

Graduation report Master Real Estate and Housing Isabelle Kras | October 2011

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PREFACE

After obtaining my bachelors degree of Architecture, Building and Planning at the Technical University of Eindhoven, this master thesis of the master Real Estate and Housing of the Technical University of Delft is my finishing study project. The master track of Real Estate and Housing consists of three specializations and this research is done within the field of Real Estate Management.

The research topic for this master thesis is sustainability of hospital buildings. Sustainability has gained more and more interest in society and in the building sector. The built environment accounts for 40% of all CO_2 emission in the Netherlands, so sustainable building has become an important issue. Hospitals alone count for 4% of the built environment, hence there is a lot to gain. Therefore it is necessary that hospitals feel the urgency to undertake actions to reduce their CO_2 emissions. The objective of this research is give insight in the definition of sustainability and to demonstrate the added value of sustainable real estate to the primary objectives of hospitals.

I would like to thank Mr. Van der Voordt and Mr. Van den Dobbelsteen from the university and Mr. Sijpestein from Twynstra Gudde for their guidance during the graduation trajectory. For their input for this research I would like to thank all interviewees. Furthermore I want to thank my family and close friends for their support and help during the whole graduation period.

Isabelle Kras, Reeuwijk, October 2011

MANAGEMENT SUMMARY

Sustainability in the healthcare sector seems to be an evident goal. The healthcare sector is a sector that is strongly changing, with trends rapidly following one another. However, sustainability is not really a part of these trends in the hospital sector yet. The objective of this research is to give insight in the definition of sustainability and to show how sustainable real estate can add value to the organization.

To attain this objective the following problem statement is formulated:

- 1. The comprehension of the concept of sustainability is the first problem; management boards find it is too vast a term, knowledge and awareness is not always standby.
- 2. The added value of (sustainable) real estate to the organization is unclear or questioned.

The hypothesis of the study is that a sustainable hospital is а corporate social responsible organization which strives to provide a healing environment that subsequently is facilitated by the building, as shown in figure 0.1.

To research this literature study is done on three fields; hospitals, the added value of real estate and sustainability. Two hospitals that are currently building studied to investigate what hospitals are already doing on sustainability and two best practices in other sectors (office and hotel) are



Figure 0.1 Hypothesis of the definition of sustainable hospital building

studied to explore what hospitals could learn from them.

Literature study shows that whereas the mission of the hospital is simple; to treat incoming patients, the organization of all processes inside the hospital is complex and can be done according many different principles. For this research the functional zoning method is selected. The functional zoning method states that the hospital can be organized according to the different real estate functions; the hot floors (including operating rooms and intensive care), the hotel-function, the office and the factory. This organization makes it possible to compare (parts of) the hospital to the office and the hotel.

The World Commission on Environment and Development defined sustainability as follows: Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987, p.43). This is then worked out in different strategies and tools that make the definition more tangible. The maybe best known strategy is that of Elkington (1998) the triple bottom line: people, planet and profit; which focuses not only on economic prosperity, but also on environmental quality and social justice.

This is further worked out into sustainable aspects by different tools used for sustainable building. A list of these tools and aspects can be found in table 5.6; the selected aspects for sustainable hospital building are shown in figure 0.2. Those aspects can be categorized into people, planet and profit and consequently have different units of measurement and are therefore difficult to compare. When achieving measurements in all different aspects the ultimate sustainable building is realized. Preconditions are formulated by the links between people and planet, planet and profit and profit and people as formulated in the hypothesis, which was underpinned by the interviewees. The organization is corporate social responsible, patients and staff are in a healing environment and investment decisions are made according to the total costs of ownership.



This scheme clarifies the definition by showing on the one hand the relation between the aspects to the different concepts of people, planet and profit and on the other hand the interrelations between the concepts resulting in a sustainable hospital building.

The second problem is answered by researching the literature on both sustainability and added values of real estate. The selected aspects of sustainability are mentioned in figure 0.2. De Vries (2007) demonstrates that real estate contributes to achieving organization's objectives and facilitating organizational performance, in table 4.1. Organizations objectives are productivity, profitability and comparative advantage (or distinctiveness) (Tangen, 2005). Cross analyzing the sustainable aspects and the added values of real estate resulted in table 0.1 and figure 0.3 demonstrating how the sustainable aspects add to the added values of real estate and therefore to the performance criteria of the hospital. Taking the sustainable aspect health as example; this aspect is about comfort; acoustic, visual and thermal and indoor air quality. Achieving good 'health' contributes to the added values increasing user satisfaction, healing environment and supporting user activities. Another example is the aspect of energy which target is to reduce the energy use, therefore contributing to the value decreasing costs (for more explanation see §6.1).

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	Energy					х						
	Water					х						
	Materials					х						Х
Planet	Ecology				х							х
	Waste					х						
	Transport	x				~						х
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Figure 0.3 Relation scheme between sustainable aspects, added values and performance criteria

Figure 0.3 can be used on the one hand for showing how sustainability adds to the organization's performance criteria. On the other hand it can be used for steering on certain sustainable aspects as a derivative of important performance criteria or added value of the organization. In this way the scheme serves as a model for management boards indicating what performance criteria are important, from which sustainable aspects can be derived. It serves for real estate managers to check what sustainable aspects are important and contributes to the added values defined and for the environmental coordinator of the hospital who can show to the real estate manager and management boards why measures within the presented sustainable aspects are important to take (see also figure 9.2 and appendix V-VII).

To make the sustainable aspects defined more tangible, for each sustainable issue the ultimate situation is defined by taking people, planet and profit apart and investigating each concept individually. This resulted in different solution fields for the sustainable aspects as shown in figure 0.4:



The main lessons learned from the cases are that:

- 1. Sustainability is perceived as an umbrella term.
 - Talking about sustainability in practice is often about energy reduction. The planet side of sustainability (energy, water, waste, etc.) is concrete and can easily be translated in measures that are technical and often related to installation systems. Costs and benefits are clear at starting time and decisions on measures are taken based on the payback time of these measures.
- 2. On the other hand healing environment is a more and more accepted and applied theory in hospitals. However, the link with sustainability or the people side of sustainability is not really made.

The idea that the (built) environment influences the well-being of people becomes more accepted and hospitals are acting on this. The more abstract aspects as 'feeling at home', distraction by view outside preferably on nature or the demand for more tranquility are being discussed from the design phase on. The environment can not only contribute to the healing process but also effects staff satisfaction as working circumstances increase.

3. Budget always seem to be the restricting factor to implement sustainable measures.

Decisions on sustainable measures are based on the payback time of these measures. This shows that investment costs are no longer leading and total costs of ownership become more important. Still, if budget needs to be cut, sustainable measures of which the benefits are not directly quantifiable in Euros are often the first to fail.

From the office and hotel sector can be learned that:

4. In both cases labels of internationally recognized assessment tools are used to indicate their ambitions and communicate the level of sustainability reached. Those labels are easy, recognizable communication tools that also permit to compare the degree of sustainability of different buildings. In addition it forces the organization to look at all aspects of sustainability instead of taking for example only energy reducing measures. For hospitals it is not necessary to directly aim at the highest level, but a label is a means to benchmark your own sustainability to other hospitals and can be used as communication tool for image purposes.

Recommendations for practice are therefore:

Make clear at the starting phase what a sustainable hospital is for your organization. By using figure 0.2 or such a picture that demonstrates sustainable aspects it is clear for everyone what is meant with the term.

Determine a sustainable strategy that fits with the overall strategy of the hospital. The model of figure 9.2 forms a good starting point to discuss sustainability with the different stakeholders involved. In this model one can clearly see that performance criteria, added values of real estate and the sustainable aspects are linked to each other. Implementing sustainable measures supporting the strategy of the hospital creates acceptance and makes it therefore easier to actually perform those measures.

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1. INTRODUCTION

The Dutch healthcare sector can be characterized by its dynamics. Demographic developments influence the demand for care. Changes in regulations and political choices influence the financing of treatments and also of real estate. New trends and developments change the thoughts on what is healing and how hospitals should be organized to offer higher quality care in a more efficient way.

My motivation for this research began with my interest in this complex world of hospitals. Hospital buildings house often large and complex organizations with many different stakeholders. Another point of interest lies in the increasing importance attached to sustainability in society. Since the Brundtland report in 1987 sustainability as a term became increasingly important and today the definition of Brundtland: 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs' is the definition everybody uses.

Sustainability is researched by many, mainly in the office and housing sector, for example by Michiel Rogaar (2011), who did his master thesis on 'sustainability in the program of requirements'. In the field of corporate real estate management in hospitals many research has already been done at this university, for example by Emelieke Huisman (2008); 'Van LTHP naar een strategisch huisvestingsdocument'. The main theme of this research is sustainability and the way this can be applied to hospital buildings. Sustainable building, also called healthy building when referring to healing environments, implies that when buildings are sustainable, people can profit or even heal from that. This in contrary with the more defensive approach of the 'sick-building syndrome', which studied how buildings make people sick, that was subject of study in the 1980's.

The aim of this research is to provide insight in what sustainability is and how sustainable real estate can add value to the hospital's primary objectives. This study could therefore be of interest for the management boards as well as for the facility and/or building departments of hospitals.

This resulted in the main question of this report is:

(How) can sustainable real estate contribute to the primary objectives of a hospital?

To answer this question the hospital as organization is researched, as well as trends and developments that influence the hospital building. This is done to understand the context in which hospitals function and to get insight in the complexity of the organization of hospitals. Further literature study is done on the added value of real estate to an organization and on sustainability. The definition of sustainability is studied as well as strategies and tools that determine the ambition or degree of sustainability of buildings. The concepts people, planet and profit that explain sustainability are broken down in tangible parameters for which the ultimate sustainable situation is defined. Starting with this ultimate situation, possible solutions to reach this ultimate situation are set out. These solutions are underpinned by examples in hospitals. Case studies show what hospitals are doing on sustainable building and what hospitals can learn from other sectors.

This is structured as follows in the report that consists of nine chapters:

Chapter two explains the research design, including reason, problem statement and research questions.

Chapter three, four and five describe the context of hospitals and hospital building, literature on added values of real estate and elaborate on sustainability, its definition and strategies and tools used in the Netherlands.

The sixth and seventh chapter reflects on the literature study. Connections between different researches are made and the three concepts of sustainability are applied to the hospital situation. This is the basis for the model that shows the relation between sustainable aspects, added values and performance criteria, but also sets out how the sustainable aspects can be worked out in possible solution fields.

The cases conducted are set out and compared in the eighth chapter: Meander Medical Centre, Isala Klinieken, TNT Green office and Hotel Amstelkwartier. This to clarify what hospitals already do and what they can learn from the office and hotel sector.

The report will finalize with conclusions and recommendations for further research and practice.

2. RESEARCH DESIGN

This chapter sets out the research methodology of this master thesis. First the reason for this subject will be explained. Secondly the problem statement is elaborated and subsequently the research questions are presented. To conclude, the layout of the research and the research method are discussed.

2.1 Reason

The last decade sustainability has gained more and more interest. In 2005 the Kyoto protocol was officially ratified by most countries in the world. By signing, the Netherlands promised to reduce their CO_2 emission by 6% in 2012 compared to 1990. In 2006 Al Gore launched the documentary 'An Inconvenient Truth', to emphasize on the danger of global warming and that acting of people does matter. It made people from over the world more aware of the climate change and the influence they have on it. The Intergovernmental Panel on Climate Change (IPCC) report from 2007 states that human activity is "very likely" to cause most of the global warming of the past half century. In the Netherlands rules concerning energy and environment are made more stringent and on top developments of renewable energy sources like solar panels or windmills are going very fast (Snelderwaard, 2010).

The office sector has already developed sustainable offices for a couple of years. Sustainable real estate appeals to companies as distinguishing factor. In may 2011 a toolkit for sustainable shopping areas was launched, Bart Kuil, director AM Real Estate Development: "Ever more parties are convinced that sustainable retail property becomes a necessary condition in terms of value creation, cost reduction, intensification of laws and regulations and Corporate Social Responsibility." These are also reasons for which hospitals should be ready to emphasize more on sustainable real estate. The urgency for hospitals to implement sustainable measures is still low, but will grow with further developments of sustainability and changing rules and regulations.

The healthcare sector is a sector that is strongly changing, with trends rapidly following one another. However, sustainability doesn't seem to be a part of these trends in the hospital sector (yet). Except for the concept of healing environment, this could be referred to as the people side of sustainability. With the new responsibility hospitals have for their own real estate, there is a lot to gain on the sustainability of hospitals.

2.2 Problem statement

Sustainability in the healthcare sector seems to be an evident goal. On the moment this is however not the case. The following problem statements are thus identified:

- 1. The comprehension of the concept of sustainability is the first problem. Management boards find it is too vast a term; knowledge and awareness is not always standby.
 - Many definitions and aspects can be given to sustainability, but because of the varying perception, coherence between the different aspects is not recognized. The easiest aspect is that of energy reduction. Technical measures give direct improvements and profits can easily be calculated. More difficult is to translate the people side of sustainability in concrete measures, not only because it often cannot immediately be translated in Euros.

2. The added value of sustainable real estate to the organization is unclear or questioned.

Only since a few years hospitals recognize the value of real estate for their organization. It is not only seen as cost anymore but as resource that contributes to efficient management of the hospital's organization. In the complex decision making process sustainability is considered less important and shifts to the background.

2.3 Research objectives

Following from these problem statements two objectives are identified:

- 1. The objective for the first problem is to give easily insight in what a sustainable hospital is.
- 2. The second objective is to demonstrate how sustainable real estate can add value to the organization's primary objectives and thus get sustainability back on the agenda.

In a traditional hospital building process the building design is a result of the functional program of requirements. A new trend, seen in the hospitals that are currently being built, is attention for the well being of users in the design rather than just for pure functionality. This research will show that besides the healing environment approach sustainability will also add to the well being of the people visiting and working in the hospital and to the healing process of patients.

2.4 Hypothesis

The hypothesis for this study is:

The definition of a sustainable hospital is a hospital with a corporate social responsible organization which strives to provide a healing environment which is subsequently facilitated by the building.

This hypothesis is illustrated by the model of figure 2.1 where the themes are placed within the triangle of people, planet and profit of Elkington (1998). In this model Corporate Social Responsibility (CSR) links both profit and people, healing environment represents the link between people and planet and the building is the link between profit and planet. The model represents the main topics of this research, as well as the assumed relation between the different topics. Currently in many hospital organizations the relation between building and organization is not always clear (Fritzsche et al, 2004). The expectation is that a sustainable building adds value to the core business of a hospital which is curing.



Figure 2.1 Sustainable hospital building

2.5 Research questions

This is expressed in the main question for this report:

How can sustainable real estate contribute to the primary objectives of a hospital?

The subject is sustainable hospital real estate. The goal of the research is to set out the added value of sustainable real estate to the primary objectives of the hospital. The different research fields are:

- Hospital (real estate)
- Sustainability

To answer this question, sub questions were formulated in the above mentioned two clusters and their combination:

A) Sustainability

- 1. What is the definition of sustainability?
- 2. What aspects of sustainability are important in the context of hospital buildings?

This cluster will be answered trough literature research and will define the range of themes included in the definition of sustainable hospital buildings.

B) Hospital Real Estate

- 3. What are the current trends and developments in the hospital sector?
- 4. Does sustainability play a role?
- 5. How does real estate add value to the organizations primary objectives?

In this cluster the current trends and developments in the healthcare sector will be described. This will involve the trends that influence the hospital buildings, but also trends that influence the primary objectives of a hospital and therefore can influence decisions on real estate. Healing environment and the functional zoning method will be discussed. The question whether sustainability plays a role will be answered by means of case study research, reading annual reports and interviewing the real estate manager of the hospital. The real estate questions will mainly be answered through the literature research on the added values of real estate to the organization.

C) Sustainable hospital buildings

- 6. What is a sustainable hospital building?
- 7. How does sustainability add to the primary objectives of an organization?
- 8. Do hospitals steer on sustainable real estate?
- 9. Which aspects influence the decision making process on sustainable measures for hospital's real estate?

This final cluster connects the two clusters before and is therefore the most important cluster of this research. First the definition of a sustainable hospital is researched. Secondly, by cross-analyzing the literature on sustainability, hospitals and real estate the

added value of sustainability is set out. The last two questions of the cluster are answered within the case studies.

2.6 Relevance

2.6.1 Scientific relevance

There is a lot of literature on sustainable buildings but this mainly concerns housing or offices. There is not much research done on sustainability of hospitals, while there is a lot to gain in this sector. There are only few initiatives that promote the health of people and the environment, such as the international coalition of hospitals and other healthcare related organizations, like Health Care Without Harm. In Sweden the Sustainable Healthcare brings together leading Swedish companies on the field of sustainable health for the reason that: "cleaner environment equals more healthy human beings". Sustainable HealthCare is a joint Swedish initiative which aim is to promote economically affordable solutions that contribute to the health and well-being of the patients and staff, while decreasing the environmental load from hospital operations (www.sustainablehospitals.se). These initiatives show that there is a demand for a more sustainable health care sector, but I did not find scientific research that shows the contribution of sustainable real estate to the primary objectives of the healthcare sector or the hospital. This research will provide a basis to fill the gap in the existing literature on sustainability and added values of real estate.

2.6.2 Social relevance

The above mentioned initiatives also show that the awareness of the importance of sustainability is growing in the healthcare sector. Yet there are only few known initiatives and in the Netherlands there are even less initiators or participants to such initiatives. Sustainable thinking is not yet integrally incorporated in the process of managing hospitals in the Netherlands. This research will show hospitals what can be done to improve the sustainability of their real estate.

2.7 Research method

This research starts with the principle that a sustainable hospital building begins with a Corporate Social Responsible organization that strives to provide a healing environment which is subsequently facilitated by the building. The current situation on sustainability and hospital buildings is described by literature in chapter 3, 4 and 5. The literature study will be completed in a reflection on the different subjects studied and will result in a model that shows the added value of sustainability to the primary objectives of the organization.

In the seventh chapter three concepts are explored more in detail. The three concepts are broken down in parameters for which ultimate situations are described. The sustainable aspects that are involved in these descriptions of the ultimate situation are then set forth in measurement units and possible solutions. This results in possible solution fields per sustainable aspect which are integrated in the model.

The case studies are used to analyze the current situation; what are important sustainable issues in hospitals now and what is the difference with other sectors? Two cases will be on hospitals currently building a new hospital and that have studied sustainability as a part of the building project. The other two cases are a hotel; hotel Amstelkwartier that has the ambition to become the most sustainable hotel in Europe, and an office, TNT Green Office Hoofddorp. TNT Green Office is an office with GreenCalc

1000, LEED Platinum and is CO_2 emission free. These two cases are chosen as best practices from other sectors similar to some functions in the hospital (hotel for the wards, and office for the policlinic and staff functions) from which hospitals can learn. The case studies consist of interviews with stakeholders and studying documents concerning the case.



Figure 2.2 Research method

3. HOSPITAL CHARACTERISTICS

In this chapter the basic characteristics of the Dutch hospital system are explained. Topics discussed are the difference between hospitals, the organization of the different processes within the hospital, the consequences for real estate and the newest trends and developments that influences real estate decisions.

Hospitals are complex buildings; when it comes to logistics hospitals are comparable to railway stations, airports and shopping malls. A hospital is a world on its own with huge numbers of patients, staff and visitors that visit the hospital every day. How complex the organization is, the main function in hospitals is simple: to examine, treat and nurse people (patients) that come to the hospital. In a few words: to cure and care. This function can be expressed in different ways as hospitals do when visions on the care they deliver are formulated.

Examples of visions of hospitals are:

- Provide easily accessible, high quality care within an environment where patients feel at home. *Groene Hart Ziekenhuis, 2011*
- We promise our patients/clients top-clinical high quality hospital care. *Reinier de Graaf Groep, 2011*
- Provide excellent care with dedication and have high valued knowledge transmission and knowledge development. *Erasmus MC, 2011*
- Being the specialist specific for your eyes, without neglecting your human feelings. *Oogziekenhuis Rotterdam, 2011*

These are visions of different types of hospitals. Three types of hospitals are distinguished in the Netherlands (www.cbs.nl, numbers of 2009):

- 1. Basic hospitals (78 hospitals)
- 2. Academic hospitals (8 hospitals)
- 3. Categorical hospitals (25 hospitals)

There is also a fourth group of hospitals that is not recognized by the CBS as separate group. These are 27 "teaching hospitals" which are united in an association of cooperating top clinical teaching hospitals (Samenwerkende Topklinische opleidingsZiekenhuizen). Their common mission is to provide high quality patient care, top clinical treatment and top referral care. Top clinical treatments are very specialized treatments like open heart surgery where as top referral care is care for patients which need complex treatments like neurosurgery or oncologic surgery (www.stzziekenhuizen.nl). The basic hospitals are hospitals which generally perform the most common medical treatments. Academic hospitals differ from top clinical hospitals in the sense that academic hospitals are linked to universities; they are therefore also often called University Medical Centers. This includes that education and more fundamental research play a role in these hospitals. Categorical hospitals are hospitals which are specialized in one type of care, for example, children's hospitals, or the hospital for the eyes in Rotterdam.

3.1 Hospital organization

Hospitals can be organized according to different principles depending on the vision of the hospital about how the care should be organized. Roughly three types of organization of activities can be distinguished; organization on the basis of the care process;

organization on the different types of care and organization based on target groups or diseases (CBZ, 2002):

3.1.1 Organization on care process

Twynstra Gudde made a snapshot of the processes identifying four stages: intake, diagnostics, treat and aftercare. The stage of intake is all about planning and preparing the appointment with the patient. Diagnostics is about examining the patient, setting a diagnose and informing the patient. Treatment is about medication and if necessary surgery and aftercare is about informing the patient on his treatment and helping him or her to reintegrate in daily life after hospitalization.

Veldhoen + Company defined for Orbis Medisch Centrum six activities after their analysis of the hospital's working processes (Derix, 2002). The different processes are: researching; talking; treating; nursing; knowing; supporting. These are then translated directly into 'centers' that are needed in the hospital: A centre for screening and diagnostics, a centre for consultation, a treating centre, a nursing centre, a knowledge and expertise centre and a logistics centre whereby the last two are considered as the backbone of the first four.

3.1.2 Organization on type of care

Another way of organizing the hospital is based on the path patients take through the hospital. This type or organization starts from the idea that each route is different in terms of atmosphere, organization, planning, position of professionals etc. Four courses are defined; acute, urgent, elective and chronic care course (CBZ, 2002). Acute care is a small department for people in life threatening situations. In the urgent care division there is time between entry and treatment to prepare for the patient and its care. Elective care can be planned, because there can be a period of days or even weeks between notification and treatment. Chronic care requires a long term relation with the patient wherefore much attention is paid to inform and guide the patient.

3.1.3 Organization on target groups or diseases

This model is based on a distinction between care units. Different specialties are grouped together according to target groups; patients with similar diseases. The themes are: brains and senses; oncology; immunity, metabolism and aging; acute care and musculoskeletal system; circulation, growth, development and reproduction. These six are subsequently represented in the surgery rooms, intensive care, clinics, daycare and policlinics. This type or organization differs per hospital whereas not every hospital provides in all specialties.

The categorization of activities, as described above, can be seen as a translation of the organization's vision on care and directly influences the accommodation of the organization. In addition to above mentioned organizational forms, a categorization according to different functions of real estate can be made.

For this research another way to organize a hospital is chosen; the underneath explained functional zoning method. This method is based on the real estate component of hospitals and is developed as a tool for hospitals for taking investment decisions. This method makes a distinction between four different types of real estate, amongst others the office and hotel, which makes it easy to compare the hospital to office and hotel

buildings. From the point of view of sustainability a lot can be learned from hotels and offices which makes the functional zoning method an interesting organizational method.

3.1.4 Functional zoning method

In 2007, the so-called 'Bouwcollege' presented a new method to take well-balanced investment decisions, in the report 'Gebouwdifferentiatie van een ziekenhuis' (CBZ, 2007). The report answers to the changing context hospital managers find themselves in. The business setting where real estate needs to contribute to efficient management demands new strategies for hospital's real estate. The best strategy for real estate is however hard to define. If the real estate fits the hospital perfectly at one time, square meters are well used and the structure contributes to the businesses processes. But, even modest growth or shrinkage or change in organizational structure leads to often difficult and expensive building adjustments. On the other hand, an oversized space and standardized, modular design lead to high operating costs. To find the most favorable solution, future developments of the organization should be taken into account and translated in requirements for the accommodation. A tool to help hospital managers to make investment decisions is the functional zoning method.

The functional zoning method is based on the principle that a hospital building can be divided in four accommodation typologies, in Dutch called 'schillen'. The reason behind this grouping of functions with the same characteristics is that real estate can be arranged most advantageously. Parts of the real estate can be realized conform market, which makes the hospital less expensive to construct and more flexible. In times that a part has become redundant, it can be sold or let more easily.

The method indicates different buildings or building zones (CBZ, 2007):

- 1. The 'hot floor', this zone includes the high-tech, capital-intensive functions specific to a hospital.
- 2. The hotel-function, where all functions are positioned for the stay of patients.
- 3. The office, here consultation hours take place as well as simple examinations and treatments. This is also the place for office facilities as staff accommodation, administration and management.
- 4. The last zone is that of the 'factory', here the medical facilities and support functions are housed.

All four 'zones' score different on specificity, investment costs, growth and shrinking capacity and marketability of the real estate. The research of Bouwcollege gives with this new method insight in how the different parts of a hospital can be managed differently.

Having described the organization of hospitals, the next paragraph describes trends and developments in the hospital sector, as well as their consequences for real estate.

3.2 Developments and consequences

The edition of December 2010 of the magazine Zorgvisie was devoted to special trends in the hospital sector. A brief summary of those trends are summed up in table 3.1 with the consequences these developments have on patients and their behavior, but also on hospital organizations and processes. The consequences for real estate are provided in the same scheme and are elaborated in the paragraphs 3.2.1 till 3.2.4 except for the CREM theory which will be explained in chapter 4.

Developments	Consequence	Consequence for real estate
ICT developments	Empowerment of patients Implementation of the new world of work e-Health/EPD (Electronisch Patienten dossier)	Efficiency; less m ² working space and archive needed
Specialization of hospitals	Changing accessibility (in terms of distance and costs) Medical tourism Upcoming of private clinics	Changing demand; more scattered specialized hospitals for small groups
Aging and increase of chronic diseases	Changing and increasing demand for care	Changing demand for real estate; accessibility for large specialized groups
Medical-technical innovations	More efficient care supply	Flexibility of real estate to accommodate new equipment
Patient oriented care	Integrated care ('ketenzorg') Customized care	More importance is attached to architecture and design; upcoming of Planetree and healing environment
All of the above	Increase of costs in care sector	CREM theory is more and more applied within hospitals.

Table 3.1 Trends and their consequences. Source: Zorgvisie, special trends, december 2010 & Visie ZIP; inspiratie voor innovatie, juni 2009

3.2.1 Changing demand of real estate

As can be seen in table 3.1 specialization of hospitals as well as the aging and increase of chronic care required, results in changing demand for real estate. To respond to those changes the question rises if all functions have to be housed in one specific hospital accommodation, or that other solutions can be found. This can be answered along two lines; functions that have to be accommodated conform market conditions or according to hospital specific settings and functions that have to be concentrated or more spread (Fritzsche et al, 2005). Concentration of functions contributes to effectiveness and flexibility. For functions where approachability is important, dispersion is better. In general, elective care, capital intensive care and specialized care should be more concentrated. For urgent care, basic care and care for large target groups, decentralization seems to be evident (Fritzsche et al, 2005). Currently can be seen that hospitals become specialized in fewer treatments and refrain from offering all treatments. This also results in cooperation's between different hospitals to guarantee the quality of the care given.

3.2.2 Flexibility

The care sector is a sector with a continuous process of changes because of innovations in medical atmosphere or changing demographics, changing perception on care etc. This demands flexible real estate, this flexibility ensures the value of the real estate over the long term. Six forms of flexibility are distinguished as summed in table 3.2:

	Meaning	Effect
User flexibility	Change of function of a space without	m ² reduction
	need for adjustments	Optimization of use
Functional	Easy change of functions of rooms	Accommodation of unequal growth
flexibility	because of standardization	and shrink of activities
Adjustment	Layout of grid and outside walls make it	Accommodation of changes in
flexibility	possible to change inner walls/spaces	demand for space because of
		innovations
Expansion	Building structure that eases expansion	Accommodation of organizational
flexibility	with an extra floor or building section	growth
Volume	Is created by the possibility of	Accommodation of organizations
flexibility	compartmentalization of buildings	shrinkage
Financial	Is about the level of real estate costs in	Accommodation of economic
flexibility	relation to the total operating costs and	developments
	about the terms and conditions of the	
	rental and leasing contracts	

Table 3.2 Forms of flexibility of real estate. Source: Fritzsche et al, 2005.

Other developments reflect the more or less recent insights in the influence of the surrounding on the patients. For example the theories of 'Planetree' and healing environment gained interest in the Netherlands. Hospitals started thinking about the positive influence their building and surroundings can have on the patients, staff and visitors. Both theories are explained in the next paragraphs.

3.2.3 Planetree

Besides specific requirements to the building, people attach great importance to the atmosphere in hospitals. Angelica Thieriot started 'Planetree'; a care-concept based on bringing the best care to patients and at the same time creating a place where staff is motivated and inspired. The concept of Planetree stands for highly valued, people oriented care in a healing environment with a healthy organization. Angelica Thieriot herself was treated in a hospital and came out with the firm intention to change the way patients are treated in hospitals. The operation succeeded, but the business-like manner of care she got during the stay in the hospital shocked her; there was little personal attention or attention for social and emotional needs.

Main topics that need attention according to Mrs. Thieriot are (Frampton et al, 2009):

- The need for aesthetic surrounding, particularly an environment which contains elements of nature.
- The importance of good, human contact, continue care and participation of family.
- The essential interest of empowerment, human dignity and control.

The devotion to people-centred care is divided in three core values; better care, healing environment and sound organization (Frampton et al, 2009):

Better care

- 1. Human interaction and loving treatment
- 2. Own choice and responsibility through information and education
- 3. Outstanding treatment and care
- 4. Healthy food, drinks and move
- 5. Additional care and meaning

Healing environment

6. Humane technology

- 7. Architecture and interior contribute to health and healing
- 8. Friends, family and community share positive role

Healthy organization

- 9. Satisfied customers
- 10. Satisfied and motivated employees
- 11. Healthy financial results
- 12. Good market position and relations with stakeholders.

3.2.4 Healing environment

Functionality and effectiveness dominated the design and arrangement of healthcare buildings for a long time. Nowadays thinking about hospital buildings shifted to creating an environment with positive effects on the patients (CBZ, 2008). Well-designed facilities may increase positive emotions, which in turn could positively affect patient's health and well-being. Dijkstra (2009) researches physical environmental stimuli that turn healthcare facilities into healing environments. Dijkstra quotes Stichler (2001) that the concept of healing environments suggests that 'the physical healthcare environment can make a difference in how quickly the patient recovers from or adapts to specific acute and chronic conditions.'

The physical healthcare environment is comprised of ambient, architectural and interior design features (Harris et al., 2002 in Dijkstra, 2009). Ambient features include for example lighting, noise levels, odors and temperature. Architectural features are the relatively permanent aspects of the physical healthcare environment, such as the spatial layout of the hospital, size and shape of the rooms and the placement of windows. Interior design features can be defined as less permanent aspects of the healthcare environment such as furnishings, colors, interior plants and artwork.

Except for Planetree other theories and researches define different elements that are comprised in the concept of healing environment. For example TNO Zorg en Bouw developed a tool to measure the positive effects of the care environment called OAZIS. This stands for (in Dutch) Onderzoek Aantrekkelijkheid Zorgomgevingen door middel van de Impact Scan (research attractiveness of care environments through the impact scan). The tool comprises of environmental variables with a scientifically proven positive effect on people in terms of recovery, well-being and satisfaction are combined in eight themes. It provides insight in the performance of an existing building or a single department and takes into account the positive effects of the different environmental variables (www.tno.nl).

Karin Dijkstra researched the perception of the hospital buildings and distinguished several spatial qualities that are part of the concept of healing environment. Dijkstra (in Mens, 2009, p32) also researched the influence of environmental factors on the healing process. Malkin (in Wagenaar 2006, p.259) divides the concept of healing environment in five fields of research of which the common thread is the reduction of stress.

All elements of the different tools and researches can roughly be divided in 4 categories as illustrated in table 3.3:

	Planetree	OAZIS	Dijkstra	Dijkstra	Malkin
View		Windows and view Nature	View Green Color	Daylight Windows and view Nature	Connection to nature Positive distractions
Comfort	Humane technology	Comfort and control Facilities and service Interior	Acoustics Waiting Boredom	Climate Odor	Environmental stressors (noise, glare, poor air quality)
Social support	Friends and family	Staff	Empowerment Social support		Access to social support Options and choices
Building	Architecture and interior contribute to health and healing	Privacy and autonomy Orientation and routing	Reception Orientation and routing Materials Privacy	Type of rooms Arrangement interior	

Table 3.3 Theories of healing environment. Based on Planetree, OAZIS, Dijkstra and Malkin

3.3 Conclusion

This chapter began with the function of the hospital and showed how different hospitals translated it into visions. The vision of the Groene Hart Ziekenhuis is for this research the most appealing: In the vision is referred in a straight way to the environment of patients (an environment where patients feel at home), stating thus that the environment is of importance for patients and their healing process. This is underpinned by different literature studies on healing environment such as Planetree. All different studies recognize the importance of nature to the healing process. As a result the healing environment links people and planet confirming the hypothesis.

Further on is elaborated on the developments within the Dutch healthcare sector. These developments are diversified and are constantly, independently, changing: Demographics, politics and technical innovations all influence the hospital sector and thus the requirements on hospital buildings. It became clear that to hold up to this changing demand, flexibility is key word. What is currently seen is that on a large scale adjustment flexibility is applied in hospitals.

With the functional zoning method other types of flexibility are made possible by building parts of the hospital conform market. Due to standardization of wards and office space and policlinics functional flexibility in those areas is enlarged. The functional zoning method also permits to compare the different parts of a hospital to other types of buildings, such as offices and hotels. This is of interest for the further research on sustainability, because especially in the office sector there is a lot of expertise in sustainable building.

4. REAL ESTATE MANAGEMENT

The trends and developments presented in the chapter before have consequences for the real estate management of hospitals. The role of real estate was only facilitating; management was mainly done on operational level. Especially the altered legislation on responsibility for hospital real estate changed this way of thinking of hospital managers. Next to operational management, the tactical and strategic management of real estate became important. This shift in management strategies is described in the first paragraph, in the second the added value of real estate is elaborated.

4.1 Corporate Real Estate Management

"The objective of Corporate Real Estate Management (CREM) is to attune corporate accommodation to organizational performance, adding value to corporate objectives and indirectly generating income" (De Jonge 1994 in De Jonge et al 2009, p10). So real estate not only has to meet the organization's financial, functional and technical requirements, but also has to contribute to the overall performance of the organization. Decisions on real estate should therefore always incorporate the interests of all stakeholders. Because of its contribution to the overall performance, real estate becomes the fifth, interdependent resource of an organization next to human resources, information and communication, capital and technology (Joroff 1993 in De Vries, 2007). Real estate management is organized by level (strategic or operational) and by focus (business or real estate). CREM is then about finding a match between business and real estate, connecting the strategic and operational level. De Jonge (et al, 2009) translated these four perspectives into four domains, or four different stakeholders, each steering on a different way on real estate as shown in figure 4.1.



Figure 4.1 Strategic real estate model (based on Suyker, 1996 in Te Hoonte et al, 2009 and in Den Heijer 2011).

The responsibilities for real estate are divided over the four roles, although in practice they are not directly transferable to different functions, they form a nice framework to become aware of the different functions and responsibilities (Te Hoonte et al, 2009).

4.2 Added value of real estate

As resource of the organization real estate can be managed to add value (contribute) to the core business of the organization. The challenge is that real estate is static and high cost intensive whereas it has to match with dynamic demand. Because real estate cannot be isolated from the other organizational resources, interrelationships with the other resources always need to be taken into account. When for example the organizational structure changes, this has consequences for the human resources (fewer employees), but also for the floor plan, and thus real estate.

De Vries (2007) identified ten added values based on literature that contribute to achieving an organization's objectives and facilitating organizational performance. Organizational objectives differ and are divided into productivity, profitability and comparative advantage or distinctiveness, which together form the performance of an organization. Tangen (2005) concludes that performance is a composed variable that consists of the relation between input and output (productivity); the yields thus realized (profitability) and the comparative advantage of an organization, the non-costs factors such as quality or satisfaction (distinctiveness).

Performance criteria	Productivity	Profitability	Distinctiveness
Added values			
1. Reduce costs		Х	
2. Increase productivity			Х
3. Enhance flexibility		Х	
4. Improve culture			Х
5. Control risks		Х	
6. Expand funding possibilities		Х	
7. Support image			Х
8. Stimulate innovation	Х		
9. Increase satisfaction	Х		
10. Enhancing synergy	Х		

Table 4.1 Added values of real estate. Source: De Vries, 2007.

These ten added values are applicable on all kinds of organizations. Huisman (2008) included another value, specific for hospitals, which is healing environment. This comprises aspects as perception (experience), color and light, as described in paragraph 3.2. Den Heijer (2011) changed some 'original' added values and added two new ones after her data analysis. The ones that have a different definition or name are controlling risk, increasing real estate value (replacing expand funding possibilities) and supporting user activities (replacing increase productivity). These thirteen ways to add value are described below (based on De Vries, 2007, Huisman, 2008, Van der Voordt and Van der Zwart, 2011 and Den Heijer, 2011). For nine added values Boelens (2009) defined real estate interventions that translate the added values in concrete interventions:

1. Reducing costs by saving on investment and operational costs, additional costs and transport costs of the real estate. The costs of real estate of hospitals account for about 12% of the total costs, whereas human resources are the largest expense of a hospital, about 60% of the total costs are for staff. However, hospitals are currently researching for example energy saving options, or applying functional zoning to the new buildings to reduce costs per square meter.

Real estate intervention: By efficient organization (shared use of space), by taking into account maintenance and energy cost in investment decisions and with flexibility to ensure a future proof building.

2. Increasing productivity by using real estate to work more efficiently. Den Heijer (2011) changed this into supporting user activities, meaning to optimally support the activities of users aimed at increasing the production. For hospitals one could think of efficiency of logistics; shorter walking distances makes staff work more efficient, or of collaboration between hospitals which enlarges the production capacity.

Real estate intervention: Efficient floor plan which realizes short walking distances and a clustering of activities. Increase of the hospital's population area by opening local polyclinics.

3. Enhancing flexibility can be achieved by technical, organizational and/or spatial measures to make it possible to use the real estate in different ways or at different times. Technical flexibility is about the ability of the construction and of technical installations to adapt to reorganization of (floor plans of) buildings. The organizational flexibility concerns the multiple use of available working space. In hospitals one could also think of broadening the opening hours to use more efficient the available space. Spatial flexibility is for example about intensification of the density of buildings. A hospital-specific example is the functional zoning that makes the less specific buildings more courant.

Real estate intervention: Anticipating on expansion by building on or around the existing hospital and on shrinkage by disposal or letting of building components

4. Improving culture by using the real estate as a means to strengthen the way of contact within the organization. Although culture is for the most part a matter of shared values and behavioral rules, culture can be supported by real estate. Most often hospital managers try to improve the culture by creating more open and informal meeting facilities in order to stimulate communication.

Real estate intervention: Stimulating integration of culture through new office concepts or an entirely new environment.

5. Controlling risks by choosing for different forms of ownership (rent, lease, buy). Controlling risk in this research is about controlling technical and financial risks by lowering the chance of production loss. This is done by monitoring the technical conditions to make sure that the primary process is not hindered (Den Heijer, 2011).

Real estate intervention: Is about making the building future proof with flexibility and possibilities for developments around the building and also about choosing for maintenance free solutions and sustainable energy sources.

6. Expanding funding possibilities by attracting debt capital and improving the solvability and liquidity of the organization. Den Heijer (2011) changed this into increasing real estate value; to increase the potential market value of land and buildings by making it suitable for paying users and rentable to third parties. *Real estate intervention: Making the building better marketable by choice for*

Real estate intervention: Making the building better marketable by choice for location and standardization to be potentially let to third parties.

7. Supporting image by using the real estate as physical image to attract positive attention to the organization. Using real estate as marketing tool is one of the eldest ways to add value to the organization. Positioning of the building and facade are the most obvious means to influence the image of an organization, but also interior; human scale, routing, use of colors, arrangement of waiting areas etc. influence the image of a hospital.

Real estate intervention: Creating own image by consciously choosing a certain material or color.

8. Stimulating innovation by creating possibilities to collaborate and work in an innovative manner. Creative thinking, needed for innovation, can be facilitated by places that support exchange of knowledge and stimulate new ideas. Most hospitals create meeting places such as knowledge or study centers.

Real estate intervention: By creating room for contact between employees.

9. Increasing satisfaction by realizing or maintaining an agreeable workplace where staff enjoys working and patients and visitors don't mind staying. Satisfaction of patients has much to do with the medical skills of staff, but the environment can be supportive for example by creating an attractive and functional environment and/or optimally facilitating medical care processes.

Real estate intervention: Attractive surrounding by using natural elements, easy accessibility of the hospital determined by the location, realizing stress reduction by clear routing and privacy with one-person bedrooms.

- 10. Enhancing synergy or stimulating collaboration by enabling meetings between different users or user groups.
- 11. Healing environment. This has to do with the satisfaction of patients and staff as states Van der Voordt and Van der Zwart, but healing environment puts the physical experience of the building central. Accessibility, routing, 'feeling at home', connection to nature and access to social support are some of the aspects that play an important role in the theory of healing environment. The objective is that because patients feel at ease, they recover more quickly with use of less calming medicines. This results in increase of productivity.

Besides those values, Den Heijer identified two new values:

- 12. Reducing footprint, which can be interpreted both as to have less floor area or to reduce the carbon footprint. Reducing the footprint adds to the profitability goals by decreasing costs as well as to sustainability goals. This one is added because many university campuses have explicit strategy on 'greening the campus' and to use less floor area.
- 13. Improving quality of place in the context of the global competition for knowledge workers, universities want to improve the quality to satisfy the users and thus add to competitive advantage.

The changed and new added values are researched within the context of universities and are therefore not one-to-one applicable on other sectors such as the care sector.

Next to productivity, profitability and distinctiveness (competitive advantage) Den Heijer (2011) added in her research into university campuses another key performance criteria;

sustainable development. Sustainable development has become more important, since many universities have campus strategies with the goal to use, manage or own less floor area. The campus of the future is for many universities smaller than the current campus, adding to the profitability performance by reducing costs. At the same time, reducing the footprint can also add to sustainability goals. Because energy reduction can be an explicit real estate goal of technical interventions of buildings, reducing footprint is added explicitly to the list of added values of real estate (see figure 4.4).



Figure 4.3 Added values of real estate. Source: Den Heijer, 2011.

Van der Voordt and Van der Zwart (2011) investigated prioritizing of the added values for hospital organizations. This is different according to the vision of the hospital, position in real estate life cycle and the local context. However, the study on ten hospitals in the Netherlands shows some interesting clustering of added values that are more or less important. These clusters seem to be connected to the triplet of people, process and place (Duffy 1992, in Van der Voordt and Van der Zwart 2011). The top three of added values prioritized by the respondents is: stimulating innovation, improving satisfaction and supporting culture, which is all about the people management side of a hospital's organization. The next three are reducing costs, increasing productivity and enhancing flexibility. These values contribute to the (production) process of the healthcare organization. The last three values are supporting image, controlling risk and improve financing possibilities. These are more directly related to the real estate portfolio; so more to the concept of place.



Figure 4.4 Example of ranking of added values by respondents. Source: Van der Voordt and Van der Zwart, 2011

4.3 Conclusion

This chapter elaborated on the theory of real estate management explaining the four different perspectives and the added value of real estate to an organization. Real estate decision making should always incorporate the interests of the four different stakeholders (managers, controllers, technical managers and users). These interests should then be weighed over time as a result of ever changing demand and obsolescence of supply.

Different researches are done on the added values of real estate:

De Vries (2007)	Huisman (2008)	Den Heijer (2011)
Reduce costs		Decreasing costs
Increase productivity		Supporting user activities
Enhance flexibility		Increasing flexibility
Improve culture		Supporting culture
Control risks		Controlling risks
Expand funding possibilities		Increasing real estate value
Support image		Supporting image
Stimulate innovation		Stimulating innovation
Increase satisfaction		Increasing user satisfaction
Enhancing synergy		Stimulating collaboration
	Healing environment	Improving quality of place
		Reducing footprint

Table 4.3 Added values

In the research of Den Heijer the new value of improving quality of place comes close to the term of healing environment. However, the objective of both is different: improving quality of place adds to the distinctiveness of an organization. Healing environment is not only about quality as comparative advantage but adds to the productivity of an organization because of the influence of the environment on the healing process. This is reason for hospitals to apply this theory to practice in the hospitals.

The value reducing footprint as explicit goal adding to the performance criteria sustainable development is not so much recognized in the hospital sector as it is for university campuses. 'Greening the hospital' or using less floor area is not an explicit
strategy in many hospitals as it is in many universities. Therefore the last value of Den Heijer is not comprised in the list of added values of real estate adding to the hospital's organization performance. The amount of floor area or building size is however an important aspect that influences the sustainability of a building and is therefore kept in mind in further research.

5. SUSTAINABILITY

This chapter examines different strategies on sustainability, like the triple bottom line, Cradle to Cradle or the three-stepped strategy. Different tools are then discussed and compared, finishing with the strategies and tools specific for hospitals

The worldwide accepted definition of sustainability is the definition from the report 'Our common future' written by the World Commission on Environment and Development (WCED), also known as the Brundtland report: *Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs* (WCED, 1987, p.43). Sustainable development is about the need to integrate economic and ecological views in the decision making process. Conclusion of the WECD therefore was that sustainable development requires a new mindset on political, economical, social, industrial and technical fields.

5.1 Sustainable strategies for organizations

5.1.1 Triple bottom line

"The challenge is to develop a sustainable global economy: an economy that the planet is capable of supporting indefinitely" because "society depends on the economy – and the economy depends on the global ecosystem, whose health represents the ultimate bottom line" (Elkington, 1998, p. 71,73). The triple bottom line focuses not only on economic prosperity, but also on environmental quality and social justice. These bottom lines are made visual in figure 5.1.



Figure 5.1 and 5.2 Three bottom lines. Source: Elkington, 1998

Between those three bottom lines (social, economical and environmental) Elkington defined 'shear zones' (shown in figure 5.2):

- The economic/environmental shear zone is referred to as eco-efficiency. Ecoefficiency is where companies try to reduce the damage they make to the environment; in other words to do less bad. This is a first step towards ecoeffectiveness as Braungart and McDonough (2002) describe in their book Cradle to Cradle.
- The social/environmental shear zone or the environmental justice. Questions are about how to justify the influence of products on the wellbeing of people and nature.
- The last shear zone is between the social and the economical bottom line; business ethics. Issues here are for example unemployment and minority rights.

5.1.2 Corporate Social Responsibility

A widely used term for companies that not only focus on profit, but also on the impact of their business on society and the environment is Corporate Social Responsibility (CSR). The World Business Council for Sustainable Development (WBCSD) defines CSR as: "The continuing commitment by business to behave ethically and contribute to economic

development while improving the quality of life of the workforce and their families as well as of the local community and society at large" (www.wbcsd.org). The work of the WBCSD is based on the idea that a coherent corporate social responsibility strategy offers clear business benefits. It is based on three pillars; economic growth (economy or profit), ecological balance (ecology or planet) and social progress (equity or people). In other words the corporation takes the responsibility for effects of the business activities on human, environment and business. The company makes conscious choices to balance the effects on people, planet and profit.

5.1.3 Triple top line

The triple bottom line, but also CSR strategies can be used by companies to connect their economic goals to the environmental and social requirements. According to Braungart and McDonough in their article 'Beyond the triple bottom line', many companies apply such strategies to minimize environmental and social liabilities. Instead of minimizing the negative effects of their products or processes, Braungart and McDonough advocate that companies should rather work in a positive way on sustainability. Therefore, the definition of product quality should be rethought from the beginning; the Figure 5.3 Fractal triangle of ecology, design. For that reason, Braungart and McDonough developed a visual tool, the fractal



economy and equity. Source: www.mbdc.com

triangle that wants to meet the triple top line instead of the triple bottom line. "Intelligent design, rather than balancing economy, ecology and equity can employ their dynamic interplay to create business opportunities and maximize value in each of the three broad areas" (article from www.mbdc.com). By maximizing the value of products or processes in this way, a new quality standard is introduced. One which integrates ecological intelligence, social justice and creativity with widely used criteria such as costs, performance and aesthetics.

5.2 Sustainable strategies for products (buildings)

5.2.1 Cradle to Cradle

Cradle to Cradle is the integral philosophy of the above mentioned triple top line. The outline of Cradle to Cradle goes beyond "the traditional goal of reducing the negative impacts of commerce (eco-efficiency), to a new paradigm of increasing its positive impacts (eco-effectiveness)" (www.mbcd.com). This point of view is taken from nature, where the cherry tree is taken as example. The tree makes an abundance of beautiful blossoms and fruit without depleting its environment. In fact the tree produces more of its 'product' than it needs for its own survival. This is where the Cradle to Cradle thinking stands for; designing products that can recover continuously and be reutilized. Three basic 'rules' of Cradle to Cradle are (Braungart, 2007):

- 1. Waste equals food. Eliminate the concept of waste. The challenge is to design products with life cycles that are safe for human as well as the environment. Products or all different components of products should be perpetually reusable.
- 2. Power with renewable energy. Maximize the use of renewable energy, use the current solar income.

3. Celebrate diversity. Respect human and natural systems. Respecting diversity of design is about thinking about the production of a product, but also about how it should be used and by whom. A product that is Cradle to Cradle should be suitable for many target groups and in many different ways.

This begins by recognizing that all sustainability has a local basis and that a total redesign of all production processes is needed.

5.2.2 Three-stepped strategy

An example of a strategy that has an outcome of 'doing less bad' and is widely used is the three-stepped strategy (Trias Ecologica). This strategy considers a building or even a neighborhood as an object and aims to minimize wisely what goes in the object. This strategy contains three steps. The intention is to first implement as many measures as possible for the first step before implementing measures of the second step and eventually use step three for the residual demand. Once installed, one should avoid what goes out and wisely deal with waste. The principle is that the first step is the most sustainable and the third relatively the least sustainable.

IN	OUT
Limit the demand; avoid unnecessary use	Prevent waste
Use sustainable or endless sources	Recycle waste
Use finite sources wisely	Process (other) waste wisely

Table 5.1 Trias ecologica or three-stepped strategy. Source: http://www.senternovem.nl

To change this strategy into a strategy of 'doing good', Van den Dobbelsteen (2008) has redefined the three-stepped strategy ('the New Stepped Strategy') in a more ecoeffective manner by banishing the third step and naming recycling more explicit:

- 1. Reduce the demand
- 2. Reuse residual flows
- 3. Use sustainable sources & let waste be food

5.3 Tools for sustainable building

There is a large diversity of assessment tools for sustainable building all over the world. Below the most important tools used in the Netherlands will be described; BREEAM, LEED, some smaller Dutch labels including GreenCalc, GPR Gebouw and the DCBA method. The first one described, ISO 14001, addresses purely environmental management aspects and could be considered as a basic tool.

ISO 14001:2004 is an internationally accepted norm which provides requirements for environmental management systems. This tool enables organizations to identify and control the environmental impact of their activities, products or services; to improve its environmental performance continually and to implement a systematic approach to setting environmental objectives and targets. The intention of ISO 14001 is to provide a framework for a holistic approach to the organization's environmental policy, plans and actions. Focus points are (www.iso14000.nl):

- To comply with the laws and regulations for environmental issues and to control the risks of their activities on the environment.
- To strive for constant improvement of the environmental performance of the organization.

This environmental management system monitors structurally the company's emissions, waste, used raw materials, energy and other environmental aspects. This gives concrete insight in achievement of environmental targets. In this way the environmental impact of the company can be controlled and diminished. This can reduce the costs on for example energy, the company can be certified and promote itself with that to its environment.

5.3.1 Ambition tool

The DCBA method is a tool for setting (sustainable) ambitions and can be used in the first phases of the building process. The method gives four levels of ambition wherein a wide range of sustainable measures can be categorized. From measures applicable in the initiation phase to measures applicable in the program of requirements. It can also be used during the whole process to discuss concretely the ambitions of the project. The four levels of ambition are:

- D The normal situation, no attention to sustainable development;
- C Correct the normal consumption, where sustainable development is of concern;
- B Limit the damage to a minimum, with sustainable development as the basis;
- A Absolutely the best choice for the specific theme, where maximum sustainability for that theme is achieved.

Themes for classification of sustainability domains are:

Table 5.2 DCBA categories of sustainability. Source: Teeuw (2010)

5.3.2 Life Cycle Analysis (LCA) based tools

GreenCalc is a tool that measures the environmental impact of a building during its whole life time (construction, use and demolition). GreenCalc includes three categories; material, water and energy which are translated in an environment index. The environment index calculation is based on the LCA of materials, the energy performance coefficient (EPC) and the water performance coefficient. The index is determined by comparing the environmental impact of the building to a reference building. This tool is also used within the Dutch BREEAM, especially on material use (www.greencalc.com).

GPR Gebouw is a software tool originally developed by W/E adviseurs and the municipality of Tilburg. This is a tool that quantifies the environmental impact and the design quality for new buildings as well as for the refurbishment of existing buildings. After entering the data, the performance of the building is laid down in different categories:

Energy: based on EPC	User value: Accessibility, functionality, technical quality and social safety
Environment: Water, environmental care and materials	Future value: Future oriented facilities, flexibility and experience value
Health: Noise, air quality, thermal comfort and lighting and visual comfort	

Table 5.3 Categories GPR gebouw. Source: www.gprgebouw.nl

5.3.3 Assessment tools

BREEAM (Building Research Establishment's Environmental Assessment Method) is a British multi-criteria tool, internationally recognized for sustainable assessment of buildings. The Dutch Green Building Council, an independent organization that develops assessment and accreditation tools for buildings and urban areas, translated BREEAM to the Dutch situation and called it BREEAM-NL. It includes a standard for sustainable building and indicates the performance of a building. The tool can be used to analyze and improve the sustainability of buildings; it can be used in the design phase of new buildings or to assess existing buildings (www.dgbc.nl).

BREEAM covers ten categories of sustainability including the main issues per category described in table 5.4:

Management (12%)	Materials (12.5%)				
Commissioning	 Embodied life cycle impact of materials 				
Construction site impacts	Materials re-use				
Security	Responsible sourcing				
	Robustness				
Health and wellbeing (15%)	Waste (7.5%)				
Daylight	Construction waste				
Occupant thermal comfort	Recycled aggregates				
Acoustics	Recycling facilities				
 Indoor air and water quality 					
Lightning					
Energy (19%)	Land use and ecology (10%)				
CO ₂ emissions	Site selection				
 Low or zero carbon Technologies 	 Protection of ecological features 				
Energy sub metering	 Mitigation/enhancement of ecological 				
 Energy efficient building systems 	value				
Transport (8%)	Pollution (10%)				
 Public transport network connectivity 	Refrigerant use and leakage				
 Pedestrian and cyclist facilities 	Flood risk				
Access to amenities	• NO _x emissions				
 Travel plans and information 	Watercourse pollution				
	 External light and noise pollution 				
Water (6%)	Innovation (in UK) (10%)				
Water consumption	 Exemplary performance levels 				
Leak detection	Use of BREEAM Accredited Professionals				
 Water re-use and recycling 	 New technologies and building 				
	processes				

Table 5.4 BREEAM categories. Source: www.breeam.org

Each category accounts for a certain percentage of the final score, for example water accounts for 6%. To rank the building each category is given credits and counts in the final score according to the fixed weight as displayed in the table. Except for the innovation credits which provide additional recognition for a building that innovates in the field of sustainable performance, above and beyond the level that is currently recognized and rewarded within standard BREEAM issues. Innovation credits therefore enable clients and design teams to boost their building's BREEAM performance.

The last category; innovation, is not implemented in the Netherlands yet, but is already in use in the United Kingdom. The Dutch BREEAM is also still in development as regard to existing buildings. For the moment there is only an assessment tool for new build offices, retail, schools and plants. According to the Dutch BREEAM it is not yet possible to measure a hospital's sustainability, in the UK there is already a special edition for healthcare facilities.

LEED can be seen as the American equivalent of BREEAM. LEED stands for Leadership in Energy and Environment Design and is based on the British BREEAM. LEED is developed by the United States Green Building Council (USGBC) to transform the way buildings are designed, build and managed to a more sustainable approach. LEED is voluntary and can be applied to any building type and at any building lifecycle phase. The program measures sustainability in a whole-building approach recognizing building performance in the following areas (www.usgbc.org):

- Sustainable sites, this category is about discouragement of development on previously undeveloped land and minimizing the impact of buildings on ecosystems and waterways.
- Water efficiency, this category is to encourage smarter use of water.
- Energy and atmosphere is about promoting different energy strategies such as the use of renewable and clean sources of energy.
- Materials and resources promote the reduction of waste as well as the selection of materials that are sustainably grown, harvested and produced.
- Indoor environmental quality is about improving indoor air quality as well as access to daylight and improving acoustics.
- Awareness and education is about educating real estate users to understand what sustainability is and how to act sustainable in the use of their real estate.
- Innovation in design provides bonus points to projects which building's performance is much better than required by LEED by using innovative technologies and strategies.
- Regional priority is about locally important environmental concerns in the United States.

Assessment tools developed in the Netherlands are also used in the market; Agentschap NL recognizes different tools to assess buildings:

- 1. Groenverklaring. This is a certificate in which the government declares that the project meets the requirements to receive 'green' financing. This document refers to measures that should be taken on energy, flexibility, polluting sources, water saving measures, sustainable produced wood and Corporate Social Responsibility (agentschap.nl). The certificate has to be requested before the demolition or renovation has begun.
- 2. EPC (energy performance coefficient) is a calculation model based on the technical characteristics of a building which states the energy efficiency of the building in a coefficient. To be a sustainable building, the building should perform 70% better than required in 1995.
- 3. Energy index; this is an index of the energy quality of a building. The index is the calculated energy use divided by the acceptable standard consumption. This results in an energy label for buildings.
- 4. Environmental law. This is not really a tool, but a minimal requirement put into force by the government. This law is about the protection of the environment with goals like having less gas emissions, better waste management and a policy of encouraging the use of 'green' energy.

5.4 Sustainable hospitals

Besides the more general strategies and tools for sustainable organizations or products, below described strategies and tools are specified to the healthcare sector and especially hospitals.

5.4.1 Towards a carbon neutral hospital

Simon Shaw describes in Guenther (2008, p. 378) a range of strategies to reduce the carbon footprint in his essay 'Towards a carbon neutral hospital'. The following categories are a blueprint for carbon neutral hospitals according to Shaw:

- 1. Minimizing energy demand is the highest priority towards a carbon neutral hospital. Factors that contribute to building energy efficiency:
 - Siting and planning

- \circ Solar and wind orientation
- $\circ \quad \text{Density of site development}$
- External envelope
 - Reduce heat losses and gains by high-performance, thermally resistant and airtight building
 - Employ envelope to maximize natural daylight and generate heat or even power.
- Internal environment
 - Analyzing environmental needs could lead to more efficient control of systems
- 2. Generation of energy (energy sources)
- 3. Material efficiency
 - Embodied energy
- 4. Transport strategy
 - Technological improvements
 - Proximity to public transportation
- 5. Food strategy
 - Production and transport
 - Local and seasonal food
- 6. Waste strategy
 - Avoid material consumption
 - Re-use
 - Recycling
 - Proper disposal
- 7. Carbon offsets
 - Reducing emission or increasing carbon absorption

Some strategies have long history in healthcare, like waste reduction, but for carbon neutrality the work is just beginning. Success requires coordination at greater scale than just the hospital among users, policy makers and educators. Success relies on effective technologies and trained professionals who understand how to employ energy efficiency measures and renewable resources in a cost-effective manner (Guenter, 2008, p. 386).

5.4.2 Health Care Without Harm

Health Care Without Harm (HCWH) is an international organization with as mission to "transform the healthcare sector worldwide, without compromising patient safety or care, so that it is ecologically sustainable and no longer a source of harm to public health and the environment" (www.noharm.org). Together with the World Health Organization HCWH wrote a discussion draft called Healthy Hospitals, Healthy Planet, Healthy People; addressing climate change in healthcare settings. They present seven elements of a climate-friendly hospital (WHO, 2009):

- 1. Energy efficiency: Reduce hospital energy consumption and costs through efficiency and conservation measures.
- 2. Green building design: Built hospitals that are responsive to local climate conditions and optimized for reduced energy and resource demands.
- 3. Alternative energy generation: Produce and/or consume clean, renewable energy onsite to ensure reliable and resilient operation
- 4. Transportation: Use alternative fuels for hospital vehicle fleets; encourage walking and cycling to the facility; promote staff, patient and community use of public

transport; site healthcare buildings to minimize the need for staff and patient transportation.

- 5. Food: Provide sustainable grown local food for staff and patients.
- 6. Waste: Reduce, re-use, recycle and compost; employ alternatives to waste incineration.
- 7. Water: Conserve water; avoid bottled water when safe alternatives exist.

5.4.3 Environmental thermometer

In the Netherlands the association for environmental care in the healthcare (in Dutch Vereniging Milieu Platform Zorgsector, MPZ) exists since 1994. This association pursues actively environmental improvements in the care sector and the protection of environmental interests of institutions, staff and patients. Together with the foundation ecolabel (Stichting Milieukeur, SMK) an 'environmental thermometer' is developed. This thermometer consists of a set of criteria for the facility operations on which the institution can work in order to get a bronze, silver or gold certificate. The golden level is linked to the national ecolabel (keurmerk Milieukeur), which gives the healthcare organization a manageable instrument to improve the environmental performance structurally and to make this tangible to staff, patients, visitors and other stakeholders. The criteria cover a wide range of subjects of which some are mandatory and others optional. How higher the ranking, the more optional criteria have to be met. The subjects are:

Environmental policy and management Waste Procurement policy Energy Hinder Renovation/construction Water Hazardous substances Green management Waste water Catering Paper Soil Cleaning Textile Plastics Air Transport

Table 5.5 Sustainable aspects of the environmental thermometer

This environmental thermometer provides a clear overview of the relevant processes and helps institutions to determine the targets for the own environmental policy to carry out efforts that have been done.

5.5 Conclusion

The overall definition of sustainability is that of the Brundtland report: *Development that meets the needs of the present without compromising the ability of future generations to meet their own needs* (WCED, 1987, p.43). This definition can be interpreted in different ways. Each sustainable strategy or tool mentions different sustainable issues. This makes the definition more tangible and manageable, but also more confusing. Table 5.6 illustrates the aspects mentioned by the above described assessment tools and theories on sustainability. From this list of sustainability aspects the final list of aspects is selected for further study. This selection will be explained as well as the precise definition used in this research of each aspect. This results in the picture of figure 5.4.

	DCBA method	GreenCalc	GPR Gebouw	BREEAM	LEED	Carbon neutral hospital (Shaw)	Climate friendly hospital (HCWH)	Environmental thermometer	
Health	Х		Х	Х	Х				
User value	Х		Х						People
Awareness	Х				Х				
Energy	Х	Х	х	х	Х	Х	Х	Х	
Water	Х	Х	Х	Х	Х		Х	Х	
Materials	Х	Х	Х	Х	Х	Х		Х	Dlanet
Ecology	Х		Х	Х	Х			Х	Flatiet
Waste	Х			Х	Х	Х	Х	Х	
Transport	Х			Х		Х	Х	Х	
Future value			х						Profit
Food						Х	Х	Х	
Carbon offsets						Х			
Cleaning								Х	Facility
Policy and								Х	
management									

Table 5.6 Comparison of sustainable tools or strategies

A few things stand out looking at table 5.6 comparing the different tools and strategies on sustainability:

- The fist is that none of the hospital focused tools mention people oriented aspects.
- Most tools have planet aspects as focal point.
- There is only one aspect mentioned by one tool that encounters the profit aspect.
- All hospital focused tools mention facility management aspects such as food or cleaning, which are not recognized by the general tools.

It has become clear that a (sustainable) hospital organization has to deal with many different factors. This research focuses on sustainable hospital buildings and will therefore focus on the sustainable aspects that are applicable or related to the hospital building. The aspects awareness, food, cleaning and policy and management are left out because these aspects have more to do with facility management and/or the use of the building than with the accommodation itself. This doesn't mean that these values are not important, but this research focuses on sustainable hospital buildings and not so much on the sustainability of processes inside. The aspect carbon offsets is left out because this is represented in other aspects, it can be influenced by changing energy use, waste etc.

A short explanation of the remaining aspects mentioned in table 5.6 follows:

People

• Health, this aspect is about the well-being of the users and visitors of the hospital. Determinants are indoor air quality and comfort (acoustics, climate, lighting and visual).

• User value is about the accessibility inside the building for wheelchairs, the functionality of the building, technical quality (maintenance level) and social safety of the users.

Planet

- Energy. The strategy that can be used to reduce the energy use is the threestepped strategy, or even more sustainable the 'new-stepped strategy'. This is to reduce the demand, reuse residual flows and use sustainable sources and let waste be food.
- Water, reducing the use of water can be done according the new-stepped strategy.
- Materials. For materials, next to the new-stepped strategy, the life cycle assessment (LCA) can be used to determine the impact of the materials used on the environment, the choice for materials should then be based on their LCA score. The ultimate situation here is to develop products that are Cradle to Cradle.
- Waste, the same strategy as for energy, water and materials can be used for waste: the new-stepped strategy. In the Cradle to Cradle strategy this issue will expire because waste no longer exists.
- Ecology is mainly about site selection and planning and therefore about keeping intact, or minimizing the impact on existing ecological systems. Site selection is about encouraging the choice for used land (brown fields) over previously undeveloped land (green fields).
- Transport has to do with the accessibility of the building. Goal of this aspect is to reduce the emission of CO_2 and particulates by reducing the motorized traffic. The location of the hospital is the most important; the proximity to public modes of transport, but also accessibility by bicycle are key factors.

Profit

• Future value is about the adaptability of the building to future uses. The lifespan of the building, technical and functional, has to be maximized to ensure future economic value. This translates in searching engineering solutions for longevity of the building, and in different forms of flexibility, from functional flexibility to volume flexibility (paragraph 3.2.2).

One aspect that is not mentioned explicitly in the tools is the first step of the threestepped strategy; reduce the (building) demand. Reducing the demand for square meters (building size) saves costs and lowers materials and energy use. This is the most farreaching method of sustainable building; by using space more efficient, square meters can be reduced.

All the aspects mentioned above contribute to the sustainability of a hospital building. This is illustrated in figure 5.4. The figure shows clearly that the concept is threefold and that the aspects of each concept have different units of measurement which are therefore difficult to compare.



Figure 5.4 Aspects of sustainable hospital building

A sustainable hospital building can be accomplished by taking into account all different aspects within the people, planet and profit concepts. The interrelations are the framework for a sustainable hospital building. The hospital organization has to be Corporate Social Responsible, taking into account the requirements of the staff as well as the balance sheet of the hospital. For patients the hospital envisages a healing environment, for the patients to feel more at ease valuing nature. Last but not least investment decisions are taken based on Total Costs of Ownership, taking into account operational and maintenance costs in decisions on sustainable measures on planet aspects.

6. ADDED VALUE OF SUSTAINABLE REAL ESTATE

The three previous chapters described three different topics, the hospital, real estate and sustainability. In this chapter the link between real estate and sustainability is made by demonstrating how sustainability contributes to the added value of real estate and through that to the performance criteria of the hospital. The reflections and relations made in this chapter will be used to analyze the cases and to draw final conclusions. In the first paragraph the relation between the added value of real estate and the different sustainable aspects is explored. The second paragraph demonstrates the relation between the sustainable aspects and the performance criteria. The last paragraph shows how sustainability fits into the different CREM perspectives.

6.1 Added value and sustainability

The main question in this research is how sustainable real estate can add value to the primary objectives of a hospital. In the previous chapters different sustainable aspects are defined as well as added values of real estate. Interesting now is to see how these two interrelate; which sustainable aspects can contribute to the added values of real estate and thus to the primary objectives of the hospital.

Table 6.1 shows the selection of sustainable aspects in relation to the added values found in literature. The table is constructed by laying the added values and the sustainable aspects next to each other and marking the aspects that have a relation. To explain the relations shown in table 6.1 the sustainable aspects will be described one by one. In figure 6.1 further on, the relation between the different aspects is made visual.

Added values of real estate Sustainable aspects	Decreasing costs	Supporting user activities	Increasing flexibility	Supporting culture	Controlling risks	Increasing real estate value	Supporting image	Stimulating innovation	Increasing user satisfaction	Stimulating collaboration	Healing environment
Health		Х							Х		Х
User value		х			X		Х		х		Х
Energy	Х										
Water	Х										
Materials	Х						Х				
Ecology							х				х
Waste	Х										
Transport							Х		Х		
Future value	Х		Х		Х	Х					
Building size	х										

Table 6.1 Linking sustainable aspects to the added values of real estate

The table has to be read in the way that sustainable aspects can contribute to one or more added values of real estate:

People

- Health contributes most directly to the added value healing environment, the comfort aspects are the same as for the sustainable aspect health. These aspects also contribute to increasing user satisfaction because of better conditions. It is this same comfort that adds to increases of productivity by lowering the percentage of ill staff.
- User value consists of four features; functionality, technical quality, accessibility and social safety. User value therefore contributes to supporting user activities, by paying attention to the functionality of the building. The technical quality adds to controlling risks by maintaining a high maintenance level. The accessibility within the building and social safety adds to increasing user satisfaction and also to the healing environment. These features support the image of the hospital as good, agreeable hospital because people are at ease in the building.

Supporting culture, stimulating innovation and stimulating collaboration are the three added values that are people related, but these are not matched with health or user value. The explanation given to these added values has to do with creating possibilities to meet as to stimulate collaboration, innovation and communication; therefore it is not part of the sustainable aspect health.

Planet

- Energy, water and waste all contribute to reducing costs. By reducing energy use, water use and the amount of waste, cost reduction is realized. These sustainable aspects are quite specific and do not influence the use of the building in any sense, consequently they cannot be matched to other added values.
- Materials add to supporting image, because the facade and interior give a first impression to visitors of the hospital. The choice for materials also influences the costs; different building materials have different prices and maintenance costs. Materials that last longer or that can be reused are less expensive in operating costs and as result add also to the value of decreasing costs.
- Ecology can also add to supporting image tanks to the site's surrounding nature. It is this same surrounding that can add to the value of healing environment where nature is of great importance.
- Transport adds to the value of increasing satisfaction when transportation facilities are good.

Profit

• Taking into account the future value of a hospital adds to the value increasing flexibility; flexibility is one of the features of future value. Future value also adds to decreasing costs; the longer the building has value the more profit the owner can make out of it instead of amortizing and demolishing the building. Controlling risks is about monitoring technical and financial improvements to ensure continuance of the primary process, consequently future value adds to this. Increasing real estate value is about making the building suitable for third parties. Taking into account future value is also about suitability of the building for future, other uses and thus also for other users.

• Reducing the building size add to cost reduction as doing the same work on less square meters saves costs.

The relations are made visual in figure 6.1. In this scheme it is immediately clear that three added values of real estate are not translated into sustainable measures. These are; supporting culture, stimulating innovation and stimulating collaboration. Noticeable is that these three are user orientated values. They state that the building can change or influence the behavior of its users. Use of the building is not part of this research and therefore these added values are excluded from further research.



Figure 6.1 Relation between sustainable aspects and added values of real estate

The scheme visualizes how sustainable aspects add to the added value of real estate. The model can also be used the other way around. Hospital managers can select important real estate values and conclude from there which sustainable aspects support those values.

6.2 Performance criteria and sustainability

Ranking the added values together as did De Vries (2007) to the performance criteria productivity, profitability and distinctiveness depict which sustainable aspects lead to the organizational goals productivity, profitability or distinctiveness as shown in table 6.2.

	Added values of real estate	Increasing user satisfaction	Healing environment	Decreasing costs	Increasing flexibility	Controlling risks	Increasing real estate value	Supporting user activities	Supporting image
People	Health	Х	х					Х	
	User value	Х	Х			Х		X	X
	Energy			Х					
	Water			х					
Dianot	Materials			Х					x
Flatiet	Ecology		х						Х
	Waste			Х					
	Transport	Х							х
Drofit	Future value			Х	Х	Х	Х		
FIOIIL	Building size			х					
	Performance criteria	Produ	ctivity	I	Profit	ability	/	Distinct	iveness

Table 6.2 Linking sustainable aspect to performance criteria

Several things stand out in table 6.2:

- The aspect user value adds to all three performance criteria.
- Future value, a profit aspect adds to all added values contributing to the profitability of the organization
- Four planet aspects contribute only by the value decreasing costs

Integrated in the model it looks like in figure 6.2. The model is made to show that sustainable aspects do add to the performance criteria. The sustainable aspects contribute to one or more added values, according table 6.1 and through these added values contribute to the performance criteria of the hospital, demonstrated in table 6.2.



Figure 6.2 Relation scheme sustainable aspects, added values of real estate and performance criteria

For example the sustainable aspects health, in hospitals extremely important for the well-being of patients. In figure 6.3 one can see that health contributes to the added values increasing user satisfaction, healing environment and supporting user activities. Through those added values it contributes to the performance criteria productivity and distinctiveness of the hospital.



Figure 6.3 Example how to use the model beginning with the sustainable aspects

The model can also be used the other way around. The real estate manager will begin with the added values of real estate, the ones that are important for the project and deduct from these values what sustainable aspects add to those values. For example the value of healing environment, as shown in figure 6.4, for hospitals of high importance,

adds to the productivity of the hospital, sustainable aspects corresponding to this value are ecology, health and user value.



Figure 6.4 Example how to use the model beginning with the added values of real estate

The last way to use the model is to start with the important performance criteria of the hospital. In this example distinctiveness is chosen. This leads to the added values supporting user activities and supporting image; sustainable aspects that strengthen the distinctiveness of the hospital are ecology, health, user value and materials.



Figure 6.5 Example how to use the model beginning with the performance criteria

In chapter seven the sustainable aspects are researched more in detail. This results in the addition of more concrete solution fields to the model.

6.3 CREM and sustainability

This paragraph shows the relation between the different roles in an organization defined by CREM and the sustainable aspects.



Figure 6.6 Sustainability aspects divided over CREM domains

The scheme above shows the responsibilities for the different sustainable aspects of each domain in the CREM model. It is clear that the general manager is responsible for the overall picture and process, in the case of the hospital that is care. The sustainable aspect that matches is health, which can also be seen as the people side of sustainability. The real estate manager is responsible for the financial and feasibility analysis, the profit side of sustainability. Future value and efficiency are therefore the sustainable aspects that fall under the responsibility of the real estate manager. Finally the facility manager, responsible for the daily management of the hospital, is responsible for the energy, water and material consumption as well as the waste management and transport to the hospital. All these characteristics can be grouped under the planet side of sustainability. When a new building needs to be build, the project manager comes in the picture. The most important sustainability aspects for him are ecology (site selection) and the materials used for building.

All sustainable elements or requirements of the different managers play an important role in the building process. Because the responsibilities lie with different persons, the alignment and decision process on sustainability is therefore not evident.

7. CONCEPTS FOR A SUSTAINABLE HOSPITAL

The report has elaborated on the definition of sustainability and on how it can add value to the core objectives of an organization. In this chapter the question how to obtain a sustainable hospital is researched in a more practical manner. To do this sustainability is broken down in the three concepts; people, planet and profit. This report started to state the hypothesis of this study: A sustainable hospital is a Corporate Social Responsible organization which strives to provide a healing environment that is accommodated by the building (see figure 2.1). In this chapter each concept of people, planet and profit is researched individually.

Each concept is expressed in important parameters for those concepts. For example a parameter of people is patients. For every parameter the relation to added values of real estate and sustainable aspects is made to be able to define the ultimate situation for each parameter. For each ultimate situation units of measurement are identified, the current situation is mapped out and this results in list of possible solutions to attain the ultimate sustainable hospital.

7.1 People

From literature is known that the most important stakeholders in a hospital are the patients, the staff and the visitors. To complete the list of stakeholders the whole society, in which the hospital is embedded, is also taken into account. These are represented in the different rows of table 7.1.

PEOPLE	Added values of RE	Sustainable issues	Ultimate situation
Patients	Healing environment Increasing user satisfaction	Health User value Ecology Transport	Building contributes to healing process (high quality, safe and functional building) Support ecological systems Good accessibility
Staff	Supporting user activities Increasing user satisfaction	Health User value Transport	Environment stimulates staff
Visitors	Increasing user satisfaction	Health User value Transport	Agreeable entrance and stay Good accessibility
Society	Healing environment Supporting image Increasing user satisfaction	Health User value Ecology Materials Transport <i>Connectivity</i>	Hospital as integral part of the city Cradle to Cradle

Table 7.1 Ultimate sustainable situation from the 'people' perspective

In the table becomes clear that health, user value and healing environment are important issues. The ultimate situation from the perspective of the patient is that the building contributes to the healing process. This is influenced by orientation and routing (way-finding) in the building, decision making should therefore take place in the design phase of the building process. The balance between on the one hand privacy and other hand boredom is important. This results in the current discussions about single versus more-bed bedrooms. The decisions in the design phase can reduce the stressors and improve the tranquility in order to contribute to the healing process. Distraction in the form of view, art or access to social support is a point of attention that has less to do with architectural solutions.

For staff architectural features are also important as they influence their daily working environment. For example outside view, to distinguish at least day and night is very important for the individual's biorhythm. Just mentioned orientation and also view outside are very important for one's health and thus productivity. On the other hand, transport to the hospital, accessibility, is important for staff satisfaction.

For visitors the same accounts as for patients and staff as far as the accessibility and the orientation and routing.

The society as a whole however has other expectations. Sustainability has gained more and more interest, it is conceivable that society expects the hospital to be role model in this field. This means that the ultimate situation is a technical totally sustainable hospital (Cradle to Cradle), which contributes to the healing process of its patients and is an integral part of the city. As Caro van Dijk (Interview, 8 April 2011) said; hospitals are often very large buildings on a big surface, which are experienced as inaccessible obstacles in the city. Solutions proposed are to place more public functions in the hospital or hospital area such as a restaurant or educational functions. Therefore the sustainable issue connectivity, defined in the model of Paul de Ruiter architecten is added to the list of sustainable issues for society.

7.1.1 Possible solutions

Sustainable solutions are described in table 7.2:

Ultimate situation	Measured by	Current situation	Possible solutions
Building contribute to healing process (high quality, safe and functional building) Environment stimulates staff	Satisfaction surveys among patients % illness of staff	'satisfied'* Absence rate of 4,7 in 2009**	View; comfort; social support; spatial layout.
Support ecological systems	Existing ecological systems	Use of new green fields	Site selection and planning
Good accessibility by public transport	Distance to closest mode of public transport Parking facilities	1.75 parking place per bed***	Paid parking Stimulate bicycle use Carpool facilities Stimulate use of public transport
Cradle to cradle	Life cycle analysis	Demolition of buildings	Use of unprocessed local materials Reuse of materials Industrial Flexible Dismountable Building
Hospital as integral part of the city	Grain size Permeability	Huge massive objects in the city	Smaller buildings More public functions

Table 7.2 Making sustainable issues tangible and defining possible building related solutions. * Source: survey among 42000 patients of the eight academic medical centers (Nederlandse Federatie UMC's, 2010).

** Source: http://statline.cbs.nl/ (7/9/2011) but also depending on municipality regulations. *** Source: http://www.mobiliteit.nu/ (7/9/2011).

A lot of examples of measures or features to take into account are given within the literature of healing environment (see table 3.3). Categories in table 3.3 are view, comfort, social support and spatial layout. Concrete requirements within the aspect view are daylight, more specific view outside and preferably with connection to nature. Comfort is about good acoustics, air quality, climate and odor. Aspects of this category are easily measureable and all achievable with good installations. Social support on the other hand is about the access of friends and family and results are less measureable, socially however this is an important factor. Factors are opening hours and the presence of facilities for rooming in.

7.1.2 Concrete examples

To make the above mentioned solution fields more tangible two examples of solutions are given:

Meander Medical Centre builds in the new hospital only single person bedrooms. This is a solution in the category of spatial layout which is already made in the design phase. This is done within the thought of healing environment; that a quiet and single room is less stressful for the patient than a room with other patients. Moreover the danger of contamination is lower and there are better possibilities for rooming-in if desirable. In this way the building, in the form of single bedrooms, contributes to the healing process.

For the Isala klinieken connection to nature is very important. Connection between the different buildings is through a lane that is connected to the outside with a wall of glass over the entire length of the building. This gives natural orientation in the building and

integrates the hospital with surrounding nature. Isala even goes one step further to support the ecological system by building about twenty bird nesting boxes in the building. New buildings are no longer suitable for nesting so to attract birds these bird nesting boxes are immured in the walls of the hospital. In this way the hospital contributes to the ecological systems of the location.

7.2 Planet

Focussing on planet, reduction of the ecological footprint is in order. This can be achieved by closing the different cycles of energy, water, materials and waste. Next to these cycles or flows, the environment (planet) itself and the ability to adapt to future changes are also issues of attention.

PLANET	Added values of RE	Sustainable issues	Ultimate situation
Closing `cycles'	Stimulating innovation Decreasing costs	Energy Materials Water Waste	Energy producing Carbon neutral Cradle to cradle
Environment 'Future proof'	Supporting image Increasing flexibility Increasing flexibility	Ecology Building size Future value	Effective use of space and time Cradle to cradle

 Table 7.3 Ultimate sustainable situation from the 'planet' perspective

Closing the cycles means for example that raw materials have to be fully biodegradable or recyclable. Materials have to come from the region of the building site to decrease the 'embodied energy'. Industrial Flexible Dismountable (IFD) building is a solution, as materials can easily be reused. This way of construction and building safeguards also the flexibility of a building and makes it future proof.

The environment is another important parameter which influences the building. From the point of view of ecology it is always better to build on brown fields and to build a minimum amount of square meters. Therefore it is important to use the space available in an efficient way; this could be realized by implementing the new way of working (new world of work). This means that one's working environment becomes flexible, which results in a decrease of the amount of square meters needed. But efficient use of space and 'future proof' also means thinking and anticipating on future changes in society, in technology and in the organization of healthcare. Hospitals are constantly renovating and building because of new insights in logistics or changing demand in care.

7.2.1 Possible solutions

The sustainable issues of planet and thus the ultimate situation defined are more specific and measurable than the criteria for the concept people, see table 7.4:

Ultimate situation	Measured by	Current situation	Possible solutions
Energy producing & carbon neutral	Building control systems	1.895 MJ/m ^{2*}	Heating Lighting Ventilation Hot water Cooling
Cradle to cradle	Building control systems	17.500 ton/year of waste (in Belgium)** 400L/day of water use (in basic hospitals in Belgium)***	Waste separation Waste prevention by using reusable products instead of disposables and first in first out management Water saving toilets, cranes and showers Use of grey water systems
Effective use of space and time	fte/m ² or bed/m ²	52% of all hospitals have a surface of 30.000 m ² or more*	New world of work Specialization and collaboration Broadening opening hours

Table 7.4 Making sustainable issues tangible and defining possible building related solutions.

* Source: http://senternovem.databank.nl

** Source: Rottiers et al, 2007

*** Source: presentation Trevi 'water en afvalwaterbeheer in ziekenhuizen', May 2007

Solutions for this concept lie in the more technical measures hospitals can take. The first being energy, Agentschap NL has mapped out the energy use of hospitals over the different functions in the hospital in MJ/m² for 2008. The total amount of energy used was then 1.895 MJ/m². The most energy consuming functions were; heating (670 MJ/m²), lighting inside (380 MJ/m²), diverse (185 MJ/m²), ventilation (150 MJ/m²), hot tap water (150 MJ/m²) and cooling (120 MJ/m²) (http://senternovem.databank.nl). Energy measures should therefore focus on these functions. On the other hand, for hospitals which are refurbished, Milieuplatform recommends buying more efficient lightning, insulation and heating systems. For new build more far-reaching measures can be taken as cogeneration or thermal storage.

After energy (for 50% responsible for the environmental impact of a hospital) waste is responsible for the next largest impact on environment, namely for 25% (Croonen, 2009). The waste production needs to be reduced and separation of waste should be done cautiously. In the hospital there are many different forms of waste, from regular waste as paper and food to specific hospital waste as needles and bandages. The difference between the two kinds of waste is the risk for infections. In 2005 a total amount of 7.5million kg specific hospital waste was offered for transportation and processing (Inspectie Verkeer en Waterstaat, 2006). This amount is growing, given that this is already a million more than in 2001 and the regulations for specific hospital waste have been sharpened in 2007.

7.2.2 Concrete examples

In the Netherlands the Deventer Hospital is known for its energy efficient concept, it received European subsidies for demonstrating how significant reduction of energy use in the healthcare sector can be realized. The design of the Deventer Hospital is based on the trias energetica. This strategy is worked out by minimizing energy losses through good insulation, maximizing energy recovery with the thermal recovery wheels that recuperates heath from the air. The last step was to generate the remaining needed

energy as sustainable as possible which is done through the thermal storage for heating in the winter and cooling in the summer.

An example of a Cradle to Cradle solution is the way Isala klinieken work on their building site. Different apartment blocks had to be demolished before constructing the new hospital. This demolition waste is used as much as possible for the temporary construction roads. This result in reduction of costs, less traffic movements and thus less noise and traffic hinder for the neighborhood. Once the construction is finished, the construction roads will be removed and the debris then will be used as rainwater infiltration beds.

7.3 Profit

A hospital which focuses on profit is about efficiency and future value as demonstrated in table 7.5:

PROFIT	Added values of RE	Sustainable issues	Ultimate situation
Effective use of the building	Supporting user activities Decreasing costs	Energy Water Waste Health Building size	Effective use of m ²
Future value	Flexibility Increase real estate value	Future value	Qualitative good building that can adapt to changes and different uses over time

Table 7.5 Ultimate sustainable situation from the 'profit' perspective

A hospital for which making money is the most important issue is all about efficiency, efficiency in organization, the working processes and logistics. The building can contribute to that by facilitating augmentation of productivity and reduction of costs. Design decisions are about compactness of the building because of walking distances and because of costs of facade (floor area/facade ratio and energy costs).

Considering future value has direct influence on design decisions; the choice for better quality of products in the beginning to ensure longer duration of the project translates in less maintenance.

7.3.1 Possible solutions

Solutions for the profit side of sustainability are more economic as can be seen in table 7.6:

Ultimate situation	Measured by	Current situation	Solutions
Effective use of m ²	See table 7.4; effective use of space and time		
Qualitative good building that can adapt to changes	Functional, technical and economical	Lifespan of about 40 years and	High maintenance level
and different uses over time	lifespan Flexibility	demolish after	Flexibility of interior

*Table 7.6 Making sustainable issues tangible and defining possible building related solutions. * Source: CBZ, 2007b. p. 17*

The lifespan of buildings is important for the future value of a building. Three types of lifespan are defined; functional, technical and economical (De Jonge et al, 2009). The functional lifespan is the time the building fulfills the functional needs of the user. For the future value of a building this is less important because a flexible building can more easily house new users. The technical lifespan is the period the building in a safe and sound manner. Important for the technical lifespan is the period wherefore the benefits for the owner are higher than the costs. This can depend on different factors; the technical and functional lifespan play a role in this, (technical) quality of the building is needed to ensure the basic needs of real estate. The flexibility of the building ensures the attractiveness of the building to different user groups and prolong in that way the economical lifespan.

Solutions to use the available space more effective or to build less square meters that can be used more effective vary: Implementing the new world of work, where flexible use of space lowers the demand for space. ICT developments that make patient files electronic which permits to dispose the archives and save space. Another way of thinking is the trend of specialization and collaboration that is already started within hospitals. By focusing on one specialization the hospital can standardize the type of space needed and this space can be used more often because more people with the same medical needs will make use of that hospital.

7.3.2 Concrete examples

The building director of Isala Klinieken, Paul Smaling states that for Isala sustainability efforts are especially on trying to prolong the lifespan of the building through good quality construction. In this way the building needs less maintenance.

In offices the new world of work is not very new anymore. In the hospital sector however, staff is still used to their own desk or office. The Jeroen Bosch hospital is an example of a hospital recently built that implemented the new world of work. The hospital building has a layer of office functions which is organized in a flexible way. On top of that, most doctors don't have their own consultation room anymore but share consultation rooms together and thus saves square meters.

7.4 Solution fields per sustainable aspect

In the previous paragraphs different concrete solution fields are discussed according to ultimate situations defined based on the sustainable aspects mentioned in chapter six. The findings are resumed in figure 7.1:



References to applicable measures are given below to further explain the solution fields summed in figure 7.1.

People

• The ultimate situation for both health and user value is the contribution of the building to the healing process of patients and an agreeable working space for staff. View outside, comfort; visual, acoustic and thermal, social support as facilities for family and friends to visit and spatial layout that determine orientation and routing in the building are important for the health aspect. See paragraph 3.2.3 and 3.2.3 for explanation of the attention points for healing environments. Accessibility in the building is about the ease of access for disabled

people, for example in a wheelchair. Functionality is a point that focuses on the user group staff, one can think about walking distances, choice for location of the different functions. Safety in a hospital is a very important issue, especially concerning contamination, the ability to isolate patient rooms.

Planet

- Closing the cycles of energy, water and waste as well as Cradle to Cradle demands another way of thinking about current use of these 'products'. This starts with thinking about the three-stepped strategy as mentioned in paragraph 5.2.2. Agentschap NL developed a 'search-engine' for energy saving measures, concrete actions focused on the healthcare sector. This can be found on www.slimmemaatregelen.nl . For the Reinier de Graaf hospital Pharmafilter is developed. This is a waste process installation that makes is possible to process almost all different kinds of waste with one installation which has an output that can be used to regenerate energy and cleans the water that remains (www.pharmafilter.nl).
- Materials. Cradle to Cradle is the ultimate strategy to use materials in a building. As Braungart and McDonough stated; sustainability has a local basis and needs a total redesign of the production process, see paragraph 5.2.1 and the book Cradle to Cradle of Braungart and McDonough. To identify the environmental impact of products a life cycle analysis can be performed on the total building. GreenCalc is specialized in making those analyses (www.greencalc.com).
- Ecology, solution fields for ecology are site selection and planning. It is important to detect existing ecological systems to be able to protect them, for example trees on the future construction site. In the first place should be chosen to build on brown fields instead of green fields. See table 5.4 BREEAM categories.
- Transport is all about accessibility. Positioning of the hospital is important, in the middle of the adherence field, near modes of public transport and taking into account room for parking spots to facilitate visitors by car. On www.mobiliteit.nu the Dutch hospitals can benchmark themselves and different solutions for better accessibility are given.

For the aspects ecology, transport, health, materials, energy, waste and water BREEAM depicted quite some concrete criteria or requirements that can be used in the building process, see: http://www.breeam.nl/nieuwbouw/categorieen_nieuwbouw .

Profit

- Future value. Flexibility and effective use of square meters are part of the future value aspect. Flexibility is about the adaptability of the building to future uses. In paragraph 3.2.2 different forms of flexibility are explained.
- Building size can be reduced by using square meters more effectively without endangering the space needed for the daily processes. Most gain lies also here in flexibility, in implementation of the new world of work for staff or prolonging working hours in operating rooms.

8. CASE STUDIES

The case studies are used in two ways, on the one hand to identify the problem and the research field. On the other hand, the conclusions and relations drawn in the literature study will be tested with practice. This is done by analyzing two hospitals and two best practices in other sectors. In literature, described in chapter three, has become clear that a hospital organization can be categorized according to different principles. For real estate the most common is the functional zoning method which categorizes real estate in different functions in order to make good investment decisions (paragraph 3.5.1). The hospital is therefore subdivided into hot floors, hotel, office and a factory zone, which is often grouped under hot floors. This method is the reason to not only analyze hospitals, but to also look into the hotel and office sector. Especially the office sector has already large experience with sustainable building. The new office of TNT in Hoofddorp, TNT Green Office, is chosen as case because they have realized the highest scores on different labels. In the hotel sector sustainability is also becoming an important issue, in Amsterdam a sustainable hotel-'menu' is developed for new-build hotels. Hotel managers or developers can see what measures lead to a sustainable hotel. Hotel Amstelkwartier, currently under construction, is build with the ambition to become the most sustainable hotel of Europe.

The approach of the cases differ: The Meander Medical Centre is the first case and is used for exploration of the research theme; what is done on sustainability and what not? This case is used to sharpen the problem statement and provides insight in sustainability of hospitals in the Netherlands. The other hospital, Isala Klinieken in Zwolle is used to check the conclusions and relations drawn on the basis of the literature study. TNT Green Office and Hotel Amstelkwartier are two cases that are meant for inspiration for the hospital sector on the field of sustainability: What can hospitals learn on sustainable building of other sectors?

The cases are performed by conducting interviews and analyzing documents concerning the cases. In the end the cases will be compared to one another to investigate what and how hospitals can learn from other sectors. The cases are single cases and therefore not necessarily represent overall current practices, but were chosen because they can be seen as precursor on sustainable building in their sector in the Netherlands.

The case description begins with a general introduction of the organization, the design plans and ambitions of the project, the measures in which this resulted, and finishes with the naming and/or prioritization of the sustainability issues.

8.1 Meander Medical Centre

Meander Medical Center (Meander MC) is a top clinical hospital with two buildings in Amersfoort and an annex in Baarn. The new hospital will replace the two existing locations in Amersfoort. Construction started in August 2010 and will be finished at the end of 2013.

Key figures of Meander:				
Meander Medical Centre	2009			
Medical specialists	206			
Employees	3.300			
Bed capacity	604			
Total revenues	€ 221 million			

Table 8.1 Key figures Meander MC 2009. Source: www.meandermedischcentrum.nl

The primary objective of the Meander Medical Centre (MMC) is to provide the whole package of care. This vision is translated into a mission; *Meander is a top clinical teaching hospital. Meander provides a full service of high quality care for her patients in a friendly, professional and reliable way*.

The strategy of Meander to fulfill this mission is to (Jaardocument 2009 MMC):

- Invest in staff and in medical equipment
- As top clinical hospital, provide in training, education and research facilities
- Steer on loyalty of patients by steering on friendly, reliable and professional staff
- Increase its position in the market by marketing
- Increase the image of the hospital with the new building
- Tighten cooperation with other parties ('ketenzorg')
- Highly valuate staff satisfaction

In the annual report of 2009 sustainability is mentioned under the heading 'society and environment'. It states that the new building will be constructed in a sustainable way and will have sustainable energy supply. The challenge lies in making the processes within the hospital more sustainable. Purchasing, transport and energy are key factors with which Meander wants to demonstrate that responsibility towards society is taken.

8.1.1 New design

For the new construction a project team called 'projectbureau Nieuwbouw' is installed with Albert Trip as director. The project team is responsible for the whole planning and construction phase, when the building is finished; management will be turned over to the facility department of the hospital. The architect selected is atelier PRO. For realization of the hospital Heijmans is responsible, together with Burgers Ergon installatietechniek and Ballast Nedam Bouw Speciale Projecten a partnership is constructed for the execution of the works.

In 2005 atelier PRO made a master plan for the Meander Medical Centre, which was the document whereupon they were chosen as architect for the new hospital. Atelier PRO translated the assignment into making an environment where people who are already



Figure 8.1 and 8.2 Meander MC. Source: www.atelierpro.nl



stressed can, on a restful manner, still find their way. The complexity is that the logistics of 'the machine' are in contrast with the ambiance people need to feel at ease. Keywords for the new building are therefore practical and comfortable. Practical in the sense that people can have a clear overview of their situation in the building. Comfortable, referring to integration in the environment and having a human scale.

The structure of the new hospital is organized in a way that the different functions of the hospital are separated. On the left are the hot floors (in red), the specific functions of the hospital. In the middle (in blue, on the left of the avenue), the wards are situated and on the right the policlinics and the offices (in orange) of the hospital. Three themes were taken into consideration for creating a healing environment; safety, the human dimension and a sustainable environment. Safety includes prevention from infections and fire safety. The human dimension is about comfort; thermal, acoustic and visual, and about daylight and visibility to nature outside. The sustainability component comprises of three components in the master plan; flexibility and materialization of the construction, energy savings and ventilation principles. Great importance is attached to the flexibility of the building in order to be able to adapt to changing housing demands in the future. As well as to energy-saving principles as the low temperature system that makes it possible to use thermal storage underground (Master plan PRO, 2005).

What can be seen is that the functional zoning concept is quite literally translated into three different buildings. As Hans van Beek stated in the interview, the three different types have three different prices per square meter, which made it possible to open up the building to create more daylight and view to the outside. This way of building also ensures more or less flexibility. The hot floors are less flexible then the wards, which can interchange if necessary with adjacent wards. The wards in turn are less flexible then the office department, where all departments are interchangeable.

The functional zoning of the hospital can be seen as sustainability approached from the real estate manager perspective. Future value and efficiency were also key words for this design.

8.1.2 Sustainable aspects

In the interview with Albert Trip, the sustainability aspects as are placed in order of importance to the Meander MC (Interview Albert Trip, March 2011):

- 1. Health (and safety).
- 2. User value now and in the future & flexibility. The building, the hull, is fixed but flexibility is guaranteed through the possibility of variation inside and through expansion by new buildings. The building is also capable of adapting to changes in care patterns. The structure of the building is made in such a way that its use can change within the same structure.
- 3. Transportation or logistics (in the building). This is about the short walking distances for the staff and easy way finding for patients and visitors. (A mobility plan still has to be made.)
- 4. Energy. In the building thermally activated building elements (betonkernactivering) is applied. This is together with differentiation of ventilation rates in the building the largest measures to minimize the energy use.
- 5. Waste separation will be implemented in every department.
- 6. Water.

- 7. Materials; within the construction process is tried to minimize material use; maximizing reuse possibilities and minimizing waste.
- 8. Ecology; this feature was principally in the beginning important when selecting the location for the hospital. 2.5 ha of trees have to be felled, but this amount will also be planted back.

Because of the green environment, Hans van Beek (principal architect at Atelier Pro) tried to maximize the impact of this environment on patients by designing a building that opens to its surrounding and even pulls nature into the building. Another aspect considered healing is reducing stress. For Hans van Beek this means that people are able to find their way. Albert Trip describes the healing environment as having a building with human scale and where the difference between day and night can be experienced.

The objective at first sight was to obtain an EPC-score (Dutch system to measure energy performance) of 0.7. This is not achieved after the retrenchment, but still a score of 0.95 is achieved, which is less than the 1.0 that is currently the standard. The score of 0.95 is mainly due to the thermally activated concrete used for the floors. A choice which was not graded very well for EPC is the choice for aluminum frames instead of wooden frames, which would be more sustainable, but needs far more maintenance than the aluminum frames.

8.1.3 Added value and sustainability

Besides the rating of sustainability aspects, the added values are also rated by Mr. Trip:

- 1. Increasing satisfaction and healing environment for patients and staff.
- 2. Increase flexibility, very explicitly.
- 3. Control costs by contribution of the new building to the operational costs.
- 4. Image.
- 5. Increase of production.
- 6. Enlarging financing possibilities. The building will be kept in ownership; Meander is large enough and able to generate knowledge to keep it in ownership.
- 7. Improving culture is not possible with real estate, thinks Mr. Trip, but making it easy to maintain can help to keep it clean.
- 8. Stimulating innovation.
- 9. Managing risks.

The scheme below shows the analysis of this ranking against the ranking of the sustainability aspects with conclusions of the literature study in mind:

Sustainability aspects		Added values
Health	1	Healing environment & increase satisfaction
User value	2	Increase flexibility
Transport	3	Reduce costs
Energy	4	Support image
Waste	5	Increase productivity
Water	6	Enlarge financing possibilities
Materials	7	Improving culture
Ecology	8	Stimulating innovation
	9	Controlling risks

Table 8.2 Hierarchy of sustainable aspects and added values for Meander according to Mr. Trip (interview March 2011)
The first two qualifications are consistent with each other. In the sustainability ranking health and user value (now and in the future, so in the scheme translated in user value and future value,) are ranked first. In the added value, healing environment and increase flexibility are ranked first which is consistent with the relation made between them in the literature study. Mr. Trip ranked transport as third, but with the explanation of logistics within the building. This is not the definition given to this sustainable aspect, transport is really about the accessibility of the building and not within the building, therefore this is not translated in the scheme. The third ranked added value is decreasing costs. Energy/waste/water are ranked 4/5/6 in the list of sustainability aspects. Further research of the sustainable possibilities of reducing the use of energy, waste and water can be advised, but also of real estate efficiency to reduce costs. In this way sustainability measures adds to the objectives of the Meander Medical Centre.

This hierarchical list is translated in the scheme below by highlighting the top three important themes to make the relations between the sustainable aspects and the added values of real estate more clear:



Figure 8.3 Relations between sustainable aspects and added values of real estate

Because the interview was taken quite early in the process some values in the scheme are different then in the list shown to Mr. Trip. User value now and in the future in the interview is translated in user value and future value as the way Mr. Trip explained user value is very much the definition of both values. The profit sides of sustainability as future value and efficiency were missing in the sustainable aspects shown to Mr. Trip, but in the interview came forward that this economic side is very important. This is reflected by the importance attached to the added value decreasing costs.

The scheme makes clear that the people side of sustainability is the most important, followed by the economic side. The planet aspects are valued less important. This is consistent with the main line of the interview with both the architect as the manager for new build. Feeling comfortable in a building with 'size and scale' where it is easy to find one's way was the main message. Of course these requirements have to fit within the budget of the hospital, translated in the added values of decreasing costs and increasing flexibility.

The scheme can also be used the other way around; beginning with the performance criteria leading to certain added value and to the related sustainable aspects. In the annual report of 2009 of Meander is stated that 'increasing the image of the hospital with the new building' and 'increasing its position in the market by marketing' are strategies to fulfill the mission of Meander mentioned on page 58. So distinctiveness is one of the important performance criteria of the hospital.



Figure 8.4 Consistency of distinctiveness in sustainable aspects

The scheme in figure 8.4 shows that this leads to the added values supporting image, healing environment and supporting user activities. Ecology, health, user value and materials are the sustainable aspects relating to those added values and thus to the distinctiveness. One can remark that image which is important in the annual report is not one of the main important added values; healing environment is much more important, leading also to distinctiveness.

Another point in the annual report was staff satisfaction and loyalty of patients. The

scheme shows that this adds to the productivity of the hospital. This is well represented in the importance attached to the values of increasing user satisfaction and healing environment, supported by (the importance attached to) the sustainable aspects health and user value.



Figure 8.5 Increasing user satisfaction

8.1.4 Conclusion

What is striking in the design of the new hospital is the almost literal application of the functional zoning. The building comprises of three building components; hot floors the specific hospital functions, the middle component is the ward, semi public for patients and their visitors and the last area is for offices and policlinics. All three differ in building structure, degree of flexibility and of character, from 'private' on appointment to public functions. This functional zoning is profitable because of different prices per square meter. Within this structure architectural decisions are made with the people who have to use the building in mind. Values Mr. Trip found important were human size and scale, orientation and view outside, without particularly calling this healing environment. Sustainability and healing environment are according to Mr. Trip umbrella terms that are not very important, the main thing is to provide a comfortable environment that is and feels safe and secure.

The health aspect is therefore a priority in the sustainable aspects as well as user value. Although the strategy of the hospital was very clear to 'increase the image of the hospital with the new building' this is not directly translated in added value of supporting image. More importance is attached to the value of healing environment which also contributes to the distinctiveness of the hospital. Health is the driving force behind decisions, but always in consideration of costs and functionality. All sustainable measures have to contribute to the well being (health and safety) of the users, but decisions also depend on investment costs and operation costs.

This case analysis is based on the following sources: *Interviews* Hans van Beek, architect atelier Pro – 4 March 2011 Albert Trip, manager nieuwbouw Meander Medisch centrum – 11 March 2011

Documents Master plan of atelier Pro, 2005 Jaardocument Meander MC, 2009

Internet www.meandermc.nl www.atelierpro.nl

8.2 Isala Klinieken

Isala Klinieken is a top clinical hospital in Zwolle resulting from a merger of two hospitals, Sophia Ziekenhuis and Ziekenhuis de Weezenlanden in 1998. There are still three separate locations, but they will move to the new building at the location of the current Sophia Ziekenhuis at the end of 2013.

Isala Klinieken	2010
Employees	5.361
Medical specialists	262
Bed capacity	994
Total revenues	€442 million

Table 8.3 Key figures Isala Klinieken 2010. Source: www.isala.nl

The mission of the Isala klinieken is: 'The Isala Klinieken is committed to the optimal recovery, uphold and enhancement of the quality of life of the people who are entrusted to its care.' To fulfill this mission, Isala Klinieken strives to (Isala Jaardocument 2010):

- Provide excellent and safe care with compassion
- Continually improve the quality of care and lead the way in innovations
- Offer employees a challenging workplace
- Set the tone in training health care professionals of the future
- Working actively with other caregivers.

With the new building Isala will dispose of a new, modern hospital with all facilities for providing high quality care. The annual report also states that Isala tries, where possible, to act social responsible in relation to the environment. Examples mentioned are the placement of energy saving installations (solar energy and thermal storage) and the use of sustainable building materials.

8.2.1 New design

In 1999 the hospital of Zwolle organized a design competition which was won by the Architectenmaatschap Isala (AMI). AMI was founded especially for this project and consists of three firms; architectenbureau Alberts & Van Huut, a/d amstel architecten and



Alberts, Van Huut & Partners. For the construction of the hospital the building consortium Design to Build (D2B) is responsible. The consortium comprises of BAM Utiliteitsbouw bv Regio Oost, Unica Installatiegroep, Croon Elektrotechniek B.V., Kropman Installatietechniek and BAM Techniek bv Regio Oost.

The ambition of Isala Klinieken is to build the most beautiful hospital of the Netherlands. This is expressed in its organic architecture, in the shapes, colors, materials and plantation in the hospital. This was done to create a place where patients can breathe freely, feel at ease and through this recover quicker. The design is made in such a way that the best care can be given in an agreeable surrounding.

The new building of Isala Klinieken consists of four pavilions or so-called butterflies, each butterfly has its own function. The hospital is arranged according to target groups and type of diseases, this results for example in the placement of the policlinics on the lower floors of the buildings because these departments attract large patient streams. Every pavilion is however different. The first pavilion is called the laboratory building; beside laboratories the building contains the mortuary, the logistical centre and the central sterilization department. The logistical centre is connected to all butterflies through underground tunnels.

The second pavilion is with eight floors the highest and includes mainly policlinics on the first floors and wards. The top floor is designated to elderly care. The third pavilion houses the real hospital functions, operating rooms, intensive care, emergency etc. On the roof of the third pavilion a helicopter deck is constructed, underneath the technical area is placed. The fourth pavilion is destined for policlinics and therapy functions, on the upper floors wards and the children's department and on the top floor the cardiology department. The main entrance is between the third and the fourth pavilion. All hospital visitors come through this entrance and the main hall. Above this hall the restaurant is located.

All butterflies are connected through a lane. This lane is the orientation point for all visitors and the binding factor of the butterflies; you always have to pass through the lane for movements between different butterflies. The lane also connects with the exterior which enforces the concept of point of reference.

8.2.2 Sustainable aspects

In the interview Mr. Smaling was asked to rank the list of sustainable aspects, see appendix IV:

- 1. Health
- 2. Future value
- 3. Efficiency
- 4. Energy
- 5. Water
- 6. Materials
- 7. Ecology
- 8. Waste
- 9. Transport

The interview with Mr. Smaling was mainly about how a building can contribute to the wellbeing of its users; therefore it is not surprising that he notes health as most

important. Future value and efficiency, the two profit parameters of sustainability are mentioned as second and third, because economy is very important. The economist of the hospital reasons not with the argument of healing environment or sustainability. But when the building stands longer and the quality is better, operating costs are lower and the building in total is cheaper.

AMI divided sustainability in two aspects, technical sustainability and in the sense of the relation between users and building. Although care is first and most of all given by people, the building can contribute to the healing process. Patients should feel at home and 'love' the building. According to architect van Huut, a sustainable building, is a building people love (Interview March 2011). Human scale and logic routing are the ingredients to make such a building.

Technical sustainability is assured by Deerns, an installation company. By applying sustainable installations and solar energy unnecessary energy consumption is reduced. Isala generates its own energy with the thermal storage system; this system is based on two water sources that serve as energy buffer. One is cold and serves to cool the hospital in the summer; the other one is filled with warm water and used in the winter to warm the building. Other energy saving methods are smaller, such as water saving closets or lights in the toilet that dims automatically if no one is present (www.isalabouwt.nl).

For this hospital was explicitly chosen not to build according the functional zoning method. Interchangeability and thereby flexibility has an important role. Therefore all butterflies have the same constructional dimensions which make it possible to interchange functions between the different butterflies. Because of the compartmentalizing in the so-called butterflies it is also simple to adapt to changing demand. One pavilion can function independently from the others, therefore it is possible to repel one pavilion or to build a new one next to the existing ones.

8.2.3 Added value and sustainability

Besides the rating of sustainability aspects, the added values of real estate are also ranked by Mr. Smaling:

- I. Supporting culture Increasing user satisfaction Supporting image
- II. Decreasing costs Supporting user activities Healing environment
- III. Increasing real estate value Controlling risks
- IV. Stimulating innovation Stimulating collaboration Increasing flexibility

Mr. Smaling chose to define categories of values that are important. This resulted in underlying hierarchy of the sustainability aspects versus the added values.

Sustainability aspects		Added values	
Health	1	Supporting culture	
Future value	2	Increasing user satisfaction	
Efficiency	3	Supporting image	
Energy	4	Decreasing costs	
Water	5	Supporting user activities	
Materials	6	Healing environment	
Ecology	7	Increasing real estate value	
Waste	8	Controlling risks	
Transport	9	Stimulating innovation	
	10	Stimulating collaboration	
	11	Increasing flexibility	

Table 8.4 Hierarchy of sustainable aspects and added values for Isala Klinieken according to Mr. Smaling (interview September 2011).

Although healing environment is placed on the second spot, the sustainable aspect health is placed on the first. Mr. Smaling explained healing environment as finding the right balance between materials, color and environment where one feels good. Important aspects for that feeling are autonomy, the way staff treats patients, orientation, wayfinding and independency of the patient. Therefore the staff is of great importance. The staffs in the two existing hospitals have very different cultures; therefore supporting culture takes the first place. Increasing satisfaction aligns perfectly with the sustainable aspect of health on the first place as well as supporting image. Although the interview with Mr. Smaling was mainly about the contribution of buildings to the well being of patients, the profit aspects of sustainability are put second. This is not surprising from the point of view of the economist of Isala Klinieken which reasons from the lower operating costs due to better quality of the building. In this way risks are mastered and the value of the real estate decreases less quick.

This is illustrated in figure 8.7:



Figure 8.7 Relations between sustainable aspects and added values of real estate

In the annual report of Isala is stated that Isala strives to 'offer employees a challenging workplace. This can be translated in the added value supporting user activities and increasing user satisfaction as shown in figure 8.8:



Figure 8.8 Added values mentioned in annual report

8.2.4 Conclusion

Mr. Smaling said that sustainability was not very much an issue in this project. However, during the interview came forward that within the project many processes were reconsidered. For example the architects who asks if the windows in the bedrooms can be opened, or the discussion about employing workers from the region even if they were not classified at first sight, as well as trying to use materials from the region and reusing

the demolition waste of the apartments for construction infrastructure. The main learning point of this case is that the rethinking of processes led to solutions that are sustainable, like building construction roads of waste and using local materials. The intention may not have been sustainability, but the results are in this case the same.

This case analysis is based on the following sources: *Interviews* Max van Huut, Architectenbureau Alberts & Van Huut – 31 March 2011 Paul Smaling, Isala Klinieken – 8 September 2011

Documents Isala Jaardocument, 2010 Artikel 'Spiegeltje, spiegeltje aan de wand.. Wat wordt het mooiste ziekenhuis van Nederland?' door ir. C. Vrij in FMT Gezondheidszorg 8. 3 December 2009

Internet www.isala.nl www.isalabouwt.nl

8.3 TNT Green office

TNT is a global transport company and express operator with more than 160.000 employees. The mission of TNT is to connect business, markets and people in a sustainable way. The vision of TNT is to be the most admired delivery company.

Within their core business, connecting people to information, the company has negative influence on worldwide trends as climate change and resource scarcity. Planet Me is a program of TNT with the credo that 'we contribute to the problem, so we must be part of the solution'. Planet Me is comprised of three focus areas:

- Count Carbon: measuring and monitoring our CO₂ performance.
- Code Orange: improving the CO₂ efficiency of our core operational activities.
- Choose Orange: engaging our employees to adopt sustainable behavior at work and at home.

The ambition is to become the world's first zero-emission transport company. This means operating zero-emission buildings and depots, managing a fleet of zero-emission vehicles, leasing only zero-emission company cars. Ultimately, zero carbon output in everything that is done (www.planetme.tnt.com).

The first step therefore was to take the inventory of the CO_2 emission of the company. For TNT this is roughly taken by 50% by airplanes, 30% by cars and 20% by the offices and other buildings of TNT (www.circle-of-blame.nl).

TNT has over 3 million square meters of real estate, spread over 65 countries. The first CO_2 emission free depot was opened in 2008 in Veenendaal. It is a $1.500m^2$ mail distribution centre that staffs 140 people and has resulted in a 70% energy saving compared with a traditional depot (www.planetme.tnt.com). Choose Orange stimulates the implementation of the concept of the new world of work. This means people can work where (at home or at the office) and when (day or evening) they want.

8.3.1 New design

The objectives with the new office were clear from the beginning:

- To create an open, flexible and inspiring working environment
- To design and construct a sustainable office as tangible proof that TNT is serious about its ambition to significantly reduce CO_2
- To lower costs.

Different requirements are then set to the new building, the first and foremost was that the building has to be CO_2 emission free. Right after that TNT required that the renting level in the new building is the same as the current rent level. And the contract has to be flexible, a volume-contract (SenterNovem, interview Flip Verwaaijen June 2008).

In Hoofddorp the first TNT Green Office, on fifteen minutes distance of Schiphol is just opened. It is a building of 17.500



Figure 8.9 TNT Green Office Hoofddorp. Source: www.paulderuiter.nl

 m^2 gross floor area, designed by Paul de Ruiter Architecten. OVG Projectontwikkeling and Triodos Real Estate are the principals of this project which TNT will lease for 10 years with an option for another 5 years. Before building the office, TNT and the consortium OVG-Triodos agreed on a certain rent level with a (fixed) energy price included in the rent. LEED platinum label, GreenCalc index of 1000 and a CO₂ emission free building are the sustainable requirements laid down in the contract between TNT and OVG-Triodos.

The design consists of two rectangular volumes connected by cascading terraces on the three first floors and by 'bridges' on the three upper floors. These terraces and bridges also function as meeting points for the users of the building. The building is orientated in such a way that daylight can enter the building by the atrium and that employees can enjoy the view of the natural setting. By placing the cascading terraces right in front of the entrance employees are encouraged to take the stairs to the upper floors instead of the elevator.

8.3.2 Sustainable aspects

For the TNT case the sustainability issues are ranked differently than for the Meander hospital (Interview Wouter Burgmans, project manager, March 2011):

- 1. Energy
- 2. Materials
- 3. User value & flexibility and transport
- 4. Waste
- 5. Water
- 6. Ecology

Awareness is a necessary precondition that has to be included in the ambition.

To meet the requirements of the labels especially the 'hard' measures of energy and materials are important. Reduction of energy use and choice for materials and where they come from are central. The aspects of user value and flexibility are very important for TNT, but were more organizational objectives of which some are not acknowledged by the used assessment tools.

Different sustainable techniques are used such as smart shading, natural ventilation, heat recovery ventilation, energy efficient appliances and lighting, thermal storage and connection of the building to the gray water system. Next to sustainability, the image of the building to its environment and users was an important requirement. The new office of TNT is a transparent and inspiring building contributing to the ambiance of the working environment (www.paulderuiter.nl).

8.3.3 Added value and sustainability

What can be deducted from the explanation on the site of Paul de Ruiter is that image and user satisfaction were important aspects in their assignment. From the interview of SenterNovem with Flip Verwaaijen, managing director TNT Real Estate, flexibility and costs were important requirements to the new building. This interpretation of importance of sustainable aspects results in the scheme of figure 8.6:



Figure 8.10 Relation sustainable aspects and added values for TNT Green Office

8.3.4 Conclusion

The contract between TNT and OVG-Triodos was very strict; requirements on sustainability were laid down contractually. The high sustainability standards required innovations in the building process and in some cases even in production of materials. This resulted in high investment costs, but the business case was still good because of the reduction of the amount of square meters thanks to the new way of working and because the idea that this was the first in a line of five or six offices.

The main learning point from this case is the importance of the person who sets the ambitions, an 'innovation champion'. He has to have the power to concretize ambitions by freeing money and time to research innovative concepts. It is these same innovations that cost a lot of research time and therefore also money. This case also shows that user value that was important for TNT was not recognized by the different assessment tools used. It is therefore important to keep up with the organizational values and not only set the ambitions on the assessment tools.

This case analysis is based on the following sources: *Interview* Wouter Burgmans projectmanager – 22 March 2011

Internet www.circle-of-blame.nl www.planetme.tnt.com

8.4 Hotel Amstelkwartier

Amstelkwartier is a new building site between the city centre of Amsterdam and the so called 'Groene hart'. At this site a new dynamic working and living area will be developed in the coming years. The ambition is to create an urban area for people that want to stay in Amsterdam but also desire open space and green. One plot is destined to build a hotel which will be a four star hotel on the Amstel in Amsterdam with about 300 rooms. Hotel Amstelkwartier has the ambition to be the first certified LEED platinum hotel in Europe. The hotel will have everything the modern guest wants; luxury and comfort that does not harm the planet.



Figure 8.11 Hotel Amstelkwartier. Source: www.paulderuiter.nl

Next to Mulderblauw Architecten who builds a lot of hotels, Architectenbureau Paul de Ruiter is contracted for their knowledge and experience with sustainable building. The ambition of the real estate developer is to build the most sustainable hotel in Europe. This is however, not strictly defined in the brief. Together with the design team different sustainable options are researched, which resulted in the choice to go for the LEED platinum label. From this moment, the platinum label is taken as requirement for the design. However, the label is used as a tool; measures have to contribute to sustainability and not only to score on the label. Besides, sustainable measures may not be taken at the expense of the luxury in the hotel (Rogaar, 2011).

8.4.1 New design

Main point in the design is the idea to close the cycles of energy, water, waste and materials as much as possible. Another criterion is to make use of the sense of place; by connecting the hotel to its surrounding. These design features are based on the model developed by Architectenbureau Paul de Ruiter on sustainability. The model shows different scenarios on importance of themes within sustainability in different situations. Caro van Dijk recognizes three underlying values, technical values

as energy or innovation. Human values as



Figure 8.12 Sustainable aspects defined by Architectenbureau Paul de Ruiter.

health or user value and the environmental values as connectivity and surrounding. Architectenbureau Paul de Ruiter designs within their technical possibilities, but also the psychological side where aspects as orientation and recognition are very important.

The building will consist of a compact core of logistic facilities, enclosed by the residence areas with much daylight entering the rooms. Full-height glass maximizes the ability to enjoy the view, moreover every room has the possibility to naturally ventilate with outdoor air. The facade responds to both the time of the day and to the presence of the guest by opening or closing the blinds which prevents heat loss or overheating. In this way the building shell saves most of the energy.

The remaining energy is generated by the hotel itself, partially with biomass from the hotel. 'Grey' water is used for toilet flushing and rainwater for the herbs in the greenhouse on the roof of the hotel. The same greenhouse uses the CO_2 of the used ventilation air; the heat from that air is then collected and used again (www.paulderuiter.nl).

8.4.2 Sustainable initiatives for hotels

On behalf of the municipality of Amsterdam a 'menu' for sustainable hotels is realized, which is part of a series of menus for sustainable building published by CO_2 servicepunt. This menu, or tool, helps hotel owners, project developers, architects and/or contractors to integrate sustainability into their building plans. There are five reasons to invest in a sustainable hotel (menu for sustainable hospitals, may 2009):

- 1. To respond to the demand of guests
- 2. To reduce energy costs
- 3. Achieving national targets
- 4. Reaching higher quality standards
- 5. Attaining an ecolabel, such as Green Key

More and more people are committed to environmental issues. A hotel can differentiate on this aspect and provide at the same time more comfort, for example through the roof garden. Other reasons are based on image, such as attaining an ecolabel, or on cost saving, such as energy reduction.

The menu itself is divided in three levels, bronze, silver and gold, connecting to the Green Key levels each referring to a different stage of ambition. The measures in the bronze level are a little more ambitious than the requirements of the building code. The silver measures are ambitious and the golden hotel is a carbon neutral hotel.

Measures on the menu are divided over several aspects:

- Energy
- Materials
- Water
- Comfort
- Image

More concrete measures are for example the use of insulation to reduce unnecessary heat loss. The lighting in a hotel accounts for about a quarter of the energy use in a hotel, energy saving lighting is an easy way to save up to 50% in respect to conventional lighting and the payback time often lies within three years. Another large part of the energy used is for heating and cooling of the hotel for which different sustainable solutions exist. Not only on technical field, but also within building management that could regulate temperature on basis of presence.

Green Key is an international ecolabel for companies in the tourism and recreation industry that are verifiable busy with sustainability, Corporate Social Responsibility and care for the environment. Green Key presents itself as being the means to communicate the hotels' sustainable performance to guests, business relations and governments. With a Green Key certificate the hotel decreases demonstrably the pressure on the environment by reduction of energy and water use and waste production. The system is based on a classification of three levels, bronze, silver and gold. The mandatory requirements have to be done for all levels and how more optional measures the hotel has taken, how higher the rating. The measures Green Key recognizes are divided according to the following theme's:

- Environmental management
- Management and staff
- Communication with guests
- Water
- Cleaning
- Waste
- Energy
- Food and drinks
- Green and location
- Transport
- Building and suppliers
- Social responsibility

These measures are not only for building or renovating a building, but can be taken organizational wide.

8.4.3 Added value and sustainability

The scheme of 8.13 is based on the interview with Caro van Dijk, the menu for sustainable hospitals of the municipality of Amsterdam and the Green Key theme's.



Figure 8.13 Relation sustainable aspects and added values for hotels

Most important sustainability themes seem to be energy, water, waste and materials; closing the cycles. These are important aspects for the achievement of LEED and are also mentioned in the menu for hospitals. Next is the importance of comfort and hospitality,

in the scheme translated in user value. Important for hotels is to differentiate from other hotels to attract customers, image is consequently a very important added value of real estate as is user satisfaction. Metioned by the menu for sustainable hotels is the decreasing costs with energy measures.

8.4.4 Conclusion

Comparing hospitals to hotels is however not really easy. Especially the feeling and emotion when entering one of the two buildings is totally different. The hotel, a four star, quite luxurious hotel gives a feeling of total control with the customer, while a patient entering a hospital is often upset and not in control. These differences demands difference in architecture and lay out of buildings. Entrances, routing and interior, or the public areas are in both cases very important.

This case analysis is based on the following sources: Interview Caro van Dijk, architectenbureau Paul de Ruiter – 8 April 2011

Documents

Rogaar, M. (2011) *Het programmeren van duurzaamheid*. Master thesis TU Delft The menu for sustainable hotels (may 2009) has been realized on behalf of the Environment & Building Supervision Department and Economic Affairs Division of the Municipality of Amsterdam. This menu is part of the series of menus on sustainable construction, published by the CO2-Servicepunt.

Internet

www.paulderuiter.nl www.nieuwamsterdamsklimaat.nl/gebouwde_omgeving/duurzame_hotels 'Handleiding hotel/conferentiecentrum The Green Key' from www.greenkey.nl

8.5 Comparison of the cases

In this paragraph the different cases are compared to each other. The following criteria are used:

- 1. The most important sustainability themes mentioned in the interviews are compared to see where the differences lie and what this could mean.
- 2. Ambition, from literature is clear that the ambition level of organizations is of influence on the final result. A clear, measurable description of the ambition is easier translated into concrete requirements and measures.
- 3. It is therefore interesting to see on what criteria/requirements the choice for sustainable building is made.

	Meander Medical Centre	Isala Klinieken	Hotel Amstelkwartier	TNT Green Office
Important sustainability themes	Health User value & flexibility Energy	Health Future value Efficiency	Energy flows Life cycle Connectivity	Energy Materials User value & flexibility
Ambition	Sustainability within budget: check afterwards	"A beautiful hospital"	LEED platinum	GreenCalc 1000 LEED platinum 'Groenfinanciering' CO_2 emission free
Arguments for sustainability	Budget (versus payback time) Contribution to healing process	Quality and long lifetime	LEED criteria	LEED and GreenCalc criteria

8.5.1 Important sustainability themes

For Meander health is number one, followed by user value and then energy. For Isala the first aspect is health, but the second and third is the economic aspects. These were not incorporated in the ranking list in the other cases and can thus not be compared. In the interview with Meander came forward that measures were only implemented if they fit within a certain pay-back time. Therefore can be assumed that the economic values are also very important for Meander. In the hotel and office cases the importance of the label shows in the ranking of the sustainability themes. As shown in the model of Paul de Ruiter, the importance per criteria differs for each new project. Deducted from the description of the hotel, connectivity and 'closing the cycles' (translated in energy flows and life cycle) are very important. From the point of view of TNT user value and flexibility is very important, but with the chosen assessment tools energy and materials prevail.

8.5.2 Ambitions set

The most striking difference between the hospital and the two other cases is the difference in ambition level. The hotel and office have both chosen a certain level of an assessment tool (in both cases LEED) that the building should accomplish. This gives a very clear definition of the term sustainability and forces the principals to think and act on all elements of sustainability named by LEED. As Caro van Dijk states, those tools are very good for comparing buildings to one another and moreover, aspects that yield less are also executed. The method forces managers to think on a wide range of themes and demonstrates that the elements included in the tool are done well or at least on a certain level. Pitfall then is that the aspired level of the assessment tool becomes the ultimate goal instead of a means to an end. This in return could suggest that budget plays a less important role in favor of the label.

This is the main difference between the hospitals and TNT; the ambitions set. For TNT LEED platinum and GreenCalc of 1000 were binding ambitions. This means that issues important in these assessment tools are the most important criteria defining a sustainable building. For GreenCalc the main focus is with energy and materials which are also very important for LEED. Because the ambitions in these assessment tools were set very high (for GreenCalc almost twice as high as realized before) the demand for innovations in this project was huge.

In hospitals this phenomenon does not occur because budget will always play an important role. Besides one can question if it is the role of the hospital to innovate in another field than their core business of healing patients. Innovation often demands large investments and outcome can be unsure, therefore this is not always suitable for hospitals that fulfill a social function. It is good enough to follow innovators and implement sustainable ideas that have proven to function.

So in comparison to hospitals offices are different in the way that hospitals don't have interest in taking the leading position in innovative sustainable building. What is interesting is the influence of the sustainable ambitions on the organization. Because the ambitions have influence on the arrangement of the interior, it influences directly the way of working. The influence of a sustainable building on the whole organization is underlined by the quote of Thomas Rau: "Technisch is er geen probleem. Methodieken om duurzaam te kunnen bouwen zijn er genoeg om direct mee aan de slag te kunnen. We weten dat het moet en ik denk dat een voorhoede ook wel beseft dát het moet. Maar toch blijven we hangen. Waarom? Omdat het duurzaam bouwen vraagt om een totaal herontwerp van de keten" (in Rakhorst, 2008) (translation: Technically there is no problem. There are enough methods to build sustainable to get started right away. We know that it needs to happen and a forefront realizes it should happen. And still we got stuck. Why? Because sustainable building requires a total redesign of the chain.) It says that sustainable building needs a total redesign of the whole building process, or production chain, as also stated by Braungart and McDonough in their book Cradle to Cradle.

Hospitals don't feel the urgency for such a total redesign of their organization and real estate. Moreover, their corporate responsibility towards society does not allow large investments other than in the healing character of the hospital. This rethinking of the process can also start small as shows Isala, with hiring local workers and reusing demolition materials.

8.5.3 Arguments for sustainability

For both hospitals the main criteria for sustainable measures is that they have to add to the well being of the users of the building and that budget is the restricting factor. For Isala a sustainable building is a good quality building with a longer lifetime as result. This reasoning does not end in the most technical sustainable measures, but in measures that add to the primary objectives of the organization. This is different from the other sectors where the ambition level of a certain label dictates the selection of measures.

8.5.4 Learning points from office and hotel

The functional zoning method is used to analyze sustainability in the hospital sector. The question at the beginning was what hospitals could learn from other sectors. The difference between commercial (offices and hotels) and non-commercial buildings is very big. This is expressed in the innovative ways both commercial cases are worked out. Whatever costs, the sustainable labels have to be met and image of the building as figurehead of the organization is very important. These labels ensure that technically the buildings are very sustainable, in the case of TNT even have zero CO_2 emissions.

What can be seen in the TNT case is that this sustainable approach also resulted in another working environment. The new world of work is introduced which means that space can be used flexible and people can work in the environment they choose. The underlying idea of this new world of work is that people are more productive when being able to work when and where they want. Healing environment is the trend that could be compared to this trend of the new world of work. People realize more and more that they are influenced by their surrounding and that the environment can contribute to ones well-being and therefore to ones productivity or healing process. In hospitals this is expressed in the high importance of hospitality. The trend of researches on and importance of healing environment is therefore not surprising and fits within current thought and principles. Sustainability is also one of the current trends, but as offices use this as branding, for hospitals this argument is less important.

What can be learned from hotels, and in the case of Meander already is, is the repetitive character of the rooms. In Meander the one-person-bedrooms all have standard dimensions and have a strongly repetitive character. This means that the different wards can expand or reduce in size when one needs (temporarily) more rooms.

Except the working methods of offices or the standardization used in hotels the use of labels is the main difference with the hospitals. For hospitals the highest standard of these tools is not feasible, but thinking about all different elements is important to not overlook on feasible sustainable solutions. Besides the use of a tool demonstrates on what sustainable elements of the hospital is worked and this can easily be communicated to the outside.

9. CONCLUSIONS AND RECOMMENDATIONS

In this chapter the main question of the report will be answered. The main question of this report is:

(How) can sustainable real estate contribute to the primary objectives of a hospital?

This will be answered by recapitulating the problem statement and answering to those problems:

- 1. The comprehension of the concept of sustainability is the first problem; management boards find it is too vast a term, knowledge and awareness is not always standby.
- 2. The added value of (sustainable) real estate to the organization is unclear or questioned.

The first paragraph is a conclusion of the study on the concept of sustainability and how this is applied in hospitals and thus responds to the first problem. The second chapter elaborates on the model that shows to hospitals how sustainability can add to the organizational performance of the hospital. The third paragraph sets out some preconditions that came up sideways during the research and are to be kept in mind to succeed in sustainable developments. The fourth and fifth paragraph describe the reflection on this study as well as recommendations for further study and recommendations for practice.

9.1 A sustainable hospital building

The first problem defined concerns the comprehension of the term sustainability. In the literature study is seen that a lot of different views, strategies and tools are presented. All different views are based on or can be broken down to the triple p of Elkington, planet, people, profit. In practice can be concluded that:

1. Sustainability is perceived as an umbrella term. In practice this means that merely measures to improve the energy performance are taken.

Talking about sustainability in practice is often about energy reduction. The planet side of sustainability (energy, water, waste, etc.) is concrete and can easily be translated in measures that are technical and often related to installation systems. Costs and benefits are clear at starting time and decisions on measures are taken based on the payback time of these measures. This one-sided view on sustainability can also be recognized in literature on sustainable hospitals. The literature is about carbon neutrality or climate-friendly hospitals, ignoring the two other concepts people and profit defined by Elkington (1998).

2. On the other hand **healing environment is a more and more accepted and applied theory** in hospitals. However, the link with sustainability or the people side of sustainability is not really made.

The idea that the (built) environment influences the well-being of people becomes more accepted and hospitals are acting on this. The more abstract aspects as 'feeling at home', distraction by view outside preferably on nature or the demand for more tranquility are being discussed from the design phase on. The environment can not only contribute to the healing process but also effects staff satisfaction as working circumstances increase.

3. **Budget always seem to be the restricting factor** to implement sustainable measures.

Decisions on sustainable measures are based on the payback time of these measures. This shows that investment costs are no longer leading and total costs of ownership become more important. Still, if budget needs to be cut, sustainable measures of which the benefits are not directly quantifiable in Euros are often the first to fail.

So the planet side is from origin seen as sustainable, the people side is in hospitals very important as their business is to cure patients and the profit side has a decisive role. It is clear that all three aspects are different and not comparable to each other. One should therefore always incorporate the three views in the strategy for a sustainable building. Aspects in those three views important for hospitals are shown in figure 9.1:



Figure 9.1 Sustainable hospital building

Figure 9.1 shows clearly that sustainability is a threefold definition. Measures on the planet side are mostly practical, no-nonsense, almost mathematic solutions. The profit side demands another way of looking at the financing system. It is not only thinking about investment costs any more, but about taking into account the total costs of ownership. The people side has besides the comfort aspect also a more soft side. A sustainable hospital has to act on all aspects defined. Preconditions are defined by the links between the concepts: A sustainable hospitals has to have a corporate social responsible organization, providing a healing environment basing investment decisions on total costs of ownership.

The functional zoning method suggests that the hospital can be divided in four functions with different demand for real estate: the hot floors, the hotel, the office and the factory. This means that real estate for those different functions is comparable to the corresponding sectors. For this research best practices of the office sector is analyzed as well as an upcoming hotel. The two main learning points are:

4. Both best practices have high standards of sustainability, based on the highest level of LEED, an assessment tool for sustainable building. This means that **the building process has a highly innovative character**, searching for the most sustainable solutions in order to achieve the required sustainable level. Innovations are uncertain or previously unknown solutions which need much research and are therefore time and money consuming. The function and character of the hospital demand innovations in the medical field, but is reluctant in other fields such as sustainable building.

5. In both cases labels of internationally recognized assessment tools are used to indicate their ambitions and communicate the level of sustainability reached.

Those labels are easy, recognizable communication tools that also permits to compare the degree of sustainability to other buildings. In addition it forces the organization to look at all aspects of sustainability instead of taking for example only energy reducing measures. For hospitals it is not necessary to directly aim at the highest label, but it is a means to benchmark your own sustainability to other hospitals and can be used as communication tool for image purposes.

The next paragraph reacts on the second problem and demonstrates the contribution of the different sustainable aspects to the added values of real estate and thus to the performance criteria of the hospital.

9.2 Added value of a sustainable hospital building

6. A sustainable building does add value to the primary objectives of the **hospital** as shown in chapter six.

This is demonstrated in the model of figure 6.2 by showing the contribution of the sustainable aspects to the added values of real estate and further on to the performance criteria. In chapter seven the ultimate situation per sustainable aspect is defined as well as more concrete solution fields. Integrating those solution fields in the model of chapter six results in figure 9.2 on the next page.

The model of figure 9.2 can be used easily by hospitals to detect what sustainable aspects add to their performance criteria or main real estate values. The model can be used in three different ways or by three different stakeholders.

The first is to begin on the total left of the scheme shown in appendix V with the performance criteria. Management boards set out the performance criteria for the hospital and can see in this model that sustainability can contribute to the company's strategy in the way the model indicates.

The model can also be used by real estate managers, as shown in appendix VI. Real estate managers define important values of real estate to the organization, thus beginning with the added values of real estate in the model.

In most hospitals in the Netherlands the environmental coordinator is responsible for the policy on the environment. For this group the model starts with the sustainable aspects, see appendix VII. In meetings with real estate managers or management boards can be shown how sustainable aspects add to the real estate values and to the performance criteria. In this way the discussion on sustainability makes sense to all stakeholders in the meeting.

The ultimate situation and the solution fields are for all stakeholders the same and thus can the model be used to take decisions on measures to take that are in line with the overall or real estate strategy of the hospital.



Figure 9.2 Relation scheme performance criteria, added values of real estate and sustainable aspects, including the ultimate situation per aspect and solution fields to achieve this ultimate situation

9.3 Preconditions

The main question is answered, but in the process of finding above mentioned answers three preconditions became clear:

- 1. As made clear above sustainability should be expressed in concrete terms at the beginning of the project. In this way it becomes tangible and easier to work on.
- 2. A sustainable project needs believers. In other graduating projects of Maarten Dansen (2009) and Michiel Rogaar (2011) already became clear that for the success of implementing sustainable measures people with mandate were needed in the organization that believe in sustainability and fight for it. This also came forward in the case of Isala the construction of the chosen organic design was not self-evident. Thanks to the first head of management board and the overpowering percentage of votes for the design the building started. For the TNT case the 'innovation champion' was very important for realizing the high standards.
- 3. The different aspects of sustainability fall under the responsibility of different managers in the organization. To succeed in all facets of sustainability alignment between the different managers is necessary.

9.4 Reflection and recommendations

9.4.1 Reflection

At the start of this study the ambition was to formulate or provide a vision on what the most sustainable hospital would look like. From that point would be reasoned back what measures have to be taken now to reach that point and the explicit costs and benefits of those measures would be researched. In hindsight it turned out to be very difficult to provide an image of the ultimate sustainable hospital. I found it would be a graduation topic on itself because a lot of assumptions have to be made on all kinds of developments influencing the 'healthscape' and the way sustainability is interpreted in the future. I also thought this typically requested images of future situations. Instead chapter seven is written, which became a compromise between defining the ultimate future hospital and learning from forward, already existing solutions. I also struggled with the idea to investigate the costs and benefits of specific measures because measures, and thus their costs and benefits, are often specific to the situation and developments in the technical field are so fast that in my opinion it would be outdated even before my graduation was finished.

In this research the first question to be answered was 'what is a sustainable hospital?' before being able to answer the main question 'how a sustainable building adds value to the organization'. Because there are not a lot of examples of hospitals that are explicitly busy with sustainability, analysis of the current situation was found not useful. Therefore is chosen to define concepts of sustainable hospitals and to research other sectors comparable to parts of the hospital (based on the functional zoning method) as well as two hospitals that are currently building new hospitals. Four cases, two hospitals, a hotel and an office, all built or in construction in the last years. For the two hospital cases the building managers of the hospital, so principals of the project were interviewed. This was unfortunately not possible for the other two cases and especially for the hotel little information was available. This makes it difficult to compare the cases equally.

The model of sustainable aspects, added values and performance criteria is based on explorative research and should be validated in a follow-up study. This can be done in hospitals that have building plans to check if the scheme is instructive enough and a help to concretize the term sustainability in tangible solutions. In this validation of the relation scheme it would be interesting to examine application of concrete measures and the estimated costs and benefits of those measures. This would also give insight in the decision process around the sustainability theme.

9.4.2 Recommendations for further research

Hospitals and sustainability are two subjects which are I found very interesting to study each on itself. A lot of research is done on sustainability, the existence of assessment tools and the theory of cradle to cradle was known. But comprehension of these subjects is something else. It was therefore a good exercise to arrange the different views on sustainability to get insight in this often called umbrella term. The research on hospitals was very diverse. There is a lot going on in the sector and many trends and developments have influence on the architecture and interior arrangement of hospitals. For this research the classification of the functional zoning method is chosen. There are however many other classifications which are interesting to study, especially the influence of the different types of care in combination with the specialization of hospitals on organizations and building strategies.

My interest is very wide on this subject, but the focus of this research is on the building component and not so much on the processes inside the hospital. Behavior and awareness of patients and staff influences the actual sustainability of the building enormously but are left out of this. It would be interesting for another research to focus more on the management side of sustainability to investigate the influence of awareness and behavior of users on the real sustainability. Departing from a technical ultimate sustainable building, how much does management and behavior influence than the sustainability?

During the research an interesting cross analysis of CREM and sustainability came up. The distribution of the responsibility for sustainability over the different roles defined by CREM is here sideways mentioned as precondition. This research only made clear that the responsibility lies with different managers. This could be a problem, it would be interesting to research the influence of this division of responsibility on the success of sustainability in the project.

9.4.3 Recommendations for practice

Make clear at the starting phase what a sustainable hospital is for your organization. By using figure 9.1 or such a picture that demonstrates sustainable aspects it is clear for everyone what is meant with the term. It can also be used as communication tool to the outside to show easily what is done on sustainability.

Determine a sustainable strategy that fits with the overall strategy of the hospital. The model of figure 9.2 forms a good starting point to discuss sustainability with the different stakeholders involved. In this model one can clearly see that performance criteria, added values of real estate and the sustainable aspects are linked to each other. Implementing sustainable measures supporting the strategy of the hospital creates acceptance and makes it therefore easier to actually perform those measures.

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APPENDICES

- I. Laws and regulations for hospitals
- II. Financing structure
- III. Healing environments over time
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- V. Sustainable hospital from the point of view of the management board
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APPENDIX I Laws and regulations

The building regime in the Dutch healthcare system has been controlled by the government since the 1950's. Control was been done to guaranty availability, accessibility, efficiency and quality of the healthcare. The laws to regulate this have been significantly changed in 2009 when the law for admission of healthcare institutions (Wet toelating zorginstellingen, WTZi) was abolished. Under this law, healthcare institutions needed permission to offer care which could be reimbursed under the Health Insurance Act (Zorgverzekeringswet) (CBZ, 2009). The WTZi regulated these authorizations, laid down rules on good governance and also determined the cases in which profits could be distributed. The purpose of the WTZi was to progressively create more freedom and responsibility for the healthcare institutions through less government interference (www.rijksoverheid.nl). But in name of the public responsibility for the quality, accessibility and affordability of healthcare, some other laws are being replaced by a new law, the law for the rights of clients of healthcare (Wet cliëntenrechten zorg, Wcz). This law controls not only the rights and obligations of the client, but also the responsibilities of the healthcare providers for the quality of the care. By including all rules about the relationship between care provider and client in one law, rights and obligations of both parties are better in tune. These rights consist of:

- 1. Right for good care
- 2. Right for choice of institution, and information to make that choice
- 3. Right of information, consent, filing and protection of privacy
- 4. Right for an effective and accessible complaint and dispute regulation
- 5. Right of say
- 6. Right for good governance and supervision
- Reporting and public accountability (samenvatting Wet cliëntenrechten zorg, 23-04-2010)

This law is now only a legislative proposal and is offered for advice to the Council of State; the intention is to put this law in effect in 2011.

APPENDIX II Financing

Since 2008 hospitals have to deal with a new financing system for their real estate. Until 2008 the government paid for the real estate of hospitals, after approval of the plans. The government paid the interest rates, so for banks investing was without much risk. However, policy makers found that hospitals were building to large and thought that the real estate should become more efficient. That is the reason the policy have changed and that hospitals are now responsible for their own real estate. Hospitals have to earn investments in the real estate back with incomes the hospital can generate with the building (www.nvilg.nl). Capital costs (interest and depreciation) are incorporated into product prices, this method is called the 'normative housing component' (in Dutch: normatieve huisvestingscomponent, NHC). The NHC is a standardized and indexed amount for all building expenses from which both depreciation and interest on investment should be paid. This component is variable to the production and is for all institutions the same. The NHC is an average value for the depreciation over the lifespan and matches the pattern of activities of the hospital (www.nvz-ziekenhuizen.nl).

APPENDIX III Healing environments over time

Stephen Verderber (2010) advocates that there is no reason that hospitals should be less aesthetic or technically interesting and even less sustainable than any other building type. He describes this through a historical perspective and some future prognostications on the relationship between the built environment, human health and sustainability. Six patterns from the Ancients and the mid-nineteenth century are recently rediscovered as being healing:

- Natural ventilation
- Natural daylight and view
- Water and sanitation
- Landscape, building configuration and site planning human scale
- Conservation of historic resources
- Local building materials and self-sufficiency

These topics can be placed in a set of chronological waves in the history of architecture and human health; the Ancient, the Medieval, the Renaissance, the Nightingale movement, the modern mega hospital and the 'sustainable healthscape'. In ancient healing temples in Greece fresh air, water and landscape were very important healing features. This was 'forgotten' in the medieval but reinforced with the Nightingale movement which concentrated on provision of clean, well-lit and ventilated hospitals. In the post-World War II, the mega hospitals were constructed, the so-called curing machines. The current wave, called sustainable healthscape, is one of restructuring old hospitals, but also demolition of former hospitals. New hospital buildings are built more in relation to the surrounding site and landscape. Patient rooms are not the grey windowless rooms anymore; attention has been paid to scale, aesthetics and appearance. Patients are in control of the environment and have outside view (Verderber, 2010).

APPENDIX IV Evidence Based Design

Within the aspect of healing environment, a new design approach is that of Evidence Based Design. According to Kirk Hamilton in the paper 'All designers use evidence' (Berlage Institute, 2008), evidence based design is the 'conscientious, explicit and judicious use of current best evidence from research and practice in making critical decisions, together with an informed client, about the design of each individual and unique project.' Evidence Based Design (EBD) appeals to the healthcare sector because within the sector a similar method is used, called Evidence Based Medicine. Like Evidence Based Medicine EBD is thus research-informed. Doing research through experiments and testing the results is something the healthcare sector understands and they are therefore more open to architecture which is based on scientific research. EBD looks at building design not only as physical space, but includes the total sensory environment of sight (Malkin, in Wagenaar 2006).

APPENDIX V Sustainable hospital from the point of view of the Management board



APPENDIX VI Sustainable hospital from the point of view of the real estate manager



APPENDIX VII Sustainable hospital from the point of view of the environmental coordinator

