is different than three to four years ago when starting a large construction project there was certainty on the right to exist, the size of the organization and the capacity. For example, we have just received notification from the government that mental care and forensic care should cooperate more. They say that only intensive care beds are allowed and the other healthcare should be ambulatory. Extramural capacity should be tripled. And you ask, what does that mean for our organization, and we are in the middle of a construction process. Then we suddenly have to consider the intention to change the law on mental care in our scenario."

Throughout the workshop, the external expert tried to convince the participants of the usefulness of scenario thinking and the real options method. The following is an example conversation: ”But I think that this is a good example. Imagine that the future will turn in the direction of this scenario, it is an imaginary but plausible scenario, subsequently you look backwards: what are the consequences for housing and what is it worth to me to develop a flexible building concept? Imagine that it will happen in ten years, what are the consequences for real estate? Do I have to build fences, do I have to make part of the building accessible for other target groups with their own entrances, and can I include this flexibility in the building, or do we have to consider it beforehand in the functional design?” The external expert further suggested clustering functions in the design: when designing, certain functions appear less essential, and one can remove these. One participant reacted: “Flexible thinking is easily discussed but often has little content. When I think in a conceptual way about the possibilities within the assigned financial boundaries, then I reason what is possible and try to obtain the maximum flexibility. I prepare this and I arrange the infrastructure in a way which I think is practical, but much more flexibility is not possible without getting in a fix, especially in our sector where security plays a role. Additional safety measures to increase flexibility by allowing other target groups are expensive.” The external expert argued: “I think you have a point there. I think that each type of flexibility has to be evaluated; what does it cost in a building and what will it be worth to me in the future. But thinking about it is already a step forward in comparison to what happened in the past.”

Ultimately, the participants agreed that scenarios might help in guiding ideas about possible consequences. However, flexible construction was still thought to be too difficult a concept. To boost the participants’ ownership and support of the scenarios, and to do this in a straightforward way, we decided to develop scenario–axes in the workshop. First there was a discussion on which two dimensions we should take as a starting point for the scenarios. In the first instance, the link between scenario planning and flexibility was unclear. This became clearer once one participant stated that “scenarios could be useful to guide thoughts with respect to health, the market, etc. Building in a flexible way is too broad a concept”. The outcomes are shown in Figure 14. Stage 1 of the workshop was therefore mainly filled with discussing the aim of the methods used, resulting in development of x-axes scenarios with on the axes the popularity of forensic care in society and clinical versus ambulatory care.

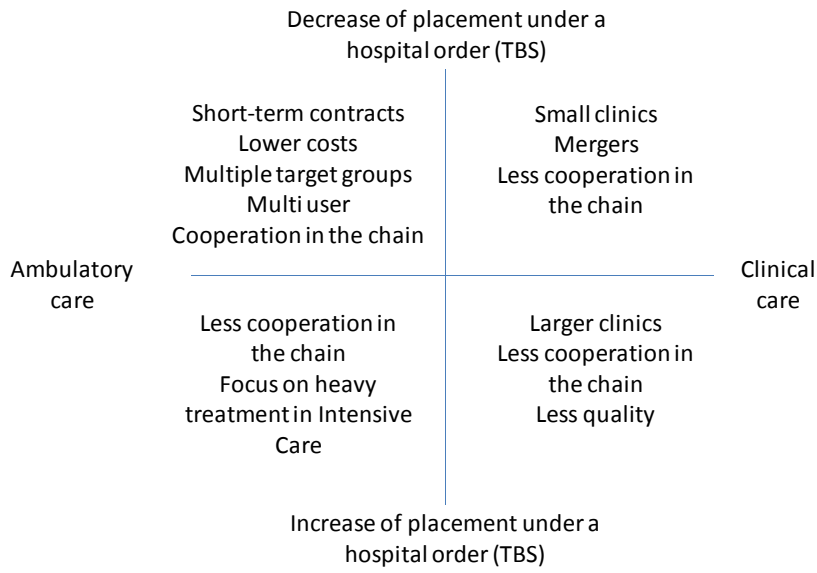

Figure 14 *Scenario-axes developed in the workshop*

During the *second stage* of the workshop, participants commented that thinking about the consequences of the scenarios on the portfolio level was too abstract and that the consequences would differ among real estate objects. We therefore chose one example, of a building, to analyse the consequences of scenarios on real estate and to determine a strategy through real options. The second and third parts of the workshop were more-or-less merged with their subjects being discussed simultaneously. The discussed building was a clinic which was currently vacant. We discussed the current problems with the building, and which considerations had led to the decisions taken with regard to the building. The external expert suggested measures that could have been taken to increase flexibility, such as having multiple entrances for different stakeholders. The participants had learnt from this situation, and from the arguments used by the external expert: ”Now, if we were to buy a property, we would explicitly choose a certain location, and then we would build differently. Then we would incorporate many real options. You have to create redundancy in the building by means of a second entrance, separated waiting rooms and separated desks which enable other parties and target groups to use the building”. Where, at the beginning of the workshop, the participants were hesitant about the workshop and reluctant to think about flexibility by means of real options, this changed during the workshop. The project manager commented that “if you look back at the projects, then we have considered these real options during the design process but not in a structured and

thorough way". However, the service centre manager mentioned, as a condition for using real options when developing real estate, that "more input is needed from the contractors, in the sense of reducing costs, and from users. This would make designing easier". A constraint felt by this participant to the use of real options was that she could not imagine how the fairly abstract concept of real options could lead to a practical instrument: "it is good to realize that you cannot have 180 degrees of flexibility and that you have to realize what you want in order to give content to concepts. This will be a tangible contribution to making decisions. The concepts [types of real options] sound good and I recognize these, and if we had had more time to think in the past we might have made other decisions. It is nice to know that other things are possible when you give it a moment's thought. This is essential, although I doubt whether this will result in a model which connects things in a logical way". More checklists and practical instruments appeared to be desirable. Concluding, the second and third stages of the workshop were combined in which strategies with regard to flexibility of particular were discussed retrospectively. The real options concept was elaborated as well but perceived as too abstract to use them for developing flexible real estate strategies. In evaluating the workshop, one participant suggested that a checklist of dimensions which could occur in a scenario, and which influence the organization, would be useful to consider when developing a business case.

6.4.2.3 Interviews after the workshop

Only one of the two participants of the forensic clinic participated in the post-workshop interview. Since most sensemaking took place during the workshop and was evaluated then, the interview was more a confirmation of the observations. Therefore one respondent was sufficient. Her definition of flexibility had not changed, nor had she gained greater insight into other measures that could create flexibility, see Table 39. Her opinion of the need for flexibility had "not really" changed. She had concluded that most real options were already applied in most cases. The respondent believed that real options are useful to communicate and negotiate regarding flexibility with contractors in the various phases of a construction project. Further, she thought that real options and scenario planning were complementary since scenarios legitimize the use of certain real options. As such, the real options concept is a way of communicating consequences to other stakeholders in the organization.

6.4.2.4 The sensemaking process

The respondents could clearly identify important cues that influenced their organization. However, when these cues were incorporated in various scenarios, this raised much discussion. Providing information on the tool and the various scenarios in advance of the workshop did not help in sensemaking, although it was uncertain how much attention had been given to this information. When the participants were asked to react to the scenarios, and to use them to analyse their real estate, this generated much discussion and eventually resulted in sensemaking of the use and usability of scenario planning as a method to assess the consequences for real estate: "There are trends which influence real estate in general and real estate in forensic care. I think one has to collect these and then compare them. OK, it's clear for me now." The x-axes scenarios that we developed together were appreciated by the respondents and became a shared frame on possible future developments. Developing multiple x-axes scenarios, each with two different dimensions, was seen as a useful theory of action to guide thinking on the consequences for real estate, and consequently to develop strategies.

Another theory of action that was recognized was to go more thoroughly through the various real options and evaluate them. The arguments used by the external expert made sense to the participants and resulted in changes to their methods, with scenario planning and real options used as theories of action to deal with uncertainties and flexibility. Retrospective sensemaking of past projects was found to be easier than prospective sensemaking of the clinic that was due to be renovated. The participants had problems in imagining the consequences of scenarios for that particular clinic and subsequently in deriving strategies to deal with these consequences. Given that one participant stated that more input from users was desirable since they (the participants) executed the client's demands, we can conclude that client input to the scenarios is also desirable in determining the consequences on the primary process, and thus on the real estate.

Belief-driven sensemaking is also influenced by expectations. In reflecting on the workshop, the participants said that they had previous experience with researchers who developed checklists, and that this very much fitted with the daily practice of the practitioners. From the discussions, we deduced that the respondents were looking for such practical tools during the workshop. Consequently, the workshop and its output probably failed to match the expectations of the participants and this is maybe why many

discussions on the tool itself arose. Another statement by the respondents supporting this thought was that the real options concept was too abstract.

6.4.3 The mental and elderly care organization

After a merger, the mental and elderly care organization was established. The organization also owns a forensic clinic. It has around 250 locations in the northern part of the Netherlands with 4,500 employees. Whereas the forensic clinic in the previous case had service centre managers decentralized among the locations, the mental care organization had centralized this function. Three years ago, a separate real estate department was set up which was only responsible for maintaining and developing real estate and was part of facility services. Two years ago this department, now consisting of 18 people including the maintenance department, established a three person sub-department, entitled portfolio management, to map the portfolio of the organization in greater detail in order to develop a long-term real estate strategy. The financial situation of the organization is sound although governmental policy changes are forcing them to be more efficient.

6.4.3.1 Interviews before the workshop

The need for flexibility was recognized by all five respondents, although one stated that real estate is responsible for only twenty per cent of costs. One respondent offered a *definition* of flexibility: the multi-usability of real estate. Another respondent defined flexibility as treating real estate as a way of saving or as a long-term investment. According to various respondents, *measures* to obtain flexibility include the distances between load-carrying walls which, if large, enable the space to be adapted. One project manager believed in innovations in the construction that enable flexibility, such as removable skirting boards, whereas the maintenance manager was more sceptical about these measures. One respondent mentioned a financial measure: sale and leaseback, although this had never been fully investigated or implemented. A strategy to deal with demographic changes, and which is being rolled out to create a more flexible real estate portfolio, is to use more flexible rental contracts, and to abandon real estate in areas where demand is dropping. The portfolio management department is investigating the influence of this measure on the real-estate risks and thus for the organization. A measure recently introduced in the process is to include go-no go moments. This procedure was

added because the board wanted to have a larger say in projects, and have the ability to steer.

The respondents mentioned various *uncertainties* that potentially have a large impact on the organization and in most cases a low predictability, an overview is presented in Table 43. with the main cues of these uncertainties affecting the organization. The most puzzling and far-reaching uncertainty for the organization is the financial separation of care from housing. An implication is that health insurance will no longer fund housing costs for clients with only a small healthcare demand. The clients will thus have to arrange their own housing and pay rent. The health organization will become a landlord and this will have accompanying consequences. A risk is that its apartments will be too expensive for clients when they have to pay their own rent and thus that a lack of occupancy may arise. According to the director of real estate, at several of the organization's locations, the real estate setting is part of the healthcare concept and, therefore, a physical separation of care and housing is not possible. Unlike many similar organizations, this organization chose to retain terrains for patients needing mental care since they then have a protected environment where they can meet with fellow patients. The staff member responsible for portfolio management foresaw the organization cooperating with other partners such as housing corporations, municipalities, real estate agents and real estate developers. In this way, buildings could be still used but owned by other parties.

Insurance companies also impose demands on the mental and elderly care organization. They urge measures to reduce costs, such as reducing working places through more mobile working. However, according to the real estate director, "the demands of the insurance company cannot be fulfilled since already twenty per cent of the employees are mobile. Besides, when implementing these measures, one overlooked the consequences such as empty spaces in buildings that are not rentable, and needing to adapt buildings to new concepts as a result of moving employees". Since the care to be provided is agreed only annually between care providers and insurance companies, this is another uncertainty and a problem when making long-term plans. Another uncertainty resulting from marketization is the requirement for patients to contribute to the costs of each treatment. This has led to a large, unforeseen, decrease of thirty per cent in demand for mental care. Another uncertainty related to the changing financing structure is the transfer of responsibility for care costs from the national government to municipalities. A consequence for health organizations in the care sector could be that municipalities may,

for instance, decide to separately procure the daily activities for patients from another organization.

Technological innovations are another uncertainty. According to the maintenance manager, the speed of technological innovation is too fast to be kept up with, and thus one should not invest too much in flexibility to enable adaptation to new technologies. Various opinions were found among the project managers and the maintenance manager with regard to what extent one should invest in flexibility to adapt to technological changes. One example of a change is the ability to consult using digital communication and techniques that enable people with dementia to continue to live at home. Respondents recognized a parallel with the general trend of a more individualistic society. Respondents think that care will thus be increasingly delivered at home and, consequently, only very specific health-related real estate will be left. However, patients' homes should be centred around a core facility to enable efficient logistics for the ambulant personnel.

Both the mental and elderly care organization's structure and its decision making processes create uncertainty for the real estate department which hinders the introduction of improved real estate strategies. The real estate department recognized it lacked awareness of real estate costs, with other departments tending to rent external cheaper spaces. Another uncertainty within the organization is a lack of clarity as to its vision and mission, and how the primary process is organized. This hampers the development of real estate that meets the demands of the organization. The organization struggles over whether to focus on intensive care in nursing homes or also on providing healthcare in people's homes. There are also important demographic uncertainties; the declining population has large impacts on the organization's activities in a remote area. The ability to attract sufficient staff is another uncertainty.

Table 43. Uncertainties mentioned in the pre-workshop interviews with respondents from the mental and elderly care organization

Uncertainties mentioned in interviews	Cues
National policy of separating the financing of the housing of patients from the healthcare system which only becomes responsible for the healthcare delivery	Health insurance companies will no longer remunerate housing costs for patients with a small healthcare demand
National healthcare policy that patients have to pay an own contribution of their treatment. This policy changes from time to time	A previous measure led to a large decrease of healthcare demand
Transfer of responsibilities for healthcare costs from the government to municipalities and uncertainty of municipal policy with regard to e.g. procurement of healthcare delivery	Entrance of other health organizations to the market and consequently more competition
Technological innovations	It is hard to keep up with the speed of innovations
The organization's structure and decision making process	Hinders introduction of improved real estate strategies
Lack of clarity on vision and mission of organization	Suboptimal real estate strategies
Demography	Affects activities of health organization
Availability of staff	

Go-no go moments are typical examples of the *real option* to stage. The researchers presented additional statements to the respondents than in the previous two organizations. These statements are included in Appendix G. Another staging option will be applied in the design and construction of a new health centre to enable the phasing of different parts. The participation of one partner in the project was still uncertain, and this option will enable one part to be eventually excluded from the build. One project leader named an option to speed up the process: since construction projects are organized in a building team, people need to put time and effort to exchange information in order to optimize the process. The involvement of the organization's skilled project managers is another investment. The option to defer is not possible according to one project manager since "the planning is holy". However, others stated that this is always possible and that they are even forced into it when there is uncertainty over financing a project. Another option considered is to speed up or shorten the writing-off period when a building is expected to be abandoned. This implies a long-term loss for the organization, but prevents a large loss when a building has to be abandoned with a high book value. The option to switch to multiple functions was clearly an important part of real estate management.

Some respondents stated that the option to abandon is not possible since it is costly, although others stated that it is possible although it costs money. One has to balance the real estate exploitation with healthcare exploitation, and there are exit strategies when this is most profitable option in terms of money or the primary process, although it costs money or effort by the practitioners. Another option that exists in theory is when one can dispose of real estate by means of a ransom. The ransom can be considered as a real option. An example was mentioned by the real estate director although it was not recognized as a real option as such when he stated that one project seemed unprofitable after the preparation phase. Although he did not see this as a real option, it did amount to an option to abandon. The option to select by means of inviting multiple parties to tender when procuring is not recognized as an option. The option to grow was recognized in the form of an innovation fund to establish pilots for testing innovations. According to the real estate director, expansion is easy but changing functions is more difficult. When there is uncertainty over capacity, one might build one part such that another part can be attached later in the construction process. The ability to expand also depends on the location.

6.4.3.2 The workshop

Based on our experience in the first two workshops, we decided to develop scenarios *in* the workshop rather than in advance. We provided a general introduction and then presented two dimensions of a scenario-axis, as shown in Figure 15, for the *first stage* of the workshop which was to develop context scenarios. These were agreed upon by the participants as an appropriate starting point for developing scenarios.

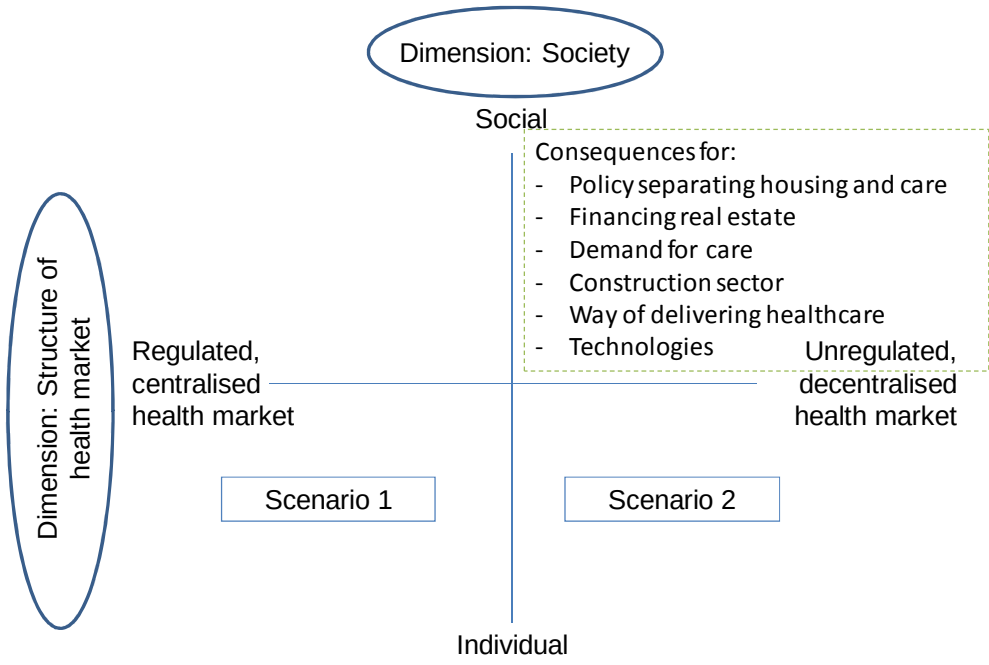

Figure 15 *Input to workshop in mental and elderly care organization for developing scenarios*

We provided an overview of uncertain developments which the participants had indicated in the earlier interviews that could be used in developing scenarios. The participants were divided into two groups to develop scenarios. As a starting point, both groups used the policy change implying the financial separation of the housing and care provision functions. In group 1, a discussion took place, mainly involving the external expert and the real estate director, on how one can limit the risk to the health organization and to housing corporations. Both had outspoken ideas on how to deal with this. Flexible concepts are already applied. An innovative concept is that the housing corporation shares the risks by means of a trial one-year period for patients of the mental and elderly care organization. Here, the housing corporation achieves a guaranteed occupation and the mental and elderly organization has no risk if the remuneration for housing turns out to be lower than the actual rent. A new insight gained during the workshop was that switching housing to accommodate students creates more flexibility. An existing measure is a clause in a rental contract allowing the contract to be abandoned if large policy changes occur. Another development will be involving other means of financing such as by investors and other private initiatives. The participants came to the conclusion that their real estate is flexible and future proof because many locations are rented on short-

term contracts, while the consequences for the primary process are larger than for real estate management: "Risks are higher with regard to the consequences in healthcare. That is, how do I maintain my health organization in such a way, within the scope that I have in the way that I currently organize this, that I keep control over the exploitation costs when I give free choice over housing to the patients." While the external expert argued for flexibility in housing, the employees of the health organization believed that the financial separation of housing and care would result in less efficient healthcare since locations would become more spread out. As the real estate director reflected in the interview after the workshop: "You can abandon the rental contracts for locations and say to the people who need healthcare: 'that is possible but I don't have housing for you'. This reasoning is not good. This location is well facilitated in both medical and social-cultural respects. The large scale of the terrain enables us to provide healthcare to a large group of people in an effective and efficient way. On this large scale, we can manage the approaching cutbacks."

Another discussion was on ways to obtain finance for real estate investments. The current strategies were discussed: "Through a large investor we found private investors instead of banks. We entered new markets which you need to know well before you should enter. Actually, we are not that familiar with this market so we have to get accustomed to it. We also look for partners to invest in and exploit projects".

Group 2 started by considering some extreme scenarios, where an individualistic society would result in a separation between healthcare for poor and for rich people. There was a discussion on what the dimension of 'individual' versus 'social' entails. One person suggested: "I think that people buying their own decentralized healthcare and having a free choice in choosing healthcare is an important starting point. The individual approach means that they will not have support in doing that." Another questioned "are you are a healthcare organization, a real estate organization or both?" An illustration of how participants made sense of the consequences of the scenarios on the organization, and its real estate, is shown in the following conversation on the effects of the policy of separating finance and housing.

> "Perhaps insurance companies will own real estate and patients can be treated there if it is smarter and cheaper there".

> "But the specialist says 'I work here and I will have to have my treatment room there'. I'm still not able to imagine how that scenario will look like. So separating housing and healthcare, I think we do not agree on where this will end. Ultimately there are many patients in those mental care organizations, but housing will reduce and as an organization we will aim specifically at healthcare. But you still need real estate to deliver healthcare but not housing since we do not provide that".
>
> "Yes, the separation of finance and housing will also be applied to more intensive healthcare indications but these are hard to provide at home. Like you cannot say, I will operate at home".
>
> "That is what I mean".
>
> "There is a tipping point when people can no longer be treated at home".

There was discussion on the extent to which 'the market' would be implemented and what the behaviour of other stakeholders such as municipalities, housing corporations and patients will be with regard to choice over housing and allowances for certain patients. In the end, they believed that Dutch society and thus its politics would never allow such a development. Group 2 concluded that, in this scenario, patients would have free choice over housing but the health organization would guide this decision in order to enable an efficient and effective primary process.

As such, both groups were at the same time thinking of scenarios (stage 1) and addressing directly stage 2 and to an extent stage 3 of the workshop: thinking about the consequences of the scenarios for real estate and strategies to deal with these consequences. Although group 2 started with one extreme scenario, the conclusions were similar to those of group 1 that had almost immediately started to think about solutions.

In the *second stage* of the workshop, we showed a map of the area with circle diagrams, visualizing the capacity and function of the organization's locations. Some were surprised by the division of functions and started a discussion. The real estate manager saw it as an illustration of the inventory of real estate they are currently making: "These circles show what is where and in what quantity. If you look at real estate in relation to how it performs, you can establish a relationship between cashflow and housing costs to compare how well a building or setting performs. Our first question, when talking like this, is what types of healthcare. I see five types here which we deliver, if you look at the

cash flows and the types of real estate, then you can say that some types of care are quite profitable, and others are not. As such, I am already making a classification of my buildings towards risk. You can refine this reasoning and point to better and worse buildings, and attach your conclusions to these." The real estate director argued that this was a good starting point in making an inventory of the characteristics of the real estate, to analyse it and to make strategies, a process which they had already started. A discussion followed on the role of municipalities and their influence on the health organization as healthcare purchasers. One person argued that although housing becomes the responsibility of the patient, the municipality and the health organizations might steer on where people want to live.

One location was selected as an example to think about the consequences of the various scenarios and developing strategies with real options. The case was a specialized clinic for intensive care that was six years old and currently vacant. When looking retrospectively at the clinic, the participants concluded that clearly good choices had not been made. The prospects for the clinic within the developed scenarios were discussed.

In the *third stage,* the vacant clinic was used to make sense on real options that could be implemented as a flexible strategy. In this workshop, we presented the real options concept in more detail than in the earlier ones, see Table 44. A discussion took place as to the influence of the real estate market on the clinic and on potential target groups for the clinic, and the suitability of real options. The participants agreed that a real option to make the real estate suitable for multiple target groups, such as by including multiple entrances, was a promising one. Keeping the clinic vacant would be a waste of capital. To prevent this, the participants argued that the time was right to think of alternative uses since the healthcare system was still in the initial phase of the transition to the new policy, and therefore the situation was not yet critical.

Table 44. Structure of real options as presented in the workshop for the mental and elderly care organization

Uncertain performance measure	A location is redundant because of changing care demands
Driver of performance uncertainty	A reason could be the newly introduced compulsory own contribution to costs resulting in a decreasing demand for healthcare
Reference strategy	The building is owned and should be sold
Alternative strategy	Investing in a relatively expensive rental contract that can be abandoned after five years
Signal for changing strategy (investing real option)	The expected demand for care decreases as a result of the announcement of a changing national healthcare policy
Conditions for strategy change (change is investing in real option)	The building is for rent, and the lessor should accept a short-term tenancy agreement
Actions required to obtain or retain flexibility (option premium)	Negotiating a short-term tenancy agreement
Action required to change strategy (exercising option)	Consider the notice period and consequences for the organization: what happens with the personnel and clients that are 'left' in the building, etc.?
Decision rule for changing strategy	IF (expected demand) < (capacity of building) THEN (short-term tenancy agreement) ELSE (keep the building)
Expiration of real option	The notice period

The participants believed that real options that were invested in are often not used because of the consequences for various stakeholders. For example, changing target groups also affects personnel since they work in other locations and this evokes resistance. So-called 'soft' and 'emotional' factors play a role when the organization makes decisions with regard to real estate. However, it is expected that when there is more urgency, efficiency will become more important. A concluding remark at the end of the workshop was that the organization needs to think in a more structured way about strategies to deal with the uncertain future healthcare demand: what healthcare will be provided and what consequences will this have for the organization and its housing component.

6.4.3.3 Interviews following the workshop

In the interviews following the workshop, most respondents indicated that they found the workshop useful because of the discussion it generated. As the maintenance manager said: " I would say that I did not get more insight into types of flexibility, but there was substantial discussion. What is possible and what not. In my opinion we just started to discuss that." A project leader stated that it was difficult in such a short period to think in abstract terms on scenarios and then translate this into concrete real estate examples. However, he noted that the real options concept had started to interest him and occupied his mind: "it is always the case with creating flexibility, you try, just as with financial options, to limit the risk. And this is what we try to do. We also do this in flexible building concepts: I invest more in this or that and in your mind you put a future value on it". The real estate director mainly saw real options as 'insurance premiums'. Aspects of real options could be recognized in the reasoning of the maintenance manager, who often emphasized that one should carefully consider whether a certain flexibility measure will be used and thus potentially pay itself back.

The real estate director thought the tool clearly fitted with the current development of a strategic policy plan with regard to real estate: "We are now looking at real estate more conceptually, where are we starting from and what is approaching us, how will we anticipate.[…] One should also talk about care, how will this fit within these developments. They work alone, real estate does its own thing, but I think this should be more of a joint process in which care, the board and real estate have such a session." The respondents were all positive on the workshop as a method to estimate the need for flexibility within the organization and they recognized that flexibility has a value that increases as uncertainty increases, see Table 39. All the respondents recognized real options as a useful method to communicate about flexibility in the development phases of real estate. The workshop did not make the participants think more about how the future organization might look like since they were already doing this. It also did not bring new ideas on flexibility.

6.4.3.4 The sensemaking process

Various uncertainties were easily recognized by respondents in the pre-workshop interviews. These uncertainties were recognized as they were events, or cues, with large impacts on the organization. Especially the new policy of financial separation between healthcare provision and housing would have large consequences. While scenarios were

being developed by the two groups during the workshop, it was mainly the real estate director and the external expert in group 1 who were involved in the discussions. The issue of power played a role in sensemaking here, where power is seen here as having an advantageous position because of knowledge. Both the real estate director and the external expert were used to thinking in more strategic terms and had more knowledge on the subject. This advantage gave them the opportunity to put their arguments forward. Unequal access to roles and positions gives people unequally strong positions in influencing the construction of social reality (Mills 2003). Character also plays a role since some people were more hesitant about putting arguments forward. Identity was another important factor with one respondent commenting in the initial interview: "Threats and opportunities in the portfolio are something for the portfolio management department, rather than project managers, to think about. Sometimes, I am involved in these kinds of things but I approach them from my technical background". With regard to procurement and selection methods, he referred to another project manager who should know more about this. Technical issues were little discussed in the workshop and thus this project leader was not that involved in the discussion. In group 2, there was more discussion and sensemaking among all the participants. Notably, both groups ultimately came up with similar scenarios and thus already had a shared frame of how current uncertainties would influence the organization and its real estate. Within the plenary part of the workshop, visualizing the locations of the organization on a map gave insight to participants on how functions were divided across the whole area. Discussing a particular case made the participants aware that they had not sufficiently considered potential target groups that could make use of the building or what the market would be for that particular location. Various issues were discussed without clear solutions. However, by raising these issues again, their presence was recognized and given fresh attention, which is a starting point in sensemaking. The following discussion did not result in sensemaking in terms of concrete strategies, but did in terms of the usefulness of such discussions as a means to create strategies and theories of action.

In the initial interviews, many respondents already mentioned various measures or theories of action to deal with uncertainties. Consequently, the workshop did not add much to the sensemaking of these theories of action. Rather, a contrasting conclusion of all the participants was that they recognized the usefulness of the workshop because of the discussion it instigated on strategies to deal with uncertainties. This differs to

sensemaking in that, while they have a clear opinion on technical flexibility measures, they are unsure how to relate this to consequences in healthcare, and to the wider context of the housing market in the region. Given this situation, the real estate director made sense that such a workshop should be undertaken with other parts of the organization.

6.5 Evaluation of the workshops

6.5.1 Factors influencing the workshop discussions

In the various workshops, two factors influenced the discussion: the function and the background of the participants, and the organizations' different institutional environments.

First, most participants used arguments for flexibility measures which are reasoned from their own function and knowledge, as a health entrepreneur or a construction coordinator. Further, some people were more able to think in abstract terms than others. The service manager of the forensic clinic was not involved in strategic issues, and neither were some of the participants in the workshops for the hospital and for the mental and elderly care organization. If board members participate in the workshop, one would expect more sensemaking to occur between the strategic and operational levels on the consequences of strategic decisions on the operation of real estate management and vice versa. An example was provided by the real estate director of the mental and elderly care organization who stated that he has on the one hand a role towards the board as a real estate investor and controller, and a role as a provider and facilitator of housing towards the healthcare providers. These two objectives are increasingly moving apart. Lessons learnt within the workshops could in some cases not be put into action since the participants lacked a mandate to make decisions. Unfortunately, no board members attended any of the workshops. This would have been interesting since the aim of scenario thinking is to think about strategic long-term issues and project these onto real estate and the operational level. One would assume that the most recent insights and strategic issues are discussed at the board level, which could therefore provide valuable input to such a workshop.

Second, the different institutional environments of the organizations influenced the content of the discussions. One difference that could be recognized between the forensic

clinic and the hospital was that the former was in the initial phase of dealing with the policy changes whereas the hospital had already been confronted with these for several years. The participants from the hospital indicated that a reason for their proactive attitude towards dealing with future uncertainties was their position as an underdog due to being a small hospital in a remote area. This stimulated creativity in order to survive. In contrast, the forensic clinic had always had a turnover guaranteed by the Ministry of Safety and Justice, and this also explained the lack of understanding and support for cost effective measures among health practitioners. Respondents from the forensic clinic indicated that a new management had been appointed with a more business economic focus, rather than a focus on the content of the primary process. This management was also more involved in real estate decisions. The real estate director of the mental and elderly clinic also pleaded for greater communication and tuning between the various independent departments within the organization to prevent unnecessary costs related to real estate. A difference between the forensic clinic and the mental and elderly care organization was that the latter sought greater cooperation between departments while, in the former, real estate responsibility was being taken away from the real estate department such that knowledge available within the organization was not being used.

6.5.2 Reality, value and instrumental judgment in the workshops

According to Vickers (1995), three types of judgment, *reality*, *value* and *instrumenta*l, are needed to analyse and evaluate a decision making process. The success of the workshops in generating sensemaking of uncertainty and flexibility measures is evaluated by analysing whether collaborative sensemaking took place in terms of these three aspects. Judgment is subjective and is determined by people's frames of reference.

In judging reality, people identify cues which in their opinion are important events. Reality judgment took place before and during the workshop, when people identified major cues in uncertain developments. Since most participants mentioned the same uncertainties before each workshop, we can assume that reality judgments within the organizations were consistent and therefore sensemaking was less needed since there was already agreement. During the first stage of the workshop, one could argue over the scenarios and whether these reflected future reality according to the participants. Through argument and discussion one could agree on these uncertainties and develop scenarios which were plausible to the participants. Here, people reframe their frames of

reference and, when sensemaking occurs, these frames overlap. The scenarios developed by the researchers seemed to either raise further discussion or, in the hospital case, to be directly accepted. To stimulate discussion, we saw that it was better to let the participants develop the scenarios, and to divide them into smaller groups when there were many participants. This advantage outweighs the disadvantage of there being less time for other aspects of the workshop. The x-axes scenario approach appeared to be a straightforward and effective way to start developing scenarios. In all the workshops, the participants shared a common understanding on the uncertainties that influenced their organization.

Value judgment took place when participants evaluated the consequences for the organization of the perceived reality as represented in future scenarios. Belief-driven sensemaking took place by means of arguments used to convince each other. Sensemaking mainly occurred in the workshops for the forensic clinic and for the mental and elderly care organization since there was agreement among the participants that they had not sufficiently considered certain consequences. In the hospital workshop, little real discussion took place since participants predominantly explained why they had made certain decisions in dealing with uncertainties. Rather than reframing, they reinforced their existing frames by expressing their opinions, and so confirming their strategies and thus theories of action. In the workshop with the forensic clinic, most of the sensemaking that occurred was of *the methods* in the tool for scenario planning and real options reasoning rather than of *the content* by means of the tool. The arguing was mainly between the external expert and the participants, where the external expert illustrated the research method in relation to the practice of the participants. The presence of someone able to make the linkage between the somewhat abstract concepts and real estate practice was valuable in this case. However, the difference between the more practical level of daily practice and the more abstract thinking needed for the workshop appeared to be difficult to bridge. Ultimately, sense was made of the tool, and the participants recognized how the tool could be useful for them. Scenarios were developed, but they found it difficult to evaluate whether the consequences of these scenarios were desirable or not for the organization. It seemed easier to make sense retrospectively when considering past projects. Another conclusion from the forensic clinic workshop was that the real estate practitioners mostly dealt with meeting user demands. As such, questions on the consequences of a new policy for the organization should first be answered by users and policymakers. This issue also played a role in the workshop for the mental and elderly

organization. There, the development of real estate strategies was hindered since policymakers within the organization were not in a position to be able to make statements on how the organization should proceed.

Evaluating the consequences for real estate of the various scenarios in the mental and elderly care workshop resulted in sensemaking that the real estate should be flexible, and that somehow the real estate layout should guarantee an efficient primary process. The current strategy of making an inventory of the current real-estate portfolio was confirmed as a good theory of action. As in the forensic clinic workshop, sensemaking of theories of action appeared to be easier in retrospect with a completed project.

Instrumental judgment refers to measures to be taken to deal with these desirable or undesirable future situations. In contrast to the workshop in the forensic clinic, agreement on the method to be used was immediately reached in the other two workshops. In addition, the concept of real options had triggered some participants of the workshop in the mental and elderly organization to think about this in advance, and they continued to reason along this line during the workshop. This was in contrast to the forensic clinic where the idea of the concept was less clear to the participants. To investigate existing instruments, we asked in the pre-workshop interview for measures that the respondents took to deal with various uncertainties. In the hospital workshop, they generally reconfirmed the measures they already took and the real options structure did not add much to sensemaking of how to look at flexibility. In the forensic clinic workshop, one participant valued the scenario workshop in that it would help them think in a more structured way on possible consequences for real estate. However, the real options concept was only thought to be useful as a means to communicate on flexibility with stakeholders, and not as a way of thinking about flexibility. One respondent stated that scenario planning and real options thinking were complementary since the real options "legitimize the scenarios. In scenarios you think of the consequences and suitable real options come out of that. You can use these to explain to colleagues that the measures are necessary." In the mental and elderly care organization workshop, as in the other organizations, the participants were convinced of the validity of their, mainly technical, measures to deal with uncertainty. It appeared difficult for some participants to make sense in developing scenarios of more abstract trends both inside and outside the organization that influence the organization. As one project manager put it, in daily life one is busy with solving technical problems. However, the workshop initiated participants

to make sense of the idea that one should think more on a strategic level, involving all the stakeholders of the organization, about the consequences of future uncertainties as a starting point for developing strategies. The real options concept was recognized by some as a means of evaluating flexibility. A striking example was given of a nearby hospital that had invested in abundant flexibility which would probably never be used. As in our intention when introducing the real options concept to include other consequences besides costs, one participant recognized that other aspects are also important in balancing flexibility, such as attractiveness for employees which will be important given the decreasing working population. From various remarks of respondents we derived that a useful instrument would be one that balanced potentially needed flexibility, investment costs and the costs of exercising real options. The results are summarised in Table 45.

Table 45. Three types of judgment in the three workshops

	Reality judgment	**Value judgment**	**Instrumental judgment**
Hospital	Agreement on presented scenarios without discussion, one uncertainty added	Scenarios are accepted and rather judged negative. No new insights on consequences of scenarios	Current course of action is valued right. No sensemaking on other strategies. Real options and scenario planning valued not much added value, only for communication/negotiation with contractors
Forensic clinic	Agreement on x-axes scenarios after arguing	More judgment of tool than of organizational strategy. Difficult to judge the consequences of scenarios	Little sensemaking on strategies. Real options and scenario planning valued positively resp. as a way of communication and stimulate thinking on future consequences.
Mental and elderly care organization	Agreement on x-axes scenarios after arguing	Sensemaking by arguing on consequences of scenarios on real estate	Evaluation of current strategies valued right. Sensemaking on other strategies for flexibility. Abstract level of scenarios sometimes difficult. Real options valued positive as a way of thinking to assess flexibility.

Experiences and expectations seemed to influence the sensemaking process and the valuing of the tool. In the forensic clinic workshop, participants had other expectations of the workshop than what was delivered as a consequence of previous experience with

scientific research. This resulted in a long sensemaking process of the methods used in the tool rather than of the content. This also resulted in the view that the concepts were too abstract. In addition, flexibility was an empty word to the practitioners: flexibility was demanded by users but never specified. However, the participants recognized that the real options concept could be used to make flexibility more concrete and to communicate about it. It is possible that the participants felt insecure about their theories of action since they had only just been confronted with the need to manage real estate more strategically. This was in contrast with the hospital, which had already been trying to make their real estate more efficient for a considerable time. However, here, little sensemaking took place although opinions on their theories of action were reinforced. Somewhere between these two situations, the sensemaking process in the mental and elderly care organization, which had been confronted with the marketization policy longer than the forensic clinic but for less time than the hospital, involved interesting discussions and greater sensemaking of the content.

6.6 Conclusions

Health organizations face various uncertainties such as policy and demographic changes which have consequences for their real estate management. Insufficiently considering these consequences can result in negative consequences for the organization as a whole. To address this danger, we developed a tool, applied within a workshop setting in three health organizations, to enhance collaborative sensemaking among decision-makers in health organizations. The aim of our study was to develop an understanding of how real-estate managers assess the consequences of future uncertainties and whether real options could enhance sensemaking of flexibility measures that can be applied to cope with these uncertainties. The various characteristics of the sensemaking theory were used to evaluate how the workshop participants made sense of the various workshop elements. Sensemaking is a process which starts by people noticing *cues* - events that are inconsistent with people's expectations. Scenarios were developed with the aim of making uncertainties that influence the organization explicit, and forcing respondents to recognize these cues. Sensemaking should result in conforming *frames of reference* among the participants in a workshop. When participants agree on scenarios, their frames of reference also correspond with regard to the main uncertainties which influence the organization and thus require measures to allow it to adapt. The workshops were seen as a means to enhance *belief-driven sensemaking*. People would make sense of each other's

arguments, which might result in an intention to take action. The various workshops showed that the organizational identity and the identity of the various participants played a role in the sensemaking process. This was also expressed in the vocabulary used to define flexibility. Evaluation of the workshops using Vickers' appreciative system showed that the various elements did in principal enhance sensemaking, although further clarification of the real options concept, and consequently more time, was needed. There was, however, a clear indication that the sensemaking process had started and was ongoing. Nevertheless, the real options concept appeared to be too complex to be immediately adopted, although it was recognized as a useful tool in negotiating with contractors over flexibility. It was compared with new concepts such as cradle-to-cradle which are considered promising but yet to be broadly accepted. Recommendations for future workshops would be to spend more time on developing scenarios and to involve more stakeholders. Visualizing spaces, such as in mock-ups and in virtual labs that show routings, can aid sensemaking. A limitation placed on the workshops was in the time made available. The researchers experienced a conflict between the available time of the participants and the time needed to sufficiently cover all the workshop stages. All the workshops seemed too short to adequately explain and discuss the real options concept. Developing thorough scenarios and analysing their consequences for the organization requires more time. Sensemaking and incorporating real options reasoning, as a way of thinking in daily practice, is a long process, and therefore future workshops should involve a longer period to further enhance sensemaking.

Although the real options approach seems promising, its actual application is lagging. Sensemaking is to an extent a result of bounded rationality (Simon, 1955; Weick, et al., 2005) and when one cannot be provided with all the information required to make a rational decision, decisions have to be based on individual or group experience and interpretations of past events. Ford and Garvin (2009) explain why bounded rationality is one of the reasons why real options have not been extensively applied. Essentially, architecture, engineering and construction projects are often very complex and, because many uncertainties are beyond the cognitive capacity of project managers, they prefer straightforward decision-support tools. Instead of offering complex quantitative tools, we have instead tried to provide another way of thinking and looking at flexibility that should limit the apparent complexity. Further, our approach tries to expand the borders of rationality, of real estate managers and of project teams, by expanding the context in

which they think about the consequences for the organization and the need for flexibility beyond financial models. This research illustrates the issues that play a role in real estate management in the Dutch healthcare sector and suggests approaches to deal with these, which offers insights for other practitioners. In addition it provides insights for researchers on how practitioners make sense of real options and what can be done to further enhance sensemaking and 'sell' the concept.

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7

CONCLUSIONS AND DISCUSSION

In this section, an overview of the main findings is provided along with a reflection on the methods used, the scientific contributions and managerial implications, the overall conclusions and propositions as starting points for further research.

7.1 Introduction

Given the rising costs of healthcare worldwide, many countries are reforming their healthcare systems through marketization. This marketization strategy is also having consequences for capital investments, especially in the Netherlands where health organizations have become responsible for financing these investments. Although efficient real estate management is part of efficient and effective healthcare provision, the Dutch policy change is an additional incentive to fully professionalize real estate management. The responsibilities for care and cure real estate shifted from a central government organization to a decentralised system giving care organizations some major incentives to manage their real estate in an efficient way. Due to the many political, social, demographic uncertainties, flexibility is needed to enable adaptation to future uncertainties. The aim of this research was therefore to develop a tool that supports real estate practitioners in making sustainable decisions for the future.

Not surprisingly, many publications on corporate real estate management focus on the flexibility issue. However, till now no methods or tools are provided to assess the types of flexibility possible in CREM. In other related research fields, as large engineering projects and real estate development, the real options theory has been suggested as a promising way to assess flexibility. This approach provides ways to both categorize flexibility in the product and the process and to approach flexibility measures in a more structured way. A real option is the right, but not an obligation, to exercise an option. In order to create such an option, one has to invest in it. One has to determine whether there is a value in having a future option and, therefore, potential future situations, with and without having that option, need to be assessed. The real options approach is a proactive approach: it demands

that choices are made, in advance, on the way the organization will proceed in the future. However, real options are less used than one would expect given their utility (Block, 2007; Triantis, 2005). Barriers to this use of real options and challenges to overcome these barriers are mentioned as well (Ford & Garvin, 2009; Triantis, 2005) but have not been studied for healthcare real estate. The aim of this research was therefore to analyse the barriers and challenges for implementing real options approach in healthcare. This led to the main research question of this thesis becoming:

- How can real options be used in strategic real estate management decision-making in healthcare?

How the real options approach is adopted depends on the purpose it is to be used for: 1) as a way of thinking -so-called real options reasoning (ROR)- where real options are used as a "language to communicate decision problems qualitatively"; 2) as an analytical tool where real options "with well specified option characteristics" are valued quantitatively; and 3) as an organizational process where real options are used as a "management tool to identify and exploit strategic options" (Triantis & Borison, 2001). Although the third option sounds more valuable, it is not necessarily better than the first option since research shows that practitioners often assess risks and risk management tools more intuitively (Busby & Pitts, 1997; Ford & Lander, 2011; Gehner, et al., 2010; Lander & Pinches, 1998). Therefore we studied the usefulness of real option thinking for decision-making on health care real estate.

An additional advantage of using real options in a qualitative way was thought to be that this would enable the managerial implications of real options, such as the conditions for creating and exercising real options and the consequences for various interests in the organization, to be assessed. In this way, the real options approach would also guide in a normative way the organizational strategy since it evaluates the desirability of certain decisions with regard to the future organization. Besides obtaining greater insight into whether one already reasons in health CREM according to real options although not explicitly, an additional aim was to create a structure for this real options reasoning in order to enhance the use of real options in practice (Ford, et al., 2002). Scenario planning can be another qualitative way to stimulate thinking about future uncertainties and the development of strategies to deal with these. It is also already much practiced in commercial real estate development (Gehner, et al., 2010). As such, another aim of this

research was to investigate if and how real options and scenario planning could support decision-making in health CREM. Therefore, a tool was developed that was tested in three workshops. In these, the sensemaking concept seemed to have promise as a frame with which to understand how the tool was evaluated by practitioners. The answers to the sub-questions, that collectively answer the main research question, are addressed in the following section.

7.2 Main findings

In this section, the main findings are presented. The methods used to obtain the results in this research are a survey among cure and care organizations in the Netherlands, two in-depth case studies of a construction project in the cure and care sector and a multiple case-study in which the decision support tool was tested in three different settings. The results of the first two parts of the research were used to develop and test the tool.

7.2.1 Searching for *phronetic* knowledge on real options

A literature review was conducted to answer the first research question:

- What is the current body of knowledge on the use of real options in Corporate Real Estate Management practice?

Since no literature seemed to exist on the use of real options in CREM, a literature review was conducted on the application of real options in areas that could be relevant for CREM in the health sector, which were real estate development, large engineering projects, project coalitions and healthcare in general. Categorizing this literature using the typologies of Aristotle revealed that hardly any *phronetic* knowledge is present in the real options literature. That is, we did not find publications dealing with concrete examples that provide heuristics and analysis of the consequences for various stakeholders and the appropriate conditions for real options. The other two types of knowledge in the typologies of Aristotle are *episteme* and *techne*. *Episteme* knowledge is universal, expressed in cause-effect relationships and mostly found in the natural sciences literature. *Techne* knowledge is most often referred to as craft or art, and is practical knowledge that is context dependent. It is goal-oriented and is more often found in the literature on practical fields such as civil engineering. *Phronetic* knowledge is also context-related but is

more concerned with ethics. *Phronesis* evaluates whether the current course of action is desirable and where one should be heading in the future, which are key questions in most organizations and especially in today's health organizations. In addition, *phronesis* provides heuristics which are required to enhance the use of real options in practice (Triantis, 2005).

The literature review on real options revealed that, in most cases, *techne* type knowledge is developed by applying real options in the specific context of real estate development and project management. In contrast, very few papers evaluate the consequences of real options in terms of stakeholder values, the main concern in CREM, and so fail to provide *phronetic* knowledge. Further, the available *techne* knowledge on real options in real estate management does not adequately reflect the practice of real estate managers of an organization that both owns and uses the building.

In conclusion, the review covered publications on real options in real estate management and healthcare and in related fields such as project management and project delivery systems. The literature review failed to locate any publications on the application of real options in healthcare practice. Practitioners need more *phronetic* knowledge to assess the desirability of their current organizational and real estate strategies. In addition, it was concluded that more *phronetic* knowledge is needed if the real options concept is to be more widely adopted in practice. Sensemaking was identified as a process that could be used to evaluate whether the real options concept would actually generate more *phronetic* knowledge.

7.2.2 The impact of project coalitions on creating real options

The research questions answered in the second phase of the research, in which a survey was conducted, were formulated as:

- What types of project coalitions are chosen for the development, construction and operation of real estate in both the cure and care sectors?
- What is the rationale behind the type of project coalition chosen?
- What types of flexibility are considered within separated and integrated project coalitions, and to what extent are they actually exercised within these project coalitions?

- What categories and types of real options can be recognized in healthcare real estate management and in different types of project coalitions?

Besides the advantage of real options that they offer another means of dealing with flexibility, categorizing real options in terms of the types of flexibility they offer provides a way to give meaning to the broad and sometimes vague definition of flexibility. As a result, categorization facilitates communication on flexibility measures. Although flexibility is often referred to as being enabled by technical solutions, flexibility in the process itself is also an important means to adapt to uncertainties. A useful distinction was made by De Neufville *et al.* (2008) between real options 'in' a project, i.e. technical solutions that create flexibility, and those 'on' the project which reflect flexibility in the process. Real option types found 'in' the project are those to grow, to switch function and to scale up or down. Real options 'on' the project include to defer, to abandon, to select and to stage. The project coalition type, or project delivery system, plays an important role in the creation and exercising of real options since agreements have to be made with the contractors who will enable these options. This is recognized by several authors who mention flexibility as one of the indicators to consider when choosing a project coalition form, although the content of this indicator has never been fully elaborated (e.g. Love, Skitmore, & Earl, 1998). The survey results collected in this research draw a more elaborate picture on the available real options, or types of flexibility, in project coalitions, and in addition provided insights into the rationale behind the types of project coalition created. This knowledge is especially relevant since integrated project coalitions are rather new in the Netherlands and there is little knowledge on their performance.

The rationale behind a particular form of project coalition involves external, internal and project-related considerations. The most important external considerations were the market situation and the availability of parties; the key internal considerations were the availability of knowledge, experience and capacity and the project itself; and the most mentioned project-related consideration was money. The last two of these considerations very much reflect the consequences of the *new regime*, under which health organizations have to be financially more self-sustaining. This requires competences with regard to real estate management that are not available, and historically were largely not required, in such organizations. However, in contrast to what one might expect, rather than policy and laws, it is the market and the availability of parties that is the most important rationale in selecting a form of project coalition. From this, one can conclude that health

organizations realize that choosing contractors has major implications for a project and for the functioning of the subsequent real estate.

Real options were to a larger extent considered before the project than exercised in the construction phase in integrated project coalitions than in separated project coalitions, but their economic feasibility was higher in the latter. This seems counterintuitive since one would assume that considering flexibility in advance implies acceptance of a certain investment to generate that flexibility. These results are derived from a survey and the reason for this apparent anomaly is not available given the questions asked. However, it could be that one has to determine the requirements of an integrated project coalition in advance, and thus look further ahead, at a time when the uncertainty will be higher. On the other hand, in separated project coalitions, new requirements can be determined after each phase and more accurately specified since uncertainty is lower. However, the results suggest that more profitable agreements can be made in integrated project coalitions, and that these are more suitable if one wants to create real options. Further, the real options 'in' the real estate are perceived as more important than those 'on' the project, especially in integrated project coalitions.

The in-depth case studies also provided insight into differences between project coalition types, although no generalized conclusions could be drawn. The most important real options exercised in the separated project coalition were those to stage and to defer. This was an important means for the board to create more time allowing to obtain knowledge on the vision of the organization, although it might have large financial implications to postpone a project. In contrast, the integrated project coalition invested a lot in the option to speed up through having a rigid decision-making process and establishing ways to collect information. Therefore, one can conclude that having a certain type of flexibility stimulates its use. The integrated project coalition form provides more of an incentive to speed up the process since deferral can have large direct consequences.

In conclusion, real options are considered and exercised differently in separated and integrated project coalitions. The economic feasibility of options was slightly more considered in integrated project coalitions than in separated (traditional) project coalitions. However, within the integrated project coalitions studied, the economic feasibility of exercising real options appeared to be much higher than in the separated project coalitions.

7.2.3 Conditions and consequences of exercising real options

In the third phase of this research, the conditions and consequences of exercising real options were investigated within various types of project coalitions to answer the following research question:

- What are the conditions and consequences of exercising real options for the various stakeholder interests in CREM?

The in-depth case studies provided concrete examples of real options and the conditions required to exercise these options. Since the context of the real options is known, the consequences of exercising the real options for the various stakeholders involved in CREM can be analysed. Real options can be used to enhance the use of flexibility measures by providing a structured way to address these issues and by pointing out direct and indirect consequences. Consequences for the various stakeholder – interests is provided in Appendix J. The growth-switch-scale and defer-stage-abandon are investment options that support mainly policymakers to adapt the building if changes occur in the primary process. The ability to adapt as a result of changes in the organizational strategy often also serves the interest of the controllers since more efficiency can be reached. The same counts for timing options such as the option to accelerate. The option to select by means of designing in parallel is more costly for the organization and therefore negative for the controllers in first instance. The select options indirectly support the policymakers since the final result is assumed to be more according to the demands of the organization. However, since project development, in which this option is most applicable, is the responsibility of the project management, as part of facility management, it is mainly in their interest. The same counts for the option to accelerate and contractual options. The option to accelerate can be less beneficial for the users since they might have less time to influence the design. However, a good representation of the users, i.e. personnel and patients, in the design process can prevent this. Operational options such as the options to enable scaling up- or down or switch function, also serve facility management in the operation phase. Users might benefit from this option since it enables them to optimize the primary process, but these changes can also be enforced from management. The care organization invested less than the cure organization in switching options. Relating this to real options reasoning, a hospital is likely to require more functions than a care

organization and, as a result, the real option to switch functions is more valuable in the cure organization, and hence more likely to be invested in.

In conclusion, irrespective of the type of project coalition applied, both organizations had invested in both strategic growth and switch options in order to be able to adapt their real estate to a changing organization as the project developed. Both organizations were changing or developing plans to change their way of working. What is striking is the difference between the two cases in the speed of the process given that both organizations had to resolve uncertainties and make decisions. The care organization opted for a separated project coalition since they were aware that this approach provided considerable flexibility to resolve uncertainties. Since most uncertainties were related to the organizational vision, which is largely determined by the board and was also being shaped during the development phase of the construction project, a critical factor was the continuing involvement of the board in this process. In theory, if these issues had been resolved earlier in the process, a faster and more efficient project coalition form, such as a mediated or integrated project coalition, could have been applied. In practice, the board's decision-making is often the factor most obstructing the process.

7.2.4 Sensemaking by means of real options and scenario planning

In phase 4 of the research, a decision-support tool was developed, which was then tested in phase 5. The following research questions were answered:

- How can scenario planning and real options reasoning be incorporated in a tool that stimulates CREM practitioners to think about flexible real estate strategies?
- Does scenario thinking and real options enhance the collaborative sensemaking of a health organization's multiple stakeholders in dealing with future changes and developing a flexible real estate strategy to adapt to these changes?

The basic idea of the real options concept made sense to most practitioners. The basic concept being that a current investment is made to create future flexibility (i.e. an option), which can be exercised through an additional investment to exercise that option (the option premium). Essentially, the idea is that one should weigh a strategy, with and without an option, and determines what having such an option would be worth to you. We found that real estate managers in healthcare do reason according to real options, and

thus a decision support tool incorporating structured real options reasoning would likely support their daily practices

Such a tool was developed to enhance sensemaking over flexibility measures for adapting to future uncertainties. This included three steps: 1) developing contextual scenarios and describing the consequences for the organization; 2) backcasting in which a plausible desired future layout is first visualized, after which one reasons backwards on how to reach that future situation from the current situation; and 3) developing a strategy that includes real options, and determining milestones for implementing and exercising real options. To determine whether such a tool actually facilitates decision-making requires insight into the sensemaking process. Collaborative sensemaking, through discussion and argument, should result in people sharing meaning and reframing their individual frames of reference, which should result in action. A multiple case study using an action research approach was carried out to see if this occurred.

In the workshops held in the various organizations, the degree of belief-driven sensemaking over strategies was dependent on the number and background of the workshop participants, and the period over which the organization had been confronted with the consequences of the *new regime,* which has been gradually implemented across all healthcare sectors in the Netherlands. The hospital, the mental and elderly organization and the forensic clinic were all struggling with various uncertainties, of which the *new regime* was the most important. The hospital has been confronted already for several years with the new regime. The hospital had been facing up to this for longest and, therefore, sensemaking over current strategies was strongest in the hospital. More sensemaking took place in the mental and elderly care organization because this organization is only recently confronted with the new regime. Finally, in the forensic clinic the participants needed more time to debate the usefulness and means of the tool rather than to discuss scenarios and real options applicable for their organization because this organization is expected to be confronted with the new regime in the near future.

In general, participants found it easier to make sense of past projects, and to determine which strategies should have been used, rather than to apply prospective sensemaking to ongoing or future projects. As a rule, real options reasoning did not add to the participants' sensemaking over types of flexibility or measures to create flexibility. However, most participants thought it useful as a way of communicating with other

stakeholders and as a means to negotiate over flexibility measures with contractors in all stages of a construction project. Also real options reasoning and scenario planning were perceived as complementary methods. Some participants were triggered to see real options thinking as a new approach to looking at flexibility, creating the opportunity to obtain *phronetic* knowledge, an internalized type of wisdom that can be applied in a specific context. This amounts to a first step in sensemaking with real options reasoning. This is an ongoing process and requires more time than available in a single workshop.

In conclusion, real options and scenario planning enhance the sensemaking of flexible real estate strategies. However, the effectiveness of the workshop process employed depends on the context of the organization and the backgrounds of the participants. Although respondents recognized real options as a useful concept in communicating about flexibility measures with other stakeholders, and as a means to negotiate with contractors over flexibility measures, whether practitioners would actually use all the aspects of the structure of real options reasoning was less certain. Further, it takes time to understand the real options concept before it can be used in sensemaking. Consequently, follow-up workshops are necessary to enhance sensemaking since it is an ongoing process, and actions taken based on sensemaking further enhance this process.

7.3 Discussion

7.3.1 Scientific contribution

The first scientific contribution of this research was its investigation of real options applied in a context which has not been previously addressed. In addition, the empirical data provide information on contextual factors linked to exercising real options, such as the conditions and consequences for stakeholders, which are often lacking in current real options theory. Such contextual information is needed to increase the applicability of the theory in practice. By means of the sensemaking concept, greater insight has been generated into how practitioners evaluate the real options concept. This knowledge provides starting points for further scientific research on the real options theory. In addition, since, according to Kuhn (1970), a discipline without the systematic production of exemplars is an ineffective one (Flyvbjerg, 2006), the contribution provided should make the real options theory more effective.

Secondly, the full spectrum of possible real options is considered in making an inventory of the real options used in practice, whereas most of the real options literature focusses on only one type of real option despite some authors noting that a portfolio of real options is available to managers if they were only aware of this (Luehrman, 1998). Consequently, an attempt has been made to provide greater insight into this process of recognizing real options. The research also shows what types of real options are most often used by practitioners, and which are less often considered.

The third contribution is the focus on *phronetic* knowledge, an aspect which is often lacking in real options literature. The real options literature is often somewhat technocratic; in this research their use is described in an ethnographic way in order to more thoroughly investigate the actual use and consequences of real options. Further, whereas most of the literature focusses on the use of real options as an analytical tool, in which the value of real options is quantified, this research addresses the use of real options as a way of thinking. Sensemaking was proven to be a useful concept in analysing this process.

Fourth, the tool used to develop flexible real estate strategies adds to the related CREM body of knowledge. In CREM literature, various methods are described on strategy development. Flexibility is addressed more thoroughly in this thesis and covers all phases of project management. Therefore, the real options approach is a useful addition to the CREM literature.

Fifth, the findings in this study also add to knowledge on flexibility in general, for instance to the extensive study on organisational flexibility of Volberda (1992). Where Volberda used a reactive strategy to analyse flexibility in organizations this thesis offers a proactive strategy to define a flexibility strategy.

Sixth, while scenario planning is a generally accepted method for stimulating thinking on future uncertainties, real options can be a valuable complement in that it provides a way to come up with concrete solutions for dealing with these uncertainties. As such, this research also adds knowledge to the scenario planning literature.

Seventh, a new aspect was to seek out the relationship between the type of project coalition and the real options considered and exercised. Where flexibility is often measured as an important aspect of a particular project coalition, this concept has rarely

been further refined or more specifically addressed with respect to flexibility performance. A more detailed overview of project coalitions and the types of flexibility is provided, as well as the rationale behind the options chosen. In addition, there was no knowledge on how health organizations organize their real estate and why they might prefer certain types of project coalition. This information might also contribute to improving healthcare systems since the governance aspect is important.

In conclusion, greater insight has been gained into how CREM practitioners in healthcare actually reason according to real options and how this can support sensemaking on flexibility measures to adapt to future uncertainties. The various categories of real options are recognized as such, although this categorization does not seem to provide additional insights into possible flexibility measures. However, the concept is perceived as useful as a communication means towards other stakeholders. CREM managers are more likely to recognize real options 'in' a project than options 'on' the project - that is in the process. However, the valuing of real options, by assessing the consequences with and without the option present, requires practitioners to adopt a new way of thinking. Nevertheless, the concept did appeal to practitioners and thus has the potential to become increasingly used when knowledge on this managerial practice becomes more widely known in the field of CREM. This research was a first initiative in this direction.

7.3.2 Practical contribution

Phronetic knowledge is useful in the academic world since it provides real examples to support theoretical explanations. This type of knowledge focusses more on contextual and practical knowledge although both *techne* and *episteme* types of knowledge can be part of *phronesis*. The first practical contribution is that knowledge on how real options are considered and exercised in various types of project coalition is provided. This adds to the knowledge on the role that the type of project coalition has in creating flexibility to adapt if circumstances change and therefore supports practitioners in decision-making. The choice of a certain type of project coalition matters because more real options are considered in advance in integrated project coalitions. In addition, this knowledge is valuable for governments that are currently evaluating the use of integrated project coalitions in their own institutions, and also propagate this knowledge to other semi-public organizations. Further, some of the results can be used to evaluate the consequences of the marketization policy. Information on the rationale for choosing

certain project coalitions is also valuable for contracting parties who should use this information to adapt their services to better meet the demands of health organizations.

Second, the in-depth case studies provide more detailed knowledge on the actual process of developing real estate, the real options used and the rationale behind decisions. Knowledge on conditions for exercising real options and the consequences for the various interests within CREM provide heuristics for other health organizations. In addition, the structured format in which the real options uncovered in the case studies are presented provides concrete guidelines for the application of real options reasoning in practice. The developed tool facilitates practitioners involved in real estate decision-making to form real estate strategies that deal with future uncertainties in a more efficient and effective way. The way that the scenario planning method is integrated into the tool adds to practical knowledge in the area of research on futures studies.

A recommendation that would improve the effectiveness of the tool is to involve more policymakers within the organization when developing scenarios and discussing real estate strategies. The concept of real options needs to be more widely known within an organization, and not just by real estate managers, if it is to be used as a means to communicate about flexibility measures. While many hospitals have once in a lifetime construction projects, many care organizations have a large portfolio with many projects. As such, it might not be feasible for the board to be intensively involved in all projects, but perhaps a board member should be assigned to participate in project teams. This would be in line with the increasing recognition of real estate as an important strategic asset in an organization.

The subject of process management in construction and flexibility have been subject of dissertations for decades, such as by Stolwijk (1987) and Vietsch (1987). Architectural building typologies are described by Stolwijk and various flexibility measures are presented. Since then, measures have been improved and new or advanced measures have been introduced, see for example the thesis of Gijsbers (2011) on the adaptability of the carrying capacity of buildings. The main difference between the period these dissertations were written and the current context, is the recent policy change where health organizations have become responsible for the financing of their real estate. Health organizations are facing more complex and unpredictable uncertainties than ever, which demands other ways of thinking about and preparing for the future. Although we

acknowledge the importance of technical flexibility, this dissertation has tried to address the issue of dealing with uncertainty by real estate managers of health organizations and focusses on organizational rather than technical flexibility.

7.3.3 Final conclusions and propositions for further research

This thesis provides various insights into the role that real options can play in strategic healthcare real estate management but also raises additional questions which, due to various limitations, could not be addressed. Therefore, this section draws final conclusions and offers propositions as starting points for further research.

Proposition 1: The use of real options would increase when particular real options 'in' the project component of healthcare construction projects are quantified and function as a benchmark to prevent excessive flexibility.

The focus of the research was on real options reasoning in a qualitative sense since this corresponds to how real estate managers tend to make decisions in practice. Another aim was to address the consequences of real options in terms of their values to various CREM interests rather than primarily focusing on the financial aspect. However, as expressed by some of the respondents, a quantitative evaluation of real options in monetary terms can sometimes be more useful in supporting arguments on the necessity for, or the undesirability of, certain flexibility measures 'in' the project, i.e. technical solutions. Real options can be used as a benchmark to value a strategy incorporating real options against a strategy without real options given the uncertainties that underlie these real options. Although it is impossible to assign accurate probabilities to many relevant uncertainties, approximations may provide sufficient insight. A further elaboration and quantification of some commonly used real options 'in' the project would therefore be useful contributions for practitioners.

Proposition 2: Exercising real options is more economically feasible in integrated project coalitions than in separated project coalitions

The results from this research provide indications as to how the *know-how* knowledge of real options valuation might fit practical reasoning. To obtain knowledge on the types of real options used in practice, a mixed method approach was used: a survey and two in-depth case studies. Given the limited size of the survey, no generalizing conclusions can

be safely drawn. Nevertheless, the survey provides a sound overview of the real options applied in practice and a starting point for this research. However certain time-related issues, such as the credit crisis and the new healthcare policy, played a role in determining the rationale behind selecting the type of project coalition. As such, the outcomes are both time and context dependent. A notable conclusion is that the economic feasibility of exercising real options was more positively valued in integrated project coalitions than in separated project coalitions. Given the mixed reports on the performance of integrated project coalitions, it would be useful to investigate this further.

Proposition 3: Real options enhance the transparency of negotiations between clients and contractors over flexibility measures.

This proposition is also related to project coalitions. These are assumed to be important means to create real options. The multiple case studies showed that real options are perceived to be useful in negotiating with contractors over flexibility measures. The structured way of assessing flexibility seemed to provide a means of communication on types of flexibility and their corresponding conditions. However, this could not be tested and would therefore be an interesting area for future research. In addition, a related limitation of this research was that the contractor's perspective was not included, although it was sometimes touched upon within the case studies. To make the real options approach successful in CREM project management, more stakeholders from outside the organization, but within the project coalition, need to be considered. This has been seen in studies on large engineering projects (e.g. Alessandri, et al., 2004), but not yet in CREM. Further research could explore the use and expected usefulness of real options for contractors in healthcare CREM. In addition, there was only limited knowledge in the health organizations on other possible types of project coalition with most real estate managers working in building teams. Therefore, future research could focus on the combination of sensemaking regarding the advantages and disadvantages of project coalition types and their relation with types of flexibility and real options.

Proposition 4: Sensemaking of flexibility by means of real options requires a change of reasoning.

The survey and the two in-depth case studies showed that real options are already used in health sector CREM, although this was in an intuitive way and not identified as such. In addition, real options were created but without weighing strategies with and without real

options. Therefore, it was concluded that real options reasoning partly corresponds with practice. The assumption was that more benefit can be obtained when real options are used in a structured way and by considering all consequences on stakeholder interests in CREM. Therefore, more insight in the concept is needed. In an attempt to achieve this, and to test this assumption, a tool, inspired by the design science paradigm, was developed and tested. Action research was conducted since the aim was to achieve organizational change by stimulating practitioners to question their current theories of action with regard to dealing with future uncertainties and then to act upon this. This was partly successful in that this line of reasoning was stimulated, although incorrect preconceptions over the purpose of the workshops may have negatively influenced the sensemaking process. Sensemaking of the concept of real options and scenario planning appears to require more time than the workshops allowed, but sensemaking of flexibility measures did occur. It seems that the real options concept is some distance from how practitioners reason: as one respondent put it, "it is another way of thinking". Consequently, the sensemaking process could be further improved and a recommendation for further research would be to refine measurements of the sensemaking process, and then to investigate which aspects obstruct or enhance sensemaking.

The workshop procedure was further refined between the three workshops in which the tool was tested. However, the limited time that was available restricted the thorough testing of the tool. Therefore, a recommendation for future research would be to apply the tool in other settings, allowing more time and involving more stakeholders. Having input from the range of interests present in an organization appears to be an important factor in making well-informed decisions since this enables real estate strategies to be evaluated from various perspectives. In addition, the aim of the tool was to enhance sensemaking over flexible real estate strategies, and an inherent aspect of sensemaking is that it leads to action. Although intentions to take action after the workshop were expressed, there is no proof that this happened. Evaluating real estate strategies a few months after such workshops would help validate the proposed tool.

Proposition 5: The applicability of real options varies between healthcare sectors and institutional characteristics.

There were clear differences between the real options used in the two in-depth case studies, one of which was a project in a hospital and the other in an elderly care

organization. The type of project coalition differed and this could be both a reason and a consequence of having certain real options. However, both projects had other characteristics which were influenced by the type of healthcare offered. In addition, besides other types of healthcare, also institutional characteristics differed. Therefore, a recommendation for further research would be to carry out further case studies in other healthcare sectors that use other project coalition types in order to compare issues and draw lessons. This should help clarify the relationship between types of healthcare and types of project coalition, and the role of institutional characteristics. Another issue is that one case concerned a real estate project where the construction had yet to start, and the new hospital was in fact delivered during the research. Various real options had been created, but not yet exercised. Further research would be enriched by a longitudinal study that evaluated real options after a number of years. Such a study would provide real knowledge on how these real options perform and whether their perceived value was well estimated in the design phase.

Finally, the decision support tool was developed based on the design science paradigm. The conditions of repeatability and transferability were not explicitly tested in the three case studies where the tool was applied. However, the participants of the workshops in which the tool was applied had to understand the tool first before they were able to make sense of it. In the cases where the participants made sense of flexibility measures by means of the tool, it can be assumed that the tool can be used repeatedly by these members. However, as discussed in the previous chapter, the scenario planning and backcasting methods stimulated the discussions and enhanced sensemaking. Unfortunately, due to time constraints during the workshops, we were not able to elaborate extensively on the real options concept. Further research should therefore focus more on the repeatability and transferability of the use of the real options concept in the tool.

The challenges that health organizations and their real estate managers face are increasing in impact and speed. Therefore, supporting tools and concepts are needed to face these challenges proactively. The real options concept appeared to be such a supporting concept. By both stimulating practitioners to think on long term consequences of uncertainties, and in the same time providing directions for actions to take now, the tool developed in this research provides a sound cure to become prepared for the future.

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SUMMARY

Worldwide, healthcare systems are facing various challenges including uncertain developments in technical innovations, in healthcare patterns and in public expectations. Overall, healthcare costs are increasing faster than the quality of the service and, therefore, many governments are reforming their healthcare systems. In the Netherlands, a far reaching policy change was recently implemented in the form of increased marketization. In contrast to healthcare reforms in other countries, the *new regime* in the Netherlands also has major consequences for real estate management. Health organizations have become responsible for the financing of their real estate, which was previously guaranteed for by the government and remunerated for based on re-calculation. In the new healthcare system, the remuneration for all the costs associated with healthcare provision, including capital investments and the salaries and education costs of specialists and supporting services, are incorporated in an overall fee that is determined for each type of treatment. Competition has become more important as well. Consequently, both delivering healthcare and the efficient and effective management of real estate have become important aspects if health organizations are to remain solvent.

The abovementioned uncertainties force health organizations to be flexible in order to be able to adapt to these changes. With these uncertainties, the most important factor in stimulating strategic real estate management in healthcare has been the new healthcare system in the Netherlands. Although other countries are not yet facing similar measures, flexible real estate management has been recognized as a valuable means and therefore the Dutch example might provide useful insights.

Real options have been recognized in other fields as a useful approach for creating flexibility to deal with uncertainties. The concept of real options is derived from financial options but applies to *real* assets. A real option is the right, but not an obligation, to exercise an option. Such an option has to be created in advance and will involve some investment in terms of money or effort. When exercising the option, an additional investment will be required. The difference to an option, as a simple choice, is that a real option should be developed in advance. Consequently, it is a proactive approach, rather than a reactive one, to when the outcomes of an uncertainty become apparent. Commonly recognized real options are those to abandon, to defer, to stage, to select, to scale up or down, to grow, to switch function and to speed up.

Real options can be used in various ways: quantitatively by determining the value of well-defined options; as an organizational process where they are used as a tool to identify and exploit strategic options; and as a way of thinking that qualitatively frames and communicates decision problems. However, their use in practice lags behind their potential according to many authors. Various barriers are given as preventing real options from being used and suggestions are made to overcome them. The most important suggestion from the literature for this research is that the real options thinking of practitioners should be improved, and that a more structured way of real options thinking would enable the spread of knowledge on this managerial practice. The objective of this research has thus become twofold: first, to obtain knowledge on how to create flexible real estate strategies in healthcare through using real options and, second, to enhance the use of real options in practice. Therefore, the research question in this thesis is formulated as:

- How can real options be used in strategic real estate management decision-making in healthcare?

In Chapter 2, the results of a literature review on the use of real options in real estate management are presented. Real estate management only deals with real estate development from the owner-investor perspective, whereas Corporate Real Estate Management also addresses the interests of the user-owner, which is generally the situation found in most health organizations. Other relevant research fields which address real options include large engineering projects, project coalitions and healthcare. I categorized the relevant literature according to the three knowledge systems proposed by Aristotle: *episteme, techne* and *phronesis. Episteme* is universal knowledge and mostly generated by the natural sciences. *Techne* is referred to as craft or art, and is context-related knowledge that has a certain goal. *Phronesis* deals with ethics and values, and analyses the consequences of *techne* and *phronetic* knowledge. I assume in this research that *phronesis* will be important in CREM in the health sector since various stakeholders with different interests play a role, and real estate managers have to respond to these interests and values. However, the real options literature mainly defines the value of real options in terms of money, while value can also be expressed in other non-financial terms. For example, the option to defer a construction project can be valued on the negative influence it has on the image of the organization. The literature review revealed that hardly any *phronetic* knowledge is present in the real options literature. Rather, the

literature deals with concrete examples that provide heuristics, analyses the consequences for various stakeholders and considers the conditions for exercising real options.

In phase 2 of the research, described in Chapter 3, an exploratory survey was conducted to explore the impact of the type of project coalition used on flexibility. The type of project coalition, or project delivery system, employed influences the amount of flexibility that is available to the client. A total of 45 useable questionnaires were completed of which 22 were from cure organizations and 23 from care organizations. The results show that real estate is organized in very different ways, and that there are trends towards both more decentralization and greater centralization in organizational real estate management. As such, no professionalization trend or emerging best practice can be discerned. The rationale behind project coalition types involved external, internal and project-related considerations. Here, the most important external consideration was the market situation and the availability of parties, the main internal considerations were the availability of knowledge, experience and capacity and the project itself, and the most mentioned project-related consideration was money. Further, the results showed that integrated project coalitions pay more attention in advance to flexibility, in both the process and the product, but exercise this flexibility less than separated project coalitions. Moreover, the economic feasibility of real options is higher in integrated project coalitions. This would suggest that integrated project coalitions enable more profitable agreements, but this was not further tested. The study shows that real options thinking *is* already incorporated in real estate management of healthcare organizations, although greater flexibility is considered in advance of a project than is actually realized during and after construction.

In Chapter 4, through two in-depth case studies, the use of real options and the relationship with project coalition type is explored in more detail. One case study concerned a construction project in a hospital organized in the form of a mediated project coalition, and the other a project in an elderly care organization that adopted a separated project coalition approach. The process of decision-making regarding flexibility was described in detail and narratively analysed by identifying all events, activities and choices on the various levels. In this way, rich examples were provided that generated insight into the consequences of creating and exercising real options, and the consequences for the various interests present in CREM. The real options were structured and presented in a consistent format for the purposes of validation and to create heuristics that could be used by practitioners. The results showed that various stakeholders have

different needs with regard to flexibility. A major difference between the separated and mediated project coalitions was the speed of the process. The reasons for this are partly inherent to the characteristics of the project coalition types. Since most of the uncertainties that necessitated flexibility were related to the organizational vision, which is largely determined by the board, and were also being shaped during the development process, a critical factor was the involvement of the board in this process.

Chapter 5 presents the development of a decision-support tool. Whereas, in the previous research phases, real options have only been recognized retrospectively, the purpose of this phase of the research was to test whether the real options concept was useful in prospectively developing real estate strategies to adapt to future uncertainties. Therefore, a decision-support tool was developed following the design science paradigm. The typical product of design science is not a causal model but an act, a sequence of acts, a process, a system or a tool. Decision making on real estate is stimulated to be done by means of the logic of real options thinking. Scenario planning is another part of the tool. Scenario planning was seen as a complementary method since real options are ways to adapt to future uncertainties. Here, one should have some idea of the potential need for flexibility and, therefore, some insight into possible futures is necessary. The tool was tested in a workshop in a hospital with various stakeholders and consisted of three steps: 1) developing context scenarios; 2) backcasting - visualizing the organization within the context scenarios, and the consequences for its real estate, and then describing a desirable future real estate layout; and 3) developing strategies through real options to reach this desired layout. The tool was evaluated from interviews held both before and after the workshop to determine its impact. This testing of the tool resulted in three design propositions to improve the tool.

The results of the final testing of the tool are described in Chapter 6. The testing took place in three workshops with practitioners from a hospital, a forensic clinic and a mental and elderly care organization. A sensemaking approach was used to evaluate whether real options thinking and scenario planning create useful insights into how to develop flexible real estate strategies. The sensemaking process was investigated by means of interviews before and after the workshops and observations during them. The results showed that sensemaking had taken place and that the identity and composition of participants influenced the sensemaking process. The tool proved a useful means to make sense of abstract uncertainties that influence an organization but which are normally outside the

scope of real estate managers. The real options approach as a way of thinking offered a structured way of comparing costs and benefits of strategies with and without flexibility.

Chapter 7 draws overall conclusions from the various research stages. The added value of real options thinking in combination with scenario planning is that it provides a way for practitioners to balance, in a structured way, two future situations: one in which one would like to enact an option but did not create one, and a future situation where one created an option at a certain price and now wishes to exercise it. However, the sensemaking process over real options as a way of thinking did not occur overnight. The real options concept triggered ideas in some practitioners more than in others, and some found it difficult to translate abstract scenarios into concrete consequences for real estate. In addition, a broad spectrum of stakeholders should attend such workshops in order to address the range of interests in an organization. Furthermore, a champion is needed to encourage the use of the tool. One proposition for further research is to further refine measurement of the sensemaking process, and investigate which aspects obstruct or enhance sensemaking. Another proposition, reflecting suggestions made by the respondents, would be to create quantitative benchmarks for the flexibility measures that are often used 'in' a project. Real options were also suggested as a useful tool in negotiating with contractors over flexibility in a project's product and process, and this application deserves further attention. The survey generated some counterintuitive results which are worthy of further investigating, in particular the large extent of perceived economically feasibility of exercising real options in integrated project coalitions. Finally, an evaluation of the performance of real options in the longer term would round off this research.

SAMENVATTING (SUMMARY IN DUTCH)

Wereldwijd hebben zorgsystemen te maken met verschillende uitdagingen zoals onzekere ontwikkelingen in technologische innovaties, ziektepatronen en maatschappelijke verwachtingen. Het is een algemene trend dat de kosten van gezondheidszorg sneller toenemen dan de kwaliteit van de zorg zelf en daarom zijn verschillende overheden hun zorgsystemen aan het hervormen. In Nederland is recentelijk een vergaande beleidsverandering ingezet in de vorm van toenemende marktwerking. In tegenstelling tot hervormingen in de gezondheidszorg in andere landen, heeft het nieuwe regime in Nederland ook grote gevolgen voor het beheer van vastgoed. Zorgorganisaties zijn verantwoordelijk geworden voor de financiering van hun vastgoed, waarvoor de overheid eerst garant stond, en waarvan de kosten werden vergoed op basis van nacalculatie. In het nieuwe systeem zijn alle kosten die gerelateerd zijn aan het leveren van zorg, zoals kapitale investeringen en de salarissen en onderwijskosten van specialisten en ondersteunende diensten, verrekend in een budget dat is vastgesteld voor verschillende soorten behandelingen. Concurrentie is ook een belangrijke factor geworden die het primair proces beïnvloedt. Daarom is effectiviteit en efficiëntie bij zowel het leveren van zorg als ondersteunende activiteiten zoals vastgoedbeheer belangrijker geworden voor zorgorganisaties om solvabel te blijven.

Flexibiliteit is noodzakelijk voor zorgorganisaties om aan te kunnen passen aan bovengenoemde onzekerheden. De belangrijkste onzekerheid die meer strategisch vastgoedmanagement in de zorg in Nederland heeft gestimuleerd is het nieuwe zorgsysteem. Hoewel andere landen nog niet vergelijkbare maatregelen hebben ingevoerd, wordt flexibiliteit in vastgoedmanagement gezien als een waardevolle maatregel en daarom zou het Nederlandse voorbeeld nuttige inzichten kunnen bieden.

Reële opties worden op andere terreinen genoemd als een nuttige benadering voor het creëren van flexibiliteit om met onzekerheden om te gaan. Het concept reële opties is afgeleid van financiële opties maar is toegepast op fysieke (reële) objecten. Een reële optie is het recht en niet de verplichting om een optie te gebruiken. Een optie moet van tevoren gecreëerd worden door middel van een investering in de vorm van geld of inspanning. Een extra investering is nodig om de optie te gebruiken. Het verschil met een optie als een keuze tussen twee mogelijkheden, is dat de reële optie van tevoren moet zijn gecreëerd. Het is meer een proactieve dan een reactieve benadering omgang met onzekerheden. Veel

voorkomende reële opties zijn de opties om te stoppen, uit te stellen, te faseren, te selecteren, op- of neer te schalen, te groeien, te veranderen van functie en te versnellen.

Reële opties kunnen op verschillende manieren worden gebruikt: kwantitatief door het bepalen van de waarde van goed gedefinieerde opties; als een organisatorisch proces waar opties worden gebruikt als een manier om strategische opties te identificeren en te exploiteren; en als een manier van denken om op een kwalitatieve manier besluitvormingsproblemen te definiëren en te communiceren. Desondanks blijft het gebruik in de praktijk achter bij de mogelijke toepassingen die worden toegekend in wetenschappelijke artikelen. Verschillende barrières worden genoemd die het gebruik van reële opties in de praktijk belemmeren, en suggesties worden genoemd om het gebruik te verbeteren. De belangrijkste suggestie voor dit onderzoek uit de literatuur is dat het denken met behulp van reële opties onder professionals moet worden verbeterd. Daarom heeft dit onderzoek twee doelen: ten eerste het verkrijgen van kennis over hoe flexibele vastgoedstrategieën in de zorg kunnen worden gecreëerd door het gebruik van reële opties en, ten tweede, hoe het gebruik van reële opties in de praktijk kan worden verbeterd. De onderzoeksvraag luidt daarom als volgt:

- Hoe kunnen reële opties worden gebruikt bij besluitvorming over strategisch vastgoed management in de zorg?

Hoofdstuk 2 beschrijft de resultaten van een literatuuronderzoek naar het gebruik van reële opties in vastgoedbeheer. Vastgoedbeheer (*real estate management)* houdt rekening met vastgoedontwikkeling vanuit het eigenaar-investeerders perspectief, terwijl *Corporate Real Estate Management* (CREM) ook rekening houdt met de belangen van de gebruiker-eigenaar, zoals meestal het geval is bij zorginstellingen. Andere relevante onderzoeksgebieden die reële opties noemen, zijn grote technische projecten, bouworganisatievormen en gezondheidszorg. Ik heb de relevante literatuur gecategoriseerd aan de hand van de drie kennissystemen van Aristoteles: *episteme, techne* en *phronesis. Episteme* is universele kennis en wordt meestal gegenereerd door de natuurwetenschappen. *Techne* wordt vaak geassocieerd met ambachten of kunst, en is context gerelateerde kennis met een bepaald doel. *Phronetische* kennis richt zich op ethiek en waarden, en de gevolgen van de toepassing van *episteme* en *techne* kennis. Een aanname in dit onderzoek is dat *phronesis* belangrijk is in CREM in de zorgsector omdat verschillende belangen van diverse belanghebbenden een rol spelen, en omdat de taak van

vastgoedmanagers is om in te spelen op deze belangen en waarden. Reële optie literatuur definieert waarde voornamelijk in termen van geld, terwijl waarde ook in andere niet-financiële termen kan worden uitgedrukt. De optie om een bouwproject uit te stellen kan bijvoorbeeld worden gewaardeerd aan de hand van de negatieve gevolgen die dat heeft op het imago van de organisatie. Het literatuur onderzoek laat zien dat er bijna geen *phronetische* kennis aanwezig is in reële optie literatuur. Dat wil zeggen dat concrete voorbeelden die heuristieken bieden voor de praktijk ontbreken en de gevolgen voor verschillende belanghebbenden niet worden geanalyseerd. Ook de voorwaarden voor het kunnen creëren en gebruiken van reële opties worden niet genoemd.

In fase 2 van het onderzoek dat wordt beschreven in hoofdstuk 3, was een verkennende enquête uitgevoerd om de impact van de bouworganisatievorm op flexibiliteit te onderzoeken. De bouworganisatievorm beïnvloedt de hoeveelheid flexibiliteit die beschikbaar is voor de opdrachtgever. In totaal waren 45 bruikbare enquêtes ingevuld waarvan 22 afkomstig waren uit de cure (ziekenhuizen) en 23 uit de care (VVT, GGZ, gehandicaptenzorg en jeugdzorg). De resultaten laten zien dat vastgoed op verschillende manieren is georganiseerd, en dat er trends zijn van zowel decentralisatie als centralisatie in de positie van de afdeling vastgoedbeheer in de organisatie. Daarom kan geen conclusie worden getrokken over een trend van professionalisering van vastgoed of een *best practice* worden afgeleid. De overwegingen voor een bepaalde keuze voor een bouworganisatievorm betreffen externe, interne en project gerelateerde factoren. De belangrijkste externe afweging is de marktsituatie en de beschikbaarheid van partijen, de belangrijkste interne overwegingen zijn de beschikbaarheid van kennis, ervaring en capaciteit en het project zelf, en de meest genoemde project-gerelateerde afweging is geld. Verder blijkt uit de resultaten dat in geïntegreerde bouworganisatievormen voor aanvang van het project meer rekening wordt gehouden met flexibiliteit in zowel het proces als het gebouw, maar dat de mate waarin flexibiliteit daadwerkelijk wordt gebruikt minder is dan waar van tevoren rekening mee werd gehouden dan in de traditionele bouworganisatievorm. Daarnaast is de economische haalbaarheid van reële opties hoger ingeschat bij geïntegreerde bouworganisatievormen. Dit wekt de suggestie dat voordeligere afspraken kunnen worden gemaakt in geïntegreerde bouworganisatievormen maar dit was niet verder onderzocht.

In hoofdstuk 4 was gedetailleerder het verband onderzocht tussen het gebruik van reële opties en type bouworganisatievorm in 2 grondige gevalstudies. De eerste gevalstudie

betrof een traditioneel georganiseerd bouwproject van een VVT organisatie en de tweede gevalstudie een bouwproject in een ziekenhuis dat was georganiseerd in een strategische samenwerking. Het besluitvormingsproces met betrekking tot flexibiliteit was in detail beschreven en geanalyseerd door middel van het identificeren van alle gebeurtenissen, activiteiten en keuzes op verschillende niveaus. Op deze manier werden uitgebreide voorbeelden aangereikt die inzicht gaven in de gevolgen van het creëren en gebruiken van reële opties, en de gevolgen voor de verschillende belangen die een rol spelen in CREM. De reële opties werden in een consistente opzet gestructureerd en gepresenteerd om de bevindingen te kunnen valideren en om heuristieken te creëren die door professionals gebruikt kunnen worden. De resultaten laten zien dat verschillende belanghebbenden verschillende behoeften hebben met betrekking tot flexibiliteit. Een groot verschil tussen de traditionele bouworganisatievorm en de strategische samenwerking als bouworganisatievorm, was de snelheid van het proces. Dit was deels te herleiden naar de eigenschappen van de bouworganisatievormen. Omdat de meeste onzekerheden die flexibiliteit noodzakelijk maken waren gerelateerd aan de visie van de organisatie, die voornamelijk werd bepaald door de Raad van Bestuur, en ook vorm kregen tijdens het ontwikkelingsproces, was de betrokkenheid van de Raad van Bestuur in dit proces een kritieke factor.

In hoofdstuk 5 wordt de ontwikkeling van een beslissingsondersteunende tool beschreven. In de voorgaande onderdelen van het onderzoek waren reële opties alleen retrospectief onderzocht, terwijl het doel van deze onderzoeksfase was om te testen of het reële optie concept bruikbaar is bij het proactief ontwikkelen van vastgoedstrategieën om aan te kunnen passen aan toekomstige onzekerheden. Om dat te testen was een beslissingsondersteunende tool ontwikkeld volgens het *design science* paradigma. Volgens dit paradigma is het resultaat van onderzoek geen causaal model maar een activiteit, een volgorde van activiteiten, een proces, een systeem of een tool. De voorgestelde tool is meer een methode waarbij besluitvormers worden gestimuleerd om vastgoedbeslissingen te analyseren aan de hand van de logica van reële optie denken. Scenario planning is een ander onderdeel van de tool. Scenario planning vult het reële optie denken aan omdat reële opties manieren zijn om aan te passen aan toekomstige onzekerheden. Om de behoefte aan flexibiliteit in te schatten is inzicht in verschillende plausibele toekomsten nodig. De tool was getest in een workshop in een ziekenhuis met verschillende belanghebbenden en bestaat uit drie stappen: 1) ontwikkelen van context scenario's; 2)

ontwikkelen van streefbeelden – visualiseren van de organisatie in de context scenario's met bijbehorende gevolgen voor het vastgoed, en daarbij het beschrijven van een wenselijke samenstelling en eigenschappen van het toekomstige vastgoed; en 3) ontwikkelen van strategieën met behulp van reële opties om deze gewenste samenstelling te creëren. De impact van de tool was geëvalueerd aan de hand van interviews die voor en na de workshop werden gehouden. Het testen van de tool resulteerde in drie ontwerpproposities om de tool te verbeteren.

De resultaten van de laatste testfase worden beschreven in hoofdstuk 6. De tool werd getest in drie workshops met werknemers van een ziekenhuis, een forensische kliniek en een GGZ instelling. Aan de hand van het concept van *sensemaking* werd onderzocht of reële optie denken en scenario planning bruikbare inzichten genereren om flexibele vastgoedstrategieën te kunnen ontwikkelen. Het *sensemaking* proces was onderzocht door middel van interview voor en na de workshops, en observaties tijdens de workshops. De resultaten laten zien dat sensemaking heeft plaats gevonden en dat de identiteit en samenstelling van deelnemers aan de workshop het sensemaking proces beïnvloeden. De tool blijkt een bruikbare methode om betekenis te geven (sensemaking) aan abstracte onzekerheden die de organisatie beïnvloeden maar die meestal buiten het blikveld van vastgoedmanagers blijven. De reële optie benadering als een manier van denken biedt een gestructureerde manier aan van het vergelijken van kosten en baten van strategieën met en zonder flexibiliteit.

In hoofdstuk 7 worden algemene conclusies getrokken over alle onderzoeksfasen. De toegevoegde waarde van reële optie denken in combinatie met scenario planning is dat het een manier verschaft aan besluitvormers om op een gestructureerde manier twee toekomstige situaties af te wegen: een situatie waarbij men een optie nodig heeft maar er geen tot zijn beschikking heeft, en één waarbij men een optie heeft gecreëerd tegen een bepaalde prijs en die nu wenst te gebruiken. Desondanks ging het sensemaking proces zoals beschreven in hoofdstuk 6 niet zonder slag of stoot. Het reële optie concept initieerde meer ideeën bij sommige deelnemers meer dan bij andere, en sommigen vonden het moeilijk om abstracte scenario's te vertalen naar concrete gevolgen voor vastgoed. Bovendien zou een diversiteit aan belanghebbenden deel moeten nemen aan de workshop waarbij de tool werd toegepast om de verschillende belangen in de organisatie te betrekken. Daarnaast is er een persoon met een voortrekkersrol nodig die het gebruik van de tool stimuleert. Een stelling voor verder onderzoek is om het meten van het

sensemaking proces te verfijnen, en om te onderzoeken welke aspecten sensemaking belemmeren of bevorderen. Suggesties van deelnemers zijn verwerkt in de stelling om kwantitatieve criteria te definiëren voor bepaalde technische maatregelen ten behoeve van flexibiliteit die vaak worden toegepast in gebouwen. Deelnemers noemden reële opties ook als bruikbare tool bij het onderhandelen met opdrachtnemers over flexibiliteit in een project, in zowel het gebouw als het proces. Deze toepassing zou verder onderzocht moeten worden. De enquête genereerde een paar tegenintuïtieve resultaten die het waard zijn om verder te onderzoeken, namelijk de vermeende hoge economisch haalbaarheid van het gebruiken van reële opties in geïntegreerde bouworganisatievormen. Tenslotte zouden de prestaties van de reële opties die onderwerp zijn van dit onderzoek op de langere termijn geëvalueerd moeten worden om het gebruik van reële opties in vastgoedbeheer in de zorg compleet te maken.

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APPENDICES

Appendix A Typologies of hospital buildings

The typologies mentioned in paragraph 2.2.3 can also be related to the 'shell model' as developed by the *building college, which provides a certain degree of* flexibility, see paragraph 2.2.2. The pavilion structure as it is applied in the Isala Clinics in Zwolle, the Netherlands, makes it difficult to switch functions between functional units without changing the organizational starting points, see Figure 16. However, the way the pavilions are build enhances parcelling flexibility by investing in separate installations for each building part. This additional investment can be recognised as options to switch function, abandon, scale up and down existing spaces. The shell model has been applied by clustering various healthcare functions in the building units, which enhances parcelling as well.

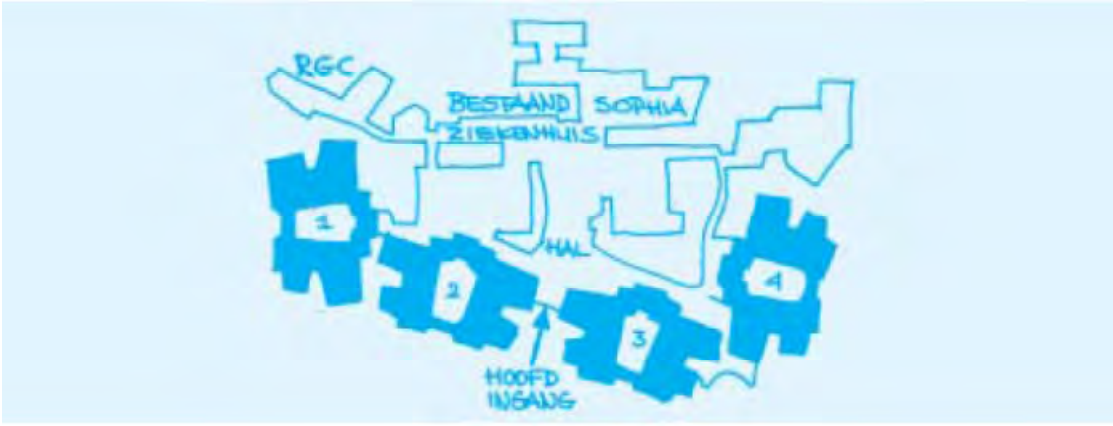


Figure 16 *The pavilion structure of the Isala clinics (College Bouw ziekenhuisvoorzieningen, 2002)*

The Martini hospital in Groningen is an example of a linear structure. The uniform lay-out of the chained building blocks enables the switching of functions, see Figure 17.

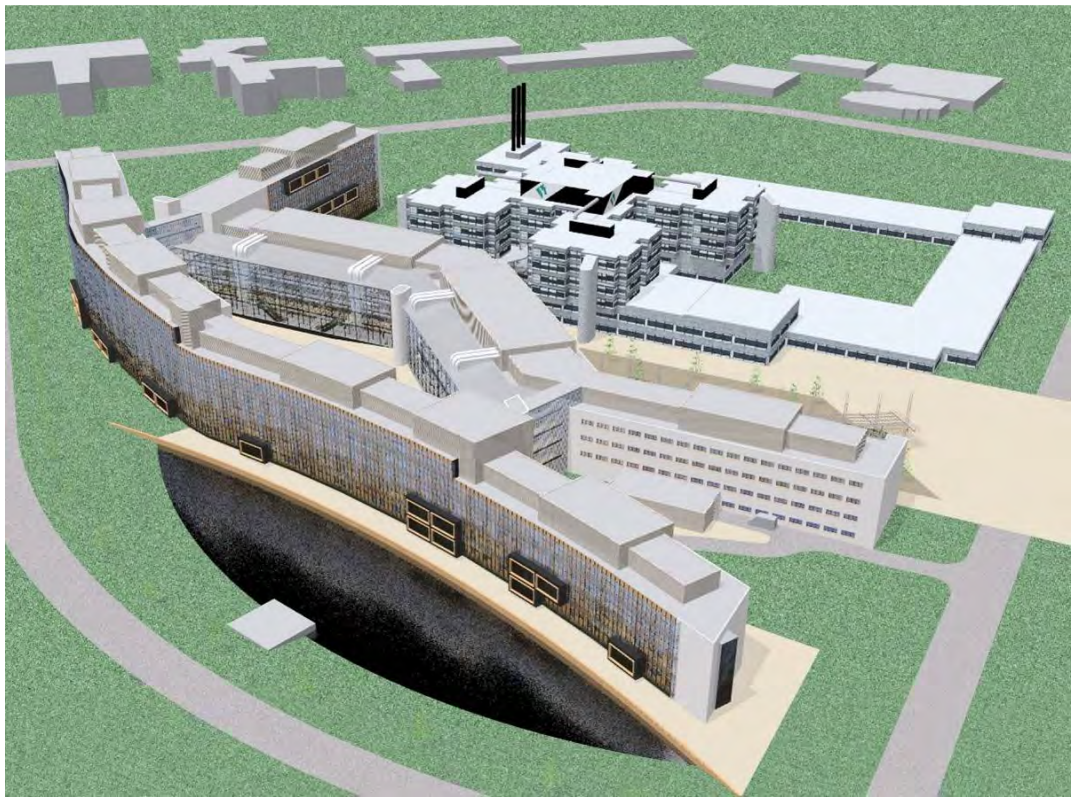


Figure 17 *The linear structure of the Martini hospital in Groningen (www.regieraadbouw.nl)*

Deventer hospital has a comb structure, see Figure 18. Additional space around the hospital allows for the expansion of the building, i.e. the option to grow. Also, the construction of the roof provides division flexibility, an option to switch functions. Elements can be removed or added, which creates volume flexibility, i.e. options to grow/shrink if it concerns other functions or to scale up or down if the same functions increase or decrease.

Figure 18 *The comb structure of the Deventer hospital (www.heijmans.nl)*

The comb structure of the Gelre hospital in Zutphen, see Figure 19, creates volume flexibility as well, since each comb can be extended or reduced, i.e. options to grow/shrink or scale up/down. Parts can be separated from the hospital and rented to other parties, i.e. the option to abandon. Applying the shell model resulted in the separation of parts which are more and less marketable. For example, the floor heating contains high-tech installations which will become obsolete earlier than other parts. The construction allows replacement of the old hot floor without hindering the primary process of providing healthcare. The distance between walls allows for the exchange of functions, i.e. the option to switch function.

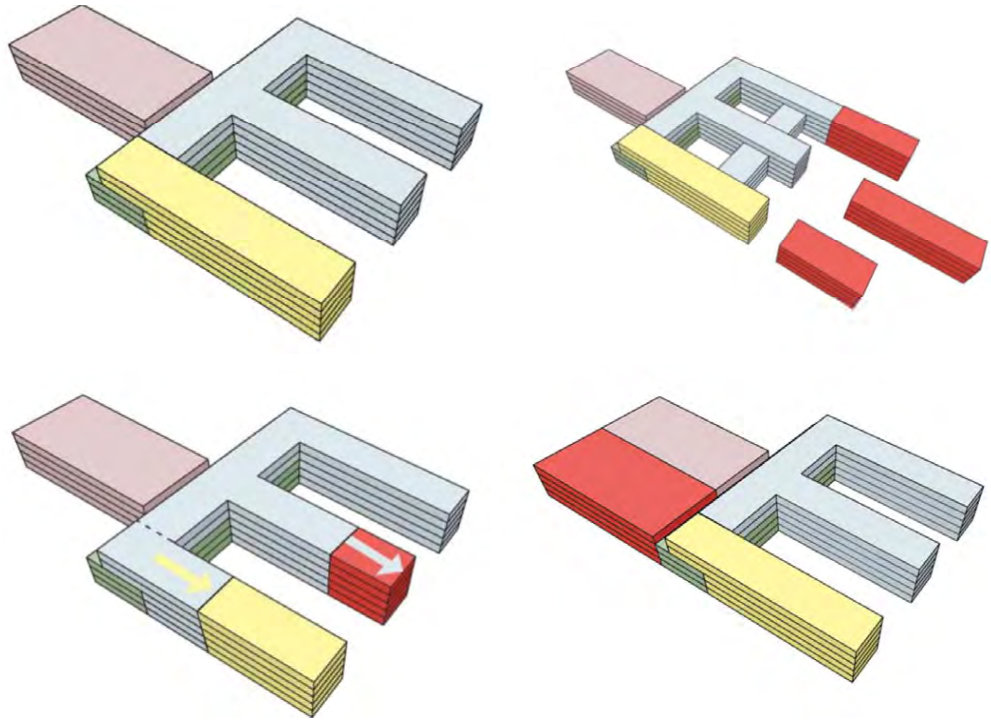


Figure 19 *Possibilities of the comb structure of hospital Gelre Zutphen (Pawiroredjo 2010)*

The passage structure of the Orbis Medical Center in Sittard has open flanks which permits expansion on both sides and vertically, see Figure 20.

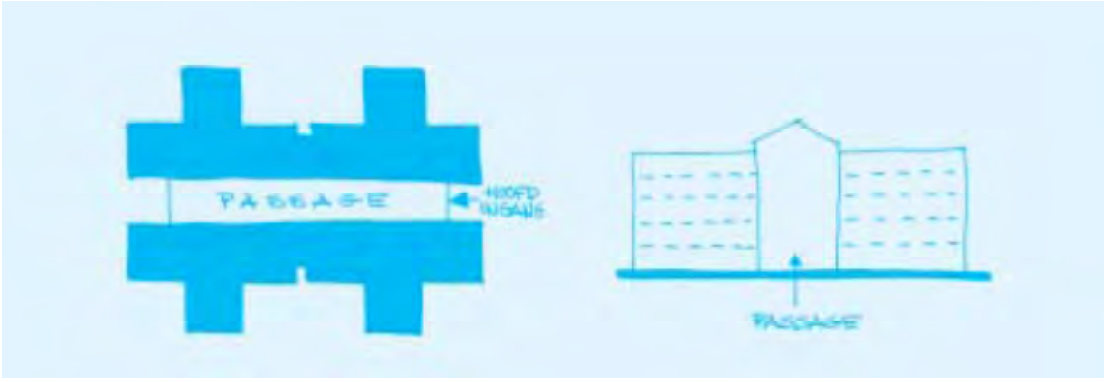


Figure 20 *The passage structure of the Orbis Medical Center (College Bouw Ziekenhuisvoorzieningen, 2002)*

The INO hospital in Bern, Switzerland has been developed based on the Open Building paradigm, implying that the building consists of three systems: the primary system should

stand for 100 years, the secondary system for 20 years and the tertiary system 5-10 years, see Figure 21. The architect explains his design solution (Kendall et al. 2002, p.16):

"Based on this aim is the suggestion to create a simple and functionally independent circulation and structural system, a low-tech primary structure for high-tech contents, surrounded by a skin, which will create a pleasant working temperature for several generations."

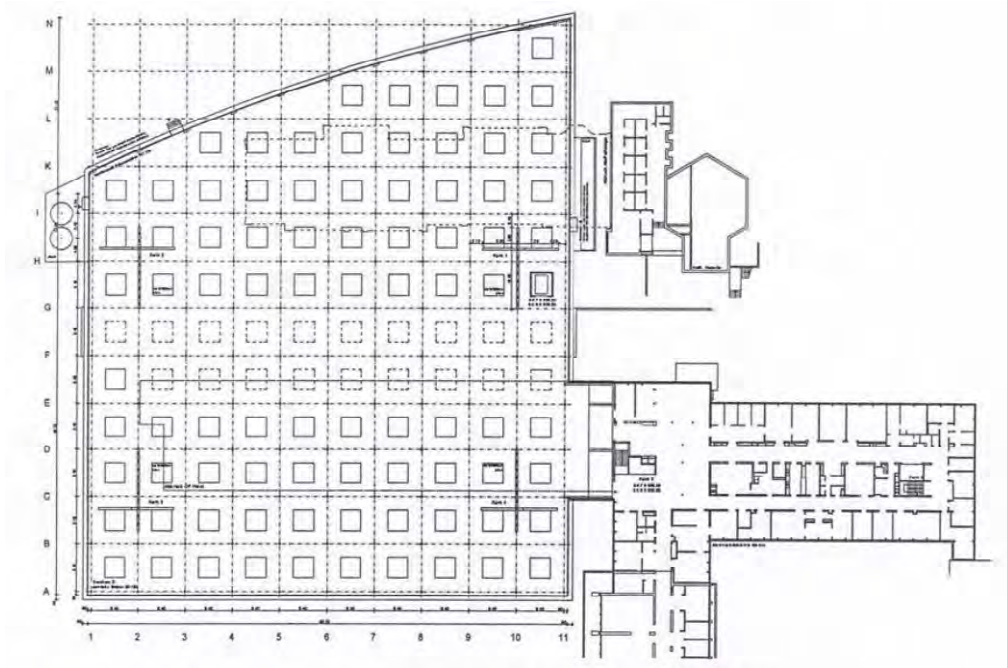


Figure 21 *Scheme for the primary system of the INO hospital in Bern, Switzerland*

Appendix B Questionnaire of survey on project coalitions and real options

Question 1

Are you involved or do you have knowledge of real estate decisions of your healthcare organization on management level? If yes, from which viewpoint?

○ Board
○ Financial
○ Real estate management
○ Project development
○ Facility management
○ Other: _____

Question 2

Which healthcare sector is applicable to your organization?

☐ Geriatric care
☐ Care for the disabled
☐ Mental healthcare
☐ Youth care

Question 3

What is the size of your organization measured in number of employees?

○ 0-500
○ 500-1.000
○ 1.000-2.500
○ 2.500-5.000
○ 5.000-10.000
○ 10.000+
○ Other: _____
○ n.a.

Question 4

What is the size of your organization measured in turnover (millions)?

○ < € 50
○ € 50 - € 100
○ € 100 € 250
○ € 250 - € 500
○ > € 500
○ Other: _____
○ n.a.

Question 5

What is the size of your organization measures in number of beds?

○ < 300
○ 300-399
○ 400-499
○ 500-599
○ > 600
○ Other: _____
○ n.a.

Question 6

What is the size of your organization measured in square meters of floor space of all locations together?

○ 3.000-14.999
○ 15.000-29.999
○ 30.000-44.999
○ 45.000-59.999
○ 60.000-74.999
○ > 75.000
○ Other:

_____

○ n.a.

Question 7

How is the position of the organization of real estate within your organization? For example a staff department, within a division, decentralised etc.

_____

○ n.a.

Question 8

Do currently plans exist to organize real estate differently within your organization? If yes, how?

_____

○ n.a.

Question 9

How many locations does your organization own?

○ 1
○ 2
○ 3
○ 4
○ 5
○ 6
○ 7
○ 8
○ Other:

_____

○ n.a.

Question 10

Please fill in the information below for one location upon which recently has been decided with regard to construction plans. Please tick one box per subject.

Date of construction (determining for the division in date of construction is the ear of the original delivery of the oldest building part)

☐ < 1960
☐ 1960-69
☐ 1970-79
☐ 1980-89
☐ 1990-99
☐ 2000-2010

Surface (m^2)

☐ 3.000-14.999
☐ 15.000-29.999
☐ 30.000-44.999
☐ 45.000-59.999
☐ 60.000-74.999
☐ > 75.000

Has the building renovated or newly constructed already once?

☐ Yes
☐ No

Do you have renovation-/new construction plans in the future?

☐ Yes

☐ No

Are multiple locations combined in the project?

☐ Yes

☐ No

☐ n.a.

Question 11

If applicable, please fill in the information for a second location? Please tick one box per subject.

Date of construction (determining for the division in date of construction is the ear of the original delivery of the oldest building part)

☐ < 1960

☐ 1960-69

☐ 1970-79

☐ 1980-89

☐ 1990-99

☐ 2000-2010

Surface (m^2)

☐ 3.000-14.999

☐ 15.000-29.999

☐ 30.000-44.999

☐ 45.000-59.999

☐ 60.000-74.999

☐ > 75.000

Has the building renovated or newly constructed already once?

☐ Yes

☐ No

Do you have renovation-/new construction plans in the future?

☐ Yes

☐ No

Are multiple locations combined in the project?

☐ Yes

☐ No

☐ n.a.

Question 12

If applicable, please fill in the information for a third location? Please tick one box per subject.

Date of construction (determining for the division in date of construction is the ear of the original delivery of the oldest building part)

☐ < 1960

☐ 1960-69

☐ 1970-79

☐ 1980-89

☐ 1990-99

☐ 2000-2010

Surface (m^2)

☐ 3.000-14.999

☐ 15.000-29.999

☐ 30.000-44.999

☐ 45.000-59.999

☐ 60.000-74.999

☐ > 75.000

Has the building renovated or newly constructed already once?

☐ Yes

☐ No

Do you have renovation-/new construction plans in the future?

☐ Yes

☐ No

Are multiple locations combined in the project?

☐ Yes
☐ No
☐ n.a.

Question 13
Does your organization have plans for new constructions?
○ No
Yes
○ New construction
○ Renovation
○ Combination of new construction and renovation
○ Other: _____
○ n.a.

The following questions address the construction and potentially operation of the most recent planned or executed large construction project. Please answer the following questions for the same construction project.

Question 14
Please indicate the height of the investment? (In millions)
_____ ○ n.a.

Question 15
Do you answer the questions for a completed, running or future project?
○ Completed project
○ Running project
○ Future project
○ n.a.

Question 16
If the healthcare developments are different than you have projected for your real estate in the project concerned, do you have the option to give the real estate object, or a part of it, another main function?
○ Yes
○ No

Question 17
Can you indicate what this other function is? One can think of: office, hotel, other type of healthcare, etc.
_____
○ n.a.

Question 18
Which types of measures have been taken to change the function?
Footprint and foundation
☐ Yes
☐ No
Technical infrastructure
☐ Yes
☐ No
Access roads
☐ Yes
☐ No
Organizational
☐ Yes
☐ No
Financial

☐ Yes
☐ No
☐ n.a.

Question 19

The project coalition/delivery system/contract form of a project can be defined as the way in which the cooperation between parties in the development of real estate is organized. Which type of project coalition is applicable to your project? Additional information on the various type of project coalition is provided under 'extra information'.

○ Traditional

Integrated project coalitions

○ Design & Build
○ Design, Build & Finance
○ Design, Build & Maintain
○ Design, Build, Finance & Maintain
○ Design, Build, Finance, Maintain & Operate
○ Alliance
○ Other: _____

Question 20

Is financing arranged for the project?

○ No
○ Yes
○ Temporary
○ Structural (for the running time of the project)

If you answered ´no´ can you clarify this?: _____

Question 21

One distinguishes between internal, external and project-related considerations to come to a real estate decision. Internal considerations are related to the organizational strategy. External considerations apply to the environment of the organization and the project, to which the organization cannot exert influence. Project related considerations are demands and characteristics of the project and the participating parties. Did you make external, internal or project-related considerations? Please indicate to what extent you made these considerations.

1 = did not consider, 5 = important consideration.

Internal considerations:

	1				5
Organizational structure	○	○	○	○	○
Organizational culture	○	○	○	○	○
Finance	○	○	○	○	○
Merger	○	○	○	○	○
Knowledge, experience and capacity	○	○	○	○	○

Comments: _____

Question 22

External considerations

	1				5
Market, availability parties for participation in project	○	○	○	○	○
Trust in cooperating parties	○	○	○	○	○
Politics and society	○	○	○	○	○
Law and regulations	○	○	○	○	○

Comments: _____

Question 23

Project-related considerations

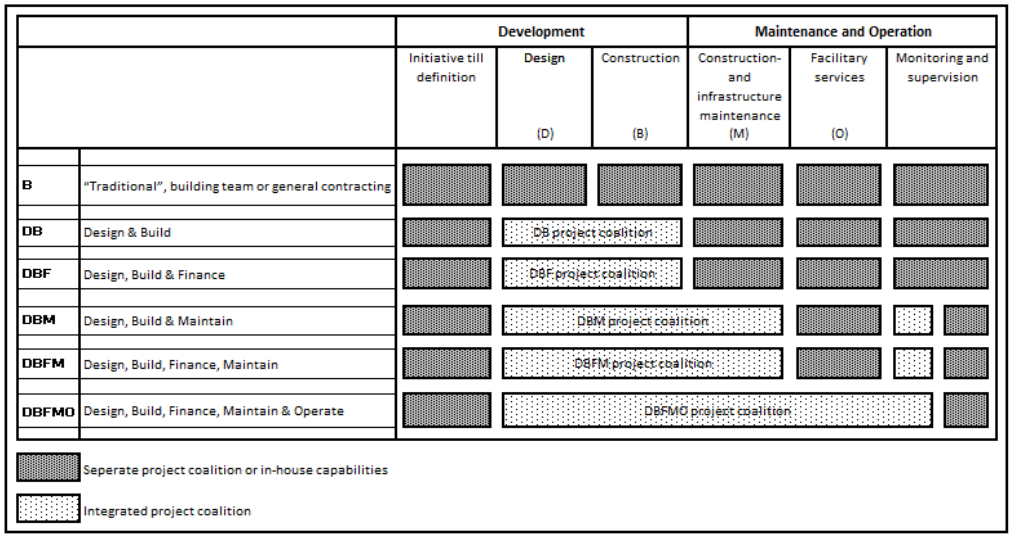
	1				5
Money	○	○	○	○	○
Time	○	○	○	○	○
Quality	○	○	○	○	○
Influence client on project	○	○	○	○	○
Complexity	○	○	○	○	○
Risks (risk allocations)	○	○	○	○	○

Comments: _____

Question 23

In the figure below, a distinction has been made between the development phase and the maintenance- and operation phase. This question addresses the development phase. Please indicate on a scale between 1 and 5 to what extent you made agreements with the contractor on the options below when providing the assignment? 1 = no assignments 5 = many assignments

	1				5	
Option to abandon	○	○	○	○	○	○ n.a.
Option to make adaptations to the design	○	○	○	○	○	○ n.a.
Option to extend the project	○	○	○	○	○	○ n.a.
Option to shrink the project	○	○	○	○	○	○ n.a.
Option to defer the project	○	○	○	○	○	○ n.a.
Option to shorten the duration of the project	○	○	○	○	○	○ n.a.
Options to extend the duration of the project	○	○	○	○	○	○ n.a.


Development
Maintenance and Operation
Initiative till definition
Design
(D)
Construction
(B)
Construction- and infrastructure maintenance
(M)
Facilitary services
(O)
Monitoring and supervision
B
"Traditional", building team or general contracting
DB
Design & Build
DB project coalition
DBF
Design, Build & Finance
DBF project coalition
DBM
Design, Build & Maintain
DBM project coalition
DBFM
Design, Build, Finance, Maintain
DBFM project coalition
DBFMO
Design, Build, Finance, Maintain & Operate
DBFMO project coalition
Seperate project coalition or in-house capabilities
Integrated project coalition

Question 24

To which extent have the options been exercised during the construction phase?

1 = not exercised, 5 = completely exercised

	1				5	
Option to abandon	○	○	○	○	○	○ n.a.
Option to make adaptations to the design	○	○	○	○	○	○ n.a.
Option to extend the project	○	○	○	○	○	○ n.a.
Option to shrink the project	○	○	○	○	○	○ n.a.
Option to defer the project	○	○	○	○	○	○ n.a.
Option to shorten the duration of the project	○	○	○	○	○	○ n.a.
Options to extend the duration of the project	○	○	○	○	○	○ n.a.

If the answers of questions 23 and 24 are different, can you clarify this? For example as a result of financial feasibility, wrong agreements made, wrong predictions made, etc.: _____

Question 25

This question addresses the maintenance- and operation phase. Please indicate on a scale between 1 and 5 to what extent you considered the options mentioned below in the maintenance- and exploitation phase? 1= no consideration, 5 = a lot of consideration

	1				5	
Option to expand or shrink the building with larger or smaller healthcare demand	○	○	○	○	○	○ n.a.
The option to use spaces differently or to change within the building by means of demountable walls etc.	○	○	○	○	○	○ n.a.
The economic feasibility of implementing the mentioned options?	○	○	○	○	○	○ n.a.

Question 26

To what extent have the possibilities been exercised during the maintenance- and operation phase? 1 = not exercised, 5 = completely exercised.

	1				5	
Option to expand or shrink the building with larger or smaller healthcare demand	○	○	○	○	○	○ n.a.
The option to use spaces differently or to change within the building by means of demountable walls etc.	○	○	○	○	○	○ n.a.
How large appeared the economic feasibility to be of the technical flexibility? 1 = small, 5 = large	○	○	○	○	○	○ n.a.

If other or no options have been exercised than what you had considered in advance, please clarify:_____

Question 27

Are facility services, such as cleaning, technical services and security, currently organized in house or outsourced to one or more external parties?

○ In house
○ Partly outsourced
○ Outsourced

Question 28

Do you plan to outsource more services in the future?

○ Yes
○ No

Partly, namely the following facility services:

_____

Question 29

Why would you outsource services or not? _____

Question 30

To what extent does the current organization of the facility services influence on the choice for a certain type of project coalition?

1 = no influence, 5 = very large influence

1 ○ ○ ○ ○ ○ 5 ○ n.a.

Question 31

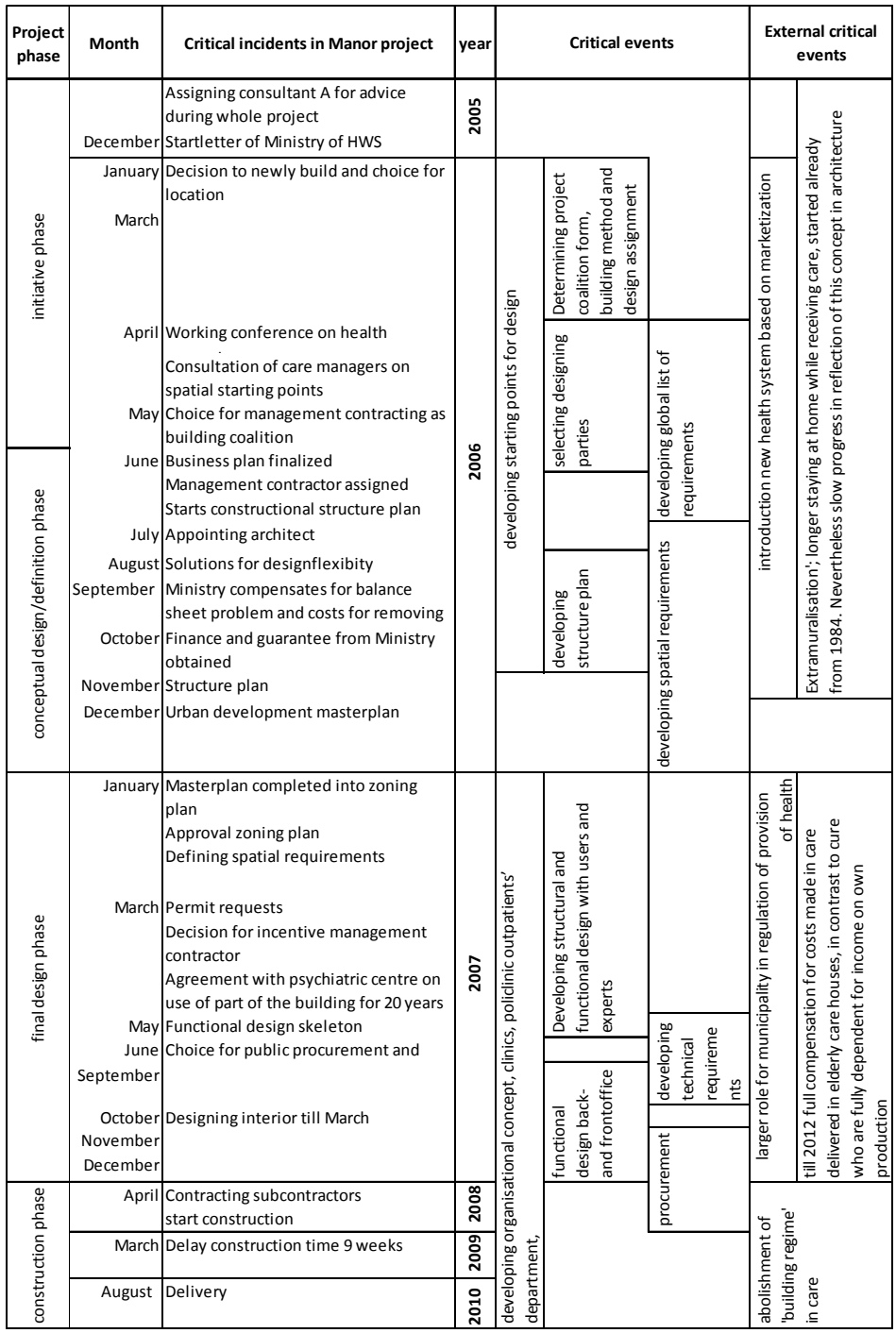
With new knowledge you have now, would you approach matters differently? If yes, how would you approach these matters?

_____

Appendix C Critical incidents and critical events in the Utopia project

Project phase	Month	Critical incidents in Utopia project	year	Organisational developments Ibis/Duota	Critical events	External critical events
Initiative phase		Feasibility study Utopia, technical research	2002			
Definition phase		Official decision to rebuild/renovate Utopia	2003	Long term housing plan of Parrot		
		Traditional procurement: appointing advisors Permit request at Ministry Decision not to sell part of terrain and acquisition of adjacent houses Masterplan and structureplan Cost estimate structureplan Second opinion by consultancy A	2005			
Conceptual design phase	Summer		2006	Merger into Ibis Duota established		
	Autumn	Cost estimate by architect of conceptual design				
Final design phase	May	Permit provision by *bouwcollege*	2007			
	July	Board approves conceptual design Advice by *bouwcollege* on balance sheet problem				
Initiative phase	February	Costestimate of final design by architect	2008			
		Project on hold				
	September	*TNO* market research apartments				
	December	Revirification report by consultancy B finished				
Definition phase	January	Starting up again of Utopia project	2009	Consultant B = New board	Ibis questioning how to manage real estate Transition period towards new regime. Uncertainty on compensation Running towards regime change New ideas on and development of health care concepts Free market system: competition is more important questioning and refining starting points/list of requirement more costcontrol of design by projectmanagement	larger role for municipality in regulation of provision of health Uncertainty on national policy on height of budgets for housing and compensations from government to solve balance sheet problem of health organisations/ uncertainty if Utopia can claim compensation abolishment of 'building regime' in healthcare introduction marketization law in healthcare till 2012 full compensation for costs made in care delivered in elderly care houses, in contrast to cure who are fully dependent for income on own production
	March	Cooperation with consultancy on vitality				
	July					
	September	Pointcare participates in project				
	September	Appointing architect				
	November	Structureplan approved by board				
	November	Document financial feasibility				
	November	Kick-off meeting preliminary design phase with working groups				
Conceptual design phase	February	Appointing advisors	2010			
	March	Board defers designing vitality center				
	April	Start conceptual design phase for living part				
	May	Project strategy by consultant				
	June	Selection of interior- and landscape architects				
	June	Appointing cost advisor				
	December	Deferment of decision on final design phase				
Definition phase	January	Fire department warns for expiration permit	2011			
	February	Hayday with decision makers: new starting points				
	June	Decision board to reconstruct instead of renovate New Structure				
	August-November	Decision board to abandon the wellness centre development				
	January	New businesscase on Utopia	2012	New real estate strategy of Ibis		

Appendix D Critical incidents and critical events in the Manor project



Appendix E Questionnaire on uncertainties for scenario development

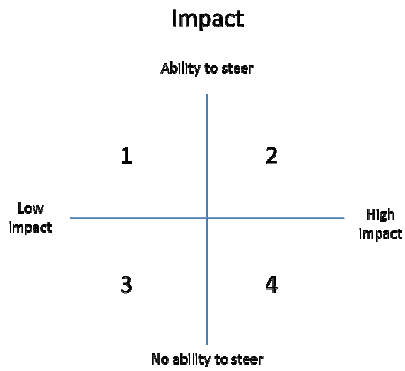
By means of a Delphi survey, an inventory was made of the opinions on the impact and predictability of the various uncertainties and these were used to develop scenarios. The scenarios were used in the workshop with the hospital. The same questions were posed to the forensic clinic to develop scenarios which are applicable to the forensic care. Since fewer respondents gave input for the workshop, no Delphi survey was needed.

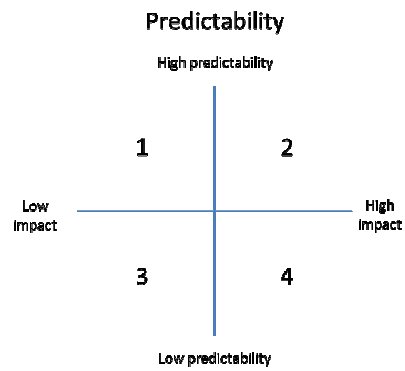
The first round of the classical Delphi procedure (Martino, 1983) is unstructured which gives respondents the opportunity to mention all relevant topics. The individual factors are then collected into one set by the researchers and processed into a structured questionnaire from which the views and opinions of panellists are inventorised (Rowe and Wright, 1993). Groupsizes, number of rounds and type of feedback provided to the respondents differs among various studies. Since the purpose of our Delphi survey was to make an inventory of important uncertainties and no full consensus on these uncertainties, we decided to finish after one round.

The following form was presented in an early phase of the research to various decision makers in a cure and care organization and experts in healthcare real estate management, to make an inventory of all important uncertainties as the first part of the Delphi survey.

Development of scenario: the impact and possibility to steer developments that influence the organization and real estate management

A part of the workshop is to think on how real estate will look like in various scenarios. To develop scenarios to use in the workshop I would like to know which development affect the organization, and how large this impact and predictability is of these developments. This is presented in the quadrants below.





Various developments or uncertainties can have influence on the organization and therefore direct or indirect on real estate management. We defined development on three levels from which uncertainties can originate, which are contextual developments, developments within the healthcare sector and developments within the organization. These three levels are presented below, with examples which could be thought of:

Question: Can you please mention important developments that are applicable to the subjects mentioned below, and depict in the quadrants where you would place this development, i.e. how do you estimate the ability to steer, predictability and impact?

1. Developments outside the healthcare sector, such as:
    - Macro-economic: situation of real estate- and construction sector, economic situation

- Example(s) of development:
- Impact (number quadrant):
- Predictability (number quadrant):

2. Developments in the healthcare sector in general affect the organizations and real estate management. Examples are:
    - National and international policy
        - Consequences of financing healthcare and the housing component
        - Ways of delivering healthcare

- Example(s) of development:
- Impact (number quadrant):
- Predictability (number quadrant):

    - Society/demography
        - Aging
        - Availability of personnel

- Example(s) of development:
- Impact (number quadrant):
- Predictability (number quadrant):

    - New insights from in healthcare concepts and ways of treatment
    - Technological and medical developments

- Example(s) of development:
- Impact (number quadrant):
- Predictability (number quadrant):

3. The general strategy within the organization is often already a reaction on contextual developments and developments within the healthcare sector. Nevertheless there might be specific characteristics or objectives in the organization that influence real estate management. Characteristics can be found in:
   - Type of healthcare/specialisations/healthcare strategy
   - Staff
   - Decision making process
   - Competition
   - Cooperation with other parties

- Example(s) of development:
- Impact (number quadrant):
- Predictability (number quadrant):

Appendix F Results of Delphi survey and list of respondents

The findings of the questionnaire presented in Appendix E were aggregated into a Delphi survey. The survey was accompanied by a an information sheet with information on the uncertainties listed in the survey, and the arguments of other respondents on the list of uncertainties mentioned in the interviews. The respondents were asked to indicate their opinion on four aspects of the uncertainty on a scale of seven: 1 = very small, 2 = small, 3 = rather small, 4 = average, 5 = rather large, 6 = large, 7 = very large. Table 46 shows the functions of the ten respondents.

The four aspects were: 1) the impact of the uncertainty on the short term, 2) the impact on the long term, 3) the predictability and 4) the ability to exert influence on the uncertainty.

To have an indication for scenario development on the importance of each uncertainty, we ranked the uncertainties based on the average answer of each aspect. The results are summarised in Figure 22. The first four uncertainties were additionally mentioned by respondents and therefore not valued by the other respondents.

Table 46. Characteristics of the respondents of the Delphi survey.

Type of organization	Function
Care	Project manager real estate
Care	Project manager real estate
Care	Project manager real estate
Care	Director real estate of limited company owning real estate of a care organization
Cure	Manager facility management
Cure	Director real estate and services
Cure	Board member real estate
Care	Board member
Care	Director
Consultancy	Consultant

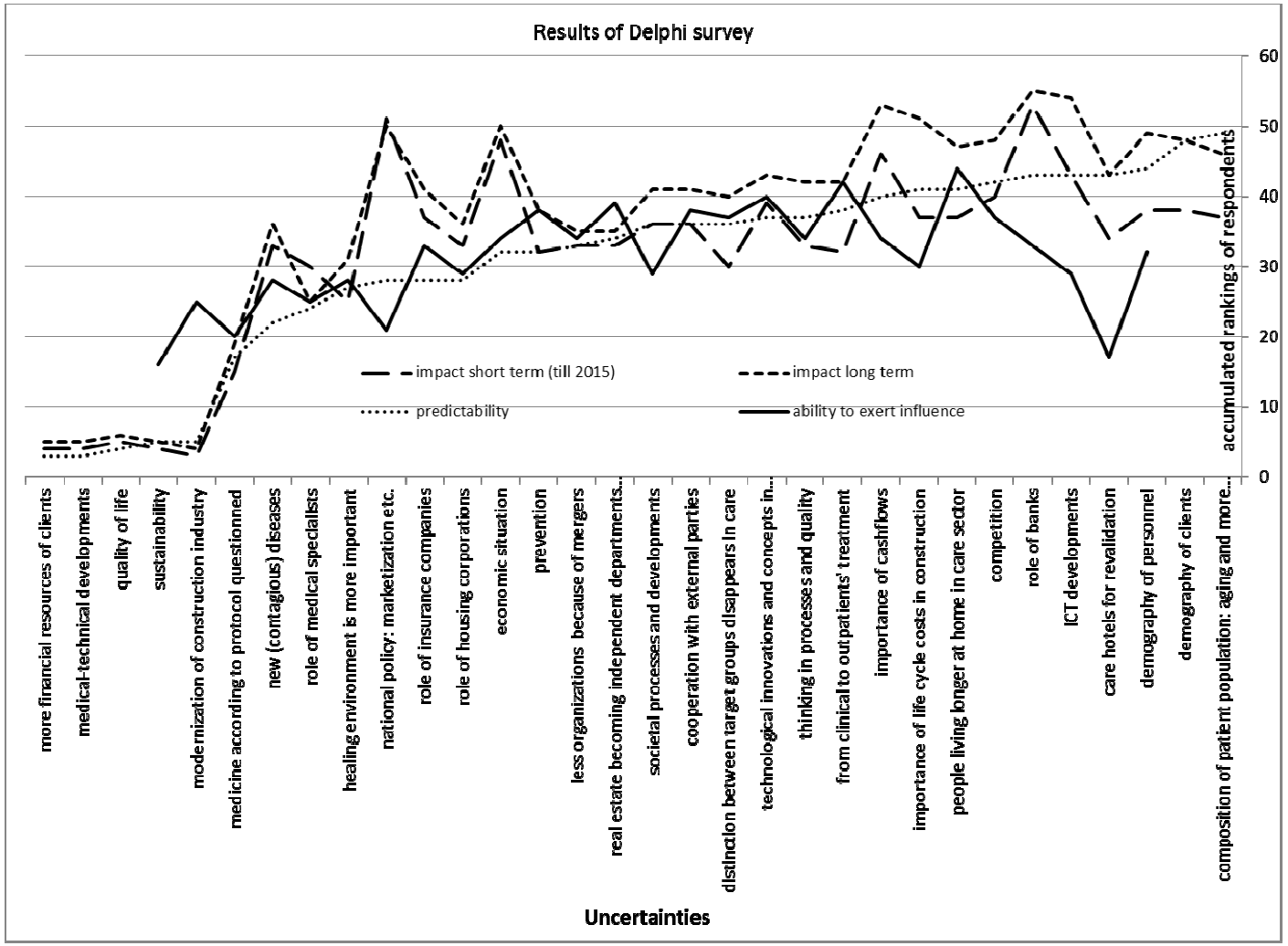


Figure 22
Results of Delphi survey, raking based on predictability of uncertainties according to respondents. N =10

Appendix G Results of statements in pre-workshops interviews with the hospital and forensic clinic

Statements on real options already used and consequences for the primary process posed before workshop 1 and 2 with the hospital and forensic clinic

		Hospital					Forensic clinic	
Statement: Imagine that…	**Question**	**Health manager**	**Technical service**	**Construction coordinator**	**Patient council**	**Controller**	**Project manager**	**Manager service centre**
1. …if financing is not arranged yet then…	…defer the project in the agreement with contractor(s) against certain conditions	3	3	2	3	3	3	2
	…defer without negative consequences for the primary process	1	1	2	4	2	4	5
2. …if it is impossible to obtain finance then…	…abandon the project in the agreement with contractor(s) against certain conditions	3	3	1	3	3	4	4
	…abandon without negative consequences for the primary process	1	1	1	2	2	2	4
3. …if the bank has demands considering the realization of the construction …	… speed up the project in agreement with contractor(s) against certain conditions	4	4	2	3	3	4	4
	… speed up without negative consequences for the primary process	4	5	2	4	4	4	2
4. …if the final design does not meet demands…	…phase the project and implement go-no go breakpoints in the agreement with contractor(s)	5	4	1	4	4	5	4
	…phase the project without negative consequences for the primary process	3	5	-	2	4	4	3

5. …if expansion is necessary in the future…	…extend the building in agreement with contractors	4	4	5	5	4	2	4
	…extend the building without negative consequences for the primary process	2	-	-	5	3	2	4
6. …if nursing departments have to be turned into offices…	…switch functions in the building in agreement with contractor(s) against certain conditions	4	4	5	4	4	4	4
	…switch functions in the building without negative consequences for the primary process	3	4	4	4	5	4	4
	Average answer	3.1	3.5	2.5	3.6	3.4	3,5	3,7

Note. Legend: 1= I totally do not agree, 2 = I do not agree, 3 = neutral, 4 = I agree, 5 = I fully agree

Appendix H Questionnaire before the workshops with the hospital and the forensic clinic

1. What is your function in the organization?
2. Do you know the construction plans of the hospital/forensic clinic?
3. Are you involved in the decision making of the construction plans?
4. Do you know the agreements with contractors?
5. How do you define flexibility in the building and in the construction process? What is it and how do you obtain it?
6. Did one consider in the construction plans the potential necessary adaptations to the building in the future as a result of economic developments?
7. Did one consider in the construction plans the potential necessary adaptations to the building in the future as a result of changes in governmental policy?
8. Did one consider in the construction plans the potential necessary adaptations to the building in the future as a result of technological changes?
9. Did one consider in the construction plans the potential necessary adaptations to the building in the future as a result of demographic trends?
10. Considering the uncertainties that are present in healthcare, how necessary is flexibility?
11. Did one take financial measures to obtain flexibility, like rental contracts and the ability to rent the building?
12. Did one take organizational measures to obtain flexibility, like using spaces in an optimal way?
13. Did one take measures to obtain flexibility in the process, like phasing of the construction process?
14. Did one take measures to obtain flexibility in the building, like access roads and installations?
15. Imagine the following situations and indicate the extent to which you agree with the following statements on the following scale:
    I totally not agree – I don't agree – neutral – I agree – I totally agree
    a. Imaging that if financing is not arranged yet.
        i. It is possible to defer the project in the agreement with contractors against certain conditions. Het is mogelijk om het project uit te stellen in de overeenkomst met opdrachtnemer(s) tegen bepaalde voorwaarden.
        ii. It is possible to defer without negative consequences for the primary process.
    b. Imagine that if it is impossible to obtain finance.
        i. It is possible to abandon the project in the agreement with contractor(s) against certain conditions.

ii. It is possible to abandon without negative consequences for the primary process.

c. Imagine that if the bank has demands considering the realization of the construction.
   i. It is possible to speed up the project in agreement with contractor(s) against certain conditions.
   ii. It is possible to speed up without negative consequences for the primary process.

d. Imagine that if the final design does not meet demands.
   i. It is possible to phase the project and implement go-no go breakpoints in the agreement with contractor(s).
   ii. It is possible to phase the project without negative consequences for the primary process.

e. Imagine that if expansion is necessary in the future.
   i. It is possible to extend the building in agreement with contractors.
   ii. It is possible to extend the building without negative consequences for the primary process.

f. Imagine that if nursing departments have to be turned into offices.
   i. It is possible to switch functions in the building in agreement with contractor(s) against certain conditions.
   ii. It is possible to switch functions in the building without negative consequences for the primary process.

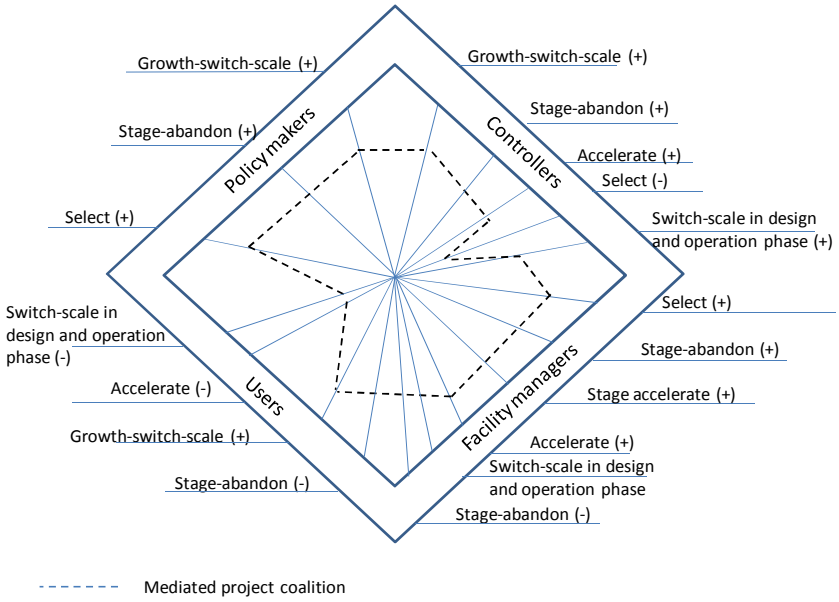
16. Further remarks

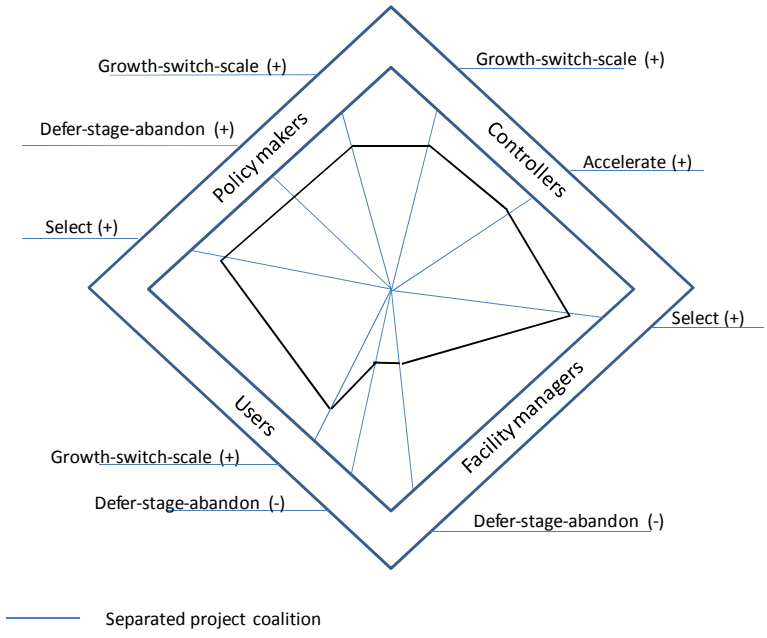
Appendix I Questionnaire before the workshop with the mental and elderly care organization

1. What is your function in the organization?
2. How long do you work in the organization?
3. What are important decisions which currently have to be made with regard to real estate?
4. Can these decisions be made or is information lacking?
5. With which decisions are you involved?
6. Are you acquainted with scenario planning?
7. Which trends (certain developments such as demography) and uncertain developments do you see and what is the unpredictability and impact on the organization? Which actors are important for the organization and how does their behaviour affect the organization? How could this behaviour be changed in the future?
8. If you look five years into the future, what is most uncertain for you?
9. If you could pose three questions to a clairvoyant, what would you ask?
10. If you are the clairvoyant and you answer your own questions and the future will turn in the positive direction that you want, how will you answer your own three questions?
11. If the future turns out negatively, how would you answer your questions?
12. Which important events from the past (good or bad) have to be remembered as lesson for the future?
13. Which important decisions with long term consequences does the organization currently have to make, decisions which have to be taken in the coming months/next year?
14. Which constraints do you experience inside/outside your organization that limit you in your function?
15. If you leave the organization, what do you hope that you will be remembered for?
16. How necessary is flexibility?
17. Who takes the initiative to take measures with regard to flexibility?
18. When are these decisions made? For example in case of a certain event?
19. Who delivers input in these decisions?

20. How do you define flexibility in the building and in the construction process? What is it and how do you obtain it?
21. Did one consider in the construction plans the potential necessary adaptations to the building in the future as a result of economic developments?
22. Did one consider in the construction plans the potential necessary adaptations to the building in the future as a result of changes in governmental policy?
23. Did one consider in the construction plans the potential necessary adaptations to the building in the future as a result of technological changes?
24. Did one consider in the construction plans the potential necessary adaptations to the building in the future as a result of demographic trends?
25. Considering the uncertainties that are present in healthcare, how necessary is flexibility?
26. Did one take financial measures to obtain flexibility, like rental contracts and rentable characteristics of the building?
27. Did one take organizational measures to obtain flexibility, like using spaces in an optimal way?
28. Did one take measures to obtain flexibility in the process, like phasing of the construction process?
29. Did one take measures to obtain flexibility in the building, like access roads and installations?
30. Which options have been applied in the project(s) already?
    - The option to defer
    - The option to abandon
    - The option to speed up
    - The option to select
    - The option to stage
    - The option to scale up or down
    - The option to grow
    - The option to switch function

Appendix J Effects of exercising real options on the various stakeholder - interests in CREM





The figure shows the effects of exercising real options enabled by both the mediated and separated project coalition, when exercising real options and is derived from the two in-depth case studies described in Chapter 4. Legend: the further from the centre, the less negative / more positive the consequences: + = positive effect, - = negative effect.

The figures are based on the table below which is derived from the case studies. Legend: ++ = real option not necessarily consequence of project coalition. + = inherent in type of project coalition.

Taxonomy of options	Type of real options	Real options	Project coalitions		CREM stakeholder - interests
			Separated	Mediated (DBM)	
			Utopia	Manor	
Investment- and disinvestment options	Growth-switch-scale	Retaining or creating enough space	++		Value of the assets might increase, important for controllers. Board has ability to change. Working space of users can be optimized.
	Defer-stage-abandon	Phased procurement and contract with contractors	+		Board can abandon, e.g. if costs rise (financial management), and defer to obtain more information. Uncertainty for personnel and patients. More work and costs for project management.
	Stage-abandon	Contract with management contractor		+	Enables project management to seek other contractor.
	Select	Competitive dialogue procedure in procurement		++	Adapt organizational vision by board and health managers, better project management.
	Select	Invite multiple interior- and landscape architects	++		Obtaining ideas on project by project/facility management and board.
	Select	Designing in parallel	++		In case of uncertainty, the project is less delayed because of this option, which is in favour of the project management. However, costs can be higher which affects the controllers.

Timing options	Accelerate	Definition of points of departure Planning process. Stakeholder management Decision making procedure		++	Project management, including board and financial director, can improve realization. Users have less flexibility to change points of departure.
Contract-ual options	Stage/ accelerate	Construction of skeleton, design of interior		+	Supports project management to speed up the project.
Operatio-nal options	Scale up/-down, switch of functions	Design, Working process		++	Might be negative for users who need to adapt their way of working. Can also be positive in that real estate can be adapted to the way of working. More efficient use of real estate supports controllers and real estate managers.

ABOUT THE AUTHOR

Maartje van Reedt Dortland was born on the 13th of November 1979 in Utrecht. She went to primary schools the 2e Marnix School in Utrecht and the Roelof Veenema School in Amstelveen. She graduated from St. Ignatius Gymnasium, Amsterdam, in 1998. In 1998 Maartje started her academic career at the Wageningen University and Research Centre. In the Tropical Landuse programme she specialised in Irrigation and Water Engineering, and in Agricultural History, graduating in 2006. During an internship, Maartje worked as a researcher for the International Development Enterprise (IDE) in Nepal, doing research about the financing of the treadle pump. For her Master thesis, Maartje worked for the SNV Peru, as a researcher and consultant. Her thesis was about innovations in wateruse, with a Peruvian village in the Andes as case study. For her minor, Maartje worked for the department of Agricultural History, Wageningen University, as a historical archive researcher, doing research about the autonomy and democracy within Water Counsel the Neder-Betuwe, 1840-1920.

After her graduation in 2006, Maartje worked as a program assistant at the Technical Centre for Agricultural and Rural Cooperation (CTA) and subsequently as a junior researcher for the Water Engineering & Management department at the University of Twente, in Enschede, being detached at the Cartesius Institute in Leeuwarden. She was researching innovations for dike flooding strategies within dike region 6. In 2008 Maartje, became a PhD candidate at the department of Construction Management & Engineering at the University of Twente in Enschede.

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Health organizations are facing more and complex uncertainties which influence the provision of healthcare. Real estate facilitates the primary process and therefore has to change accordingly. Corporate Real Estate Management is the discipline that develops strategies that match the current and future demand and supply of real estate.

A means to enable adaptation to uncertainties is flexibility. Real options thinking provides a way to create flexibility proactively. This dissertation explores how real options can be used in decision making regarding strategic real estate management in healthcare.

The relation between types of project coalitions and flexibility is investigated, the applicability of real options thinking in practice, and sensemaking of flexibility by means of a decision support tool with scenario planning and real options thinking.