MASTER

Puzzle with design knowledge
implementing sustainability in the definition phase of the building processes of Royal
Haskoning using a co-operation session

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By
H. A. Wolfs
Puzzle with knowledge

Implementing sustainability in the definition phase of the building processes of Royal Haskoning using a co-operation session

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The philosophy Cradle to Cradle states; *devise and develop products on the basis of safe and entirely reusable raw materials.* Therefore a Wire-O bind is used.
PREFACE

My name is Maaike Wolfs; I grew up in Moergestel, a small village near Tilburg. Quite a lot new houses are built in Moergestel. All these houses, small or big, reach the essential requirements stated in the “bouwbesluit”. Unfortunately any sustainable technique is used; solar energy or reuse of rainwater is hardly ever used. I think it is a pity that we have good sustainable techniques, but we hardly use them.

We complain about high energy prices, but we don’t react by just switching to another technique. This has a relation with social processes, Rogers (2003) explains that a proven technique doesn’t have to become a success. So the question rose: Why is the use of proven sustainable techniques not common? The make sustainability a success, the social process to obtain sustainability needs to change.

This research focuses on a change in the building process to make sure the result is a more sustainable building.

This research is created with the help of several people. My supervisors supported & stimulated me up to the end. My relatives have invested time in me. And my friends did support me. I would like to thank t persons in specific; John and Lantenza thank you for your time and patience!

Maaike Wolfs
February 2009
Zwijndrecht
MANAGEMENT SUMMARY

By the end of the nineteen sixties the Club of Rome is set up, which brought together their concern of the future of the world. The World Commission on Environment and development (WCED) has written the report "Our common future" in 1987, more known as The Brundtland report. In 1997 the Kyoto-protocol has been established in the Japanese city Kyoto, it arranges reduction of emission of greenhouse-gasses. And more recently the popular movie "An inconvenient truth" of Guggenheim presented by Al Gore (2006) is published. More or less sustainability is for quite some time a topic.

In literature hardly any information is published about the building process in relation to sustainability. Ofori (1998) states: "The relationship between construction activities and the environment is well recognized. Further effort is necessary to establish common concepts, principles and techniques relating to sustainable construction." Lotspeich, Rumsey and van der Ryn (2003) have tried to create rules for the building process to obtain more sustainability.

Royal Haskoning is an independent consultancy in construction sector operating worldwide. In their annual report is stated that sustainability is an issue in the mission and daily work (Royal Haskoning, 2007). The commitment to the environment is contributed by the special interest group Royal Cradle, their philosophy is based on the philosophy Cradle to Cradle (Braungart and McDonough, 2003). It states it is possible to break through the spiral of exhaustion of natural stocks, of waste and of clogging, obtained by devising and developing products on the basis of safe and entirely reusable raw materials.

The members of Royal Cradle are convinced applying sustainable techniques has to do with working integral, willingness to succeed, everybody having the same philosophy and life-time thinking. They want to accelerate the use of sustainable techniques by working integral between different divisions and intensive working together. In that way they develop best practices and guidelines.

The division Building Management & Consultancy is facilitating this research. "They speak the different languages, think about the content of proposals & solutions and always work from their professional backgrounds, supported by specialists in many fields" (www.royalhaskoning.com). The division Building Management & Consultancy are specialized in integrated management of building projects and high-quality advice in the field of corporate real estate. (www.royalhaskoningbm.com)

Similar as described the literature also Royal Haskoning is searching for the right implementation of sustainability in their building process. The goal in this research is: It is still unclear for Royal Haskoning how to achieve sustainability in building projects, given the high level goals of the principal.
The methodological cycle of Van Strien is applied (Van Aken, 2007). In the first and second phase of the cycle an overview on the problem mess is created by analysis of the bottlenecks related to not achieving sustainability. The focus of this research is up to the first second and third phase. An Ishikawa diagram is used to identify factors causing the problem, which are called Principal, Co-operation in the sector, Royal Haskoning and the last one Certification. A good sustainable project is indicated to be a project what is a result of reinforcement of the sustainability themes (Section 2.2 figure 4) on each other, they all have to match. The process is restricted to definition phase, the research goal has become: Change the definition phase of the building processes of Royal Haskoning to realize projects which achieve sustainability.

After restriction in process again the generated data is analyzed but now focused on the goal this results in the preliminary cause and effect model. This model is revalued by selected literature. Resulted in several factors which influence the implementation of sustainability (Unclear ambition principal, no C2C vision available, Communication, Interaction, Techniques not implemented in planning, Techniques difficult to express in money, No applicable tools, Boundaties, Enthusiasm and Influence).

The second phase has ended with the choice of one factor to be changed. The most remarkable factor is bad start design phase, which is related to the several factors. One factor related to bad start design phase is selected to be redesigned; this is interaction in the definition phase of the building process of Royal Haskoning. The choice is made, because this factor fits to the predefined problem and can be influenced by the organization of RH himself.

The design is started by drawing up specifications of the design. The goal of the design is to stimulate the implementation of sustainability in the definition phase of the building process. The design itself is a co-operation model; to create changes which collects different perspectives, activities and methodologies for working together (Fredriksson, 2005).

Currently Royal Haskoning is working on the building process by research, an ambition workshop and the creation of a schedule of requirements. This research suggests creating an ordinantion by a cooperation session. The ordinantion is a story of creating the emergence of the building, a basis for the schedule of requirements and the blue print. Among other things the story will make clear how sustainability will be implemented.

The input of the session is the order, the ambition workshop, the research (information about the order and situation) and knowledge of the consultants and designers. The design enranges cooperation during a session of 3 hours. During this time the participants will create three ordinantions to finally choose one option, in that way the most creativity is used and the best option can be chosen. The start of the session is by an introduction on the case by the consultant.
To achieve three ordinantions is chosen to use charrettes. A charrette is seen as “a final, intense work effort to meet a project deadline” (www.charretteinstitute.org). The consultant will lead the session and led the designers work by sketch designing and storytelling. Sketch designing is useful because “working through the symbol system of sketching” enables to capture and create ideas (Goel, 1995). Storytelling is needed because that will to understand, identify, and communicate about the situation. The last part of the session is choosing the best ordinantion out of the three created, this will be done by valuing or multi criteria analyse.

The participants of the session will be consultants and designers; they will create an ordinantion as a team. “Team working enables individuals with knowledge and skills to work together and solve problems that an individual specialist could not.” (Denton, 1997). The output of the design is an ordinantion, which is not the end of the definition phase. This will give an interpretation about the following subjects: the order and situation (financial, qualitative and quantitative factors (safety, logistic, flexible, planning)), focus of the principal (costs, ecological, marketing, relation between building & ongoing process) and absolute don’ts. The use of this session is guided by the created leaflet.

This design needs to get implemented in the organization. Therefore the theory of Kotter (1996) is used. To come to a good implementation of the design the eight suggested phases need to be completed, Royal Haskoning already finished phase one and two. A change plan is suggested in order to create this change. To have an overview on the problem in phase three the colour-theory of Caluwé and Vermaak (2006) is applied. There is found that the consultants, designers and the problem have different colours. The solution needs to be expressed in a manner that these differences will be overcome.

The contribution to practice can be found in several parts of this research. First the analysis has made clear what influences implementing sustainability in a project of Royal Haskoning. Second insight is implementing sustainability is not an easy job and finally the change plan.

The generalization is limited because the design is created for a certain management structure and a certain culture. The change plan is created specific for Royal Haskoning. But implementation into other companies is interesting to be executed. Further research is needed for the next topics:

- Apply the final two phases of the cycle of Van Strien, called implementation and evaluation.
- Place the design in a different context.
- Explore subjects which are treated superficial: factor interaction, the effect and the use of the charrette, change management in general and rewarding.
- Finally some new statements could be explored. What would be the design if another part of the Ishikawa diagram was chosen? Or another factor?

For Royal Haskoning some practical recommendations are distilled. The first one is implement the change plan. Second check the chosen colours in the colour-theory; maybe they do not fit anymore to the company. And the last recommendation is less specific; also try to model the factors which are not redesigned in this research.
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1 INTRODUCTION OF THE RESEARCH

1.1 Introduction

This chapter expresses the start of this graduation research. The beginning is the participation in the “Afstudeer atelier CME 2008 - 2009”, is this atelier students will share experiences and learn from experiences of others. The atelier will be discussed in the following section.

The research is facilitated by Royal Haskoning Rotterdam; explained in section 1.3. The company is expressed by their guiding principles, their history and their divisions. The facilitating division of this research is Building Management & Consultancy, which will also be expressed. Royal Haskoning is focusing on sustainability; the special interest group called Royal Cradle will be explicated.

The research problem statement will get fundament found in the personal motivation (preface) and in literature. The research goal and the research questions are formulated based on the problem statement. Finally the outline of the report is made.

1.2 The CME Atelier

This graduation research is a part of the “Afstudeer atelier CME 2008 - 2009”. For the final report a model for process improvement should be produced, which can be broader than only process acceleration. It can also be about interaction between parties. The research suggests 6 subjects, called the “6 S-en”, at least two of them need to be implemented. These “6-sen” are factors, actors, rules, decision actions, phases and levels.

The objective of this graduation research is explained in the preceding section. Still some questions a need to be answered, who is involved in the process, what the process looks like, what problems are and so on. Probably all the six subjects have some role in this graduation research. During the scope of this research restricted to the process phases and factors.

1.3 The company Royal Haskoning

This research is facilitated by Royal Haskoning division Building Management & Consultancy. Therefore a short introduction of the company follows.

Royal Haskoning operates in 68 offices worldwide through an array of 10 divisions. See figure 1 for an overview.

Figure 1 Offices of Royal Haskoning worldwide (www.royalhaskoning.com)
The company has approximately 4300 engineers, architects, consultants and environmental scientists. The consultancy foundations are laid in Nijmegen by the engineers Johannes van Hasselt and Jacobus de Koning in 1881.

Royal Haskoning has acquired a lot of experience worldwide, knowledge and expertise. They provide a personal, effective and local consultancy services. “We are one company, operating under one name, offering our clients a total package of services” (www.royalhaskoning.com). The code of conduct is founded on integrity, respect, openness and team spirit, which is an essential criterion of their success.

The company Royal Haskoning is built out of modules; called the divisions of the Spatial Development, Infrastructure & Transport, Architecture & Building, Building Services, Industrial installlations, Environment, Water, Coastal & Rivers, Martime and Building Management & Consultancy. In figure 2 an overview is created of division sizes. This chart is created with the use of the industrial outputs per division in percentages of 2007 (Royal Haskoning, 2007). This research is facilitated by Royal Haskoning division Building Management & Consultancy. A management overview is created in appendix 2 Management. As stated in the appendix the advice groups are managed by a Director Advice Group (DAG). The DAG’s are managed by a Division Director (DD) and they are managed by the Board of Management (BOM) (www.royalhaskoning.com).

**Building Management & Consultancy**

The managers and consultants of the division Building Management & Consultancy create cooperation between people and organizations, between citizens, governments and businesses to get the best result. “They speak the different languages, think about the content of proposals & solutions and always work from their professional backgrounds, supported by specialists in many fields” (www.royalhaskoning.com). The managers and consultants are active in the field of urban areas & buildings, with activities from health care to infrastructure, from education to urban development and from office concepts to property.

The division Royal Haskoning Building Management & Consultancy is specialized in integrated management of building projects and high-quality advice in the field of corporate real estate. This division is convinced that high quality in building projects only can be reached if the cooperation between consultant, architect, engineers and contractors has high requirements during all stages of the building process. (www.royalhaskoningbm.com)
Royal Haskoning and sustainability

Royal Haskoning makes explicit in their annual report of 2007 that sustainability is an issue in the mission and daily work "We focus on important themes such as mobility, transformation of space, climate change, safety and risk, quality of life in the work environment, and aesthetics. This commitment to society is a source of inspiration." (Royal Haskoning, 2007). All parts of the organization assent the concerning contribution to a sustainable society (Royal Haskoning, 2007). The objective is to gain profit for the environment by realizing sustainable solutions (Royal Haskoning, 2007). Already in the environmental policy statement of the board of management of 2006 is stated: "Environmental management gives interpretation to our business corporate social responsibility. An ISO 14001 certificate also can contribute to show our added value to our clients." Still this statement is involved, therefore can be stated that Royal Haskoning is committed to the environment.

The commitment to the environment is contributed by the special interest group Royal Cradle. This is an interest group, active since the summer of 2008, consisting out of people of different (building related) divisions; Architecture & Building, Spatial Development, Architects, Building Services, Building Management & Consultancy and Environment. The philosophy of Royal Cradle is based on the philosophy created by Michael Braungart and William McDonough explained in the book Cradle to Cradle (2003). According to the authors it is possible to break through the spiral of exhaustion of natural stocks, of waste and of clogging. This can be obtained by devising and developing products on the basis of safe and entirely reusable raw materials. He opinion of Royal Cradle is safeguarding the future, they have developed themes to develop more concrete content which can be used in projects. These themes are explained in figure 3.

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Figure 3 Sustainability themes of Royal Cradle
According to the members of this group applying sustainable techniques has to do with working integral, willingness to succeed, everybody having the same philosophy and life-time thinking. Royal Cradle wants to accelerate the use of sustainable techniques by working integral between different divisions. The board of management is already stimulating to work integral between different divisions by the Business Balanced Improvement Card (2008). Royal Cradle is started to make the philosophy applicable, by intensive working together on a project. In that way they develop best practices and guidelines.

1.4 Evolving attention of sustainability

During time several initiatives have been taken to reflect the effects of human activity on the earth. By the end of the nineteen sixties the Club of Rome was set up. These European scientists brought together their concern of the future of the earth. The club of Rome published several reports concerning the environment; the most known is the one where they advise to border the increase of the economy.

The World Commission on Environment and Development (WCED) wrote the report “Our common future” in 1987, more known as The Brundtland Report. The striking conclusion of the report: the most important global environment problems are the consequence of the poverty in one part of the world, and the not-durable consumption and production of the other part of the world. They used the definition of sustainable development: “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.

In 1997 the Kyoto-protocol was established in the Japanese city Kyoto. It arranges reduction in emission of greenhouse-gasses. The aim of this pact is to reduce the emissions of greenhouse gasses and by that to reduce the undesirable impact of climate change. With this protocol the industrial countries have agreed to reduce the emission of greenhouse gasses in 2008-2012 with on average 5.2%, with respect to the level in 1990.

More recently the popular movie “An inconvenient truth” of Guggenheim presented by Al Gore (2006) is published. This movie is based on the report of Brundtland and presents the consequences of global warming on the climate. Although there is still discussion between scientists about the “truth”, the general opinion in global warming is alarming. The Intergovernmental Panel on Climate Change (IPCC), which is established by the United Nations, reports in their most recent report, that it is probable that the bulk of the re-heating of the last 50 years can be attributed to human activity (burning fossil-fuels, deforestation and stipulated industrial and agrarian) (IPCC, 2007).

Also The Netherlands is confronted with the effects of climate change due to greenhouse-gasses. According to Deursen (2001) the growing economy, population and climate change have a negative effect on the balance of the distribution of water. People are using all parts of the country and want to live close to the water. The rainfall will get worse because there is no storage. The problems will be dramatically, because the water is not secured.
1.5 Problem statement

In the preceding the evolving attention to sustainability became clear. Ofori (1998) makes clear what an important research of sustainability should be: “The relationship between construction activities and the environment is well recognized. Further effort is necessary to establish common concepts, principles and techniques relating to sustainable construction.”

There are just a few papers published about the relation of the building process and sustainability. Lotspeich, Rumsey and van der Ryn (2003) made some rules for the building process: work with integrated approach, use a neutral score sort system and use of outside energy efficiency reviewers. Unfortunately this paper has disadvantages; these rules aren’t referred and the authors live in the USA, where the building industry isn’t comparable with that of the Netherlands.

In the “Energy efficiency in buildings Facts and Trends report” of WBCSD (2007) is stated: “Progress can begin immediately because knowledge and technology exist today to slash the energy buildings use, while at the same time improving levels of comfort. Behavioral, organizational and financial barriers stand in the way of immediate action.” In other papers some general suggestions can be found. Unfortunately no paper explains or suggests a process to create a sustainable building.

Raiford makes clear in her paper (2002) that there is a huge need for design rules. She explains she gets questions of building owners how to get their building sustainable, but there is no do to list. Currently LEED is developing a set of guidelines for the operation and maintenance of buildings (Raiford, 2002). But LEED is a method to certificate buildings, not to help to improve the building process.

In other papers very trivial and general suggestions are given. Gangemi, Malanga and Ranzo (2000) suggest that specialists need to be part of the team early in the process. Ofori (2000) states that supply chain management can solve the problems related to the sustainable techniques. Therefore first the appropriate supply chain needs to be designed. Also Sorrell (2003) suggests trivial things like “safeguard against opportunism” and other authors suggest collaboration, clustering and so on. Unfortunately no paper explains the process to create a sustainable building.

Royal Haskoning states in their annual report 2007 “The term sustainability is an issue in mission and daily work of Royal Haskoning. In all sections of the company it is reflected concerning our possible contribution to a durable society in which the development of the current generation, which of the future generations can stand in the way.” Although the implementation of sustainable techniques in buildings seems to be too less, according to consultants of Royal Haskoning. They explained that there are situations where the principal have high level goals on sustainability but the developed building isn’t sustainable at all. This is an example representing the problem of implementing sustainability in buildings.
In literature hardly any information is published about the building process in relation to sustainability. Beside literature also Royal Haskoning is searching for the right implementation of sustainability in their building process. Royal Haskoning wants to know what needs to be changed to be able to realize real sustainability. The problem statement in this thesis is as follows:

| It is still unclear for Royal Haskoning how to achieve sustainability in building projects, given the high level goals of the principal. |

1.6 Research goal and questions

The preface made the personal motivation of Maaike clear; she wants to take a closer look to the building process to make sure buildings are more sustainable. In literature hardly any information about the relation of sustainable building and the building process is found. This matches the problem statement of Royal Haskoning, namely: What needs to be changed in the production process to realize projects which add sustainability? This process is complex and is affected by several different factors; like techniques, society or users and so on. The goal in this research is:

| Change the building process of Royal Haskoning to realize projects which achieve sustainability. |

Several definitions need to be explained before this goal can be obtained. For the definition of sustainability the Brundtland Report (1987) is used; “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. This definition makes clear what the core target of sustainability is; beside that it is a common used definition in research. The building process consists of several phases; initiative phase, definition phase, design phase, execution phase and usage (Maas, 2004).

The general research question behind this research is:

| How to implement sustainability in building processes? |

To find an answer to the research question several questions need to be made. These are formulated in the following:

- What does a building process look like?
- Who is involved in the building process?
- What are problems with the implementation of sustainability?

The research aims at a contribution to practice and to a science. Sustainability can be obtained when everything fits together, therefore designers need to cooperate. The media reports (LLiNK, 16-10-2008) creating a sustainable building is an easy job. This is a wrong perception; working together with different professions results in problems. Solving problems which occur because of fundamental differences (view on the project, language) is not an easy job.
Beside this practical relevance there's also a scientific contribution. In literature a lot of information can be found about techniques; information about the advantage, applicability and so on. Unfortunately there is hardly information available about the impact of these techniques on the building process. This research will generate insights in this part of literature.

1.7 Outline of the report

This report contains of six chapters. The first chapter is an introduction on the research. The second chapter will express the used methodology. The methodology expresses the approach of the research; how qualitative research is created and how validation of the design is ensured.

The research contains literature, which is discussed in chapter three. First literature about sustainability in general will be discussed and second literature about the relation of sustainability with the building process. After these topics literature, which relates to the created model, is discussed. Finally this relation will be discussed for the solution and generalization.

The analysis is explained in the fourth chapter. First an overview of the problem mess is created, followed by the preliminary cause and effect diagram. This model will be revalued with literature and finally one factor is chosen to redesign. The last section is a diagnosis of the whole situation.

The chosen factor will be redesigned into the design, in chapter five. First the design specifications are expressed, followed by the actual design. The implied insights in the design are discussed in the section tests. The implementation of the design is presented by a change plan, subsequent the conclusion follows.

In the final chapter conclusions and recommendations are stated. The second section in this chapter expresses the main contributions of the research. Subsequent the limitations are explained. This research could be expanded; the suggestions are stated in further research. The rest of the report represents an epilogue, the reference list and the appendices.
2 METHODOLOGY

2.1 Introduction

The approach of this research is based on a framework, which is explained in this section of the report. The methodological cycle of Van Strien is explained first. In the succeeding section the approach of the cycle specific for this research is discussed. This explains the approach to create an overview in the problem mess, the approach of the analysis & diagnosis and finally the approach of the design & change plan. The last section is a summary of the approach for this research.

2.2 Methodological cycle

The research is guided by the book *Problem solving in organizations* of Van Aken and others (2007). The regulative cycle of Van Strien is applied (Van Aken, 2007) to find a solution to the formulated goal. This results in a change plan suggested by their Business Problem Solving method. And finally it will result in recommendations for Royal Haskoning to the research goal. The cycle visualised in figure 4. The practical application of this cycle is presented in section 2.3.

First an exploration of the problem needs to be made (figure 4.1. Problem mess). This will be done by taking a closer look to different sorts of information related to sustainability (website, annual report et cetera), but most important with interviews. These interviews will be helpful to create a model of the problem, what is an overview of the factors which are related to the problem. This phase will result in the problem definition (figure 4.2. Problem definition).

The third phase of the regulative cycle is creating an analysis and making a diagnosis, see figure 4. This will be done by analyzing the obtained information again, but now focused on the problem definition. This will result in a preliminary cause and effect model.

![Figure 4 Cycle of Van Strien (Van Aken, 2007)](image-url)
The regulative cycle will be carried on by creating the solution (figure 4 phase 4. Design & change plan). First the requirements for the solution need to get defined. Second the solution needs to be created. To make sure this solution is realistic; this is evaluated with the predefined requirements and discussed with experienced people of the company. The third part of the solution is the change plan; this is a plan which helps to realize the object design, thinking about actions to be taken and actors which are involved (Van Aken, 2007). The change plan consists of two parts. The first part is the preparation part, a more exploring one. The second part is an action plan, in this part actions to be taken will be explained (Van Aken, 2007).

The fifth phase of the regulative cycle of Van Strien is the implementation of the design by the use of the change plan in the organization (figure 4 5. Implementation). The last phase of the cycle is about the evaluation of this implementation (figure 4 6. Evaluation). These last two phases of the cycle will not be executed. This choice is made because the time is too limiting to create the whole cycle. Therefore the focus will be on the phases: 1. Problem mess, 2. Problem definition, 3. Analysis & diagnosis and 4. Design & change plan.

The process of the cycle is iterative, because different steps will be taken during time. Beside that the process is parallel, because all the actions will be organized together. For example the definition of requirements and the model creation will be investigated simultaneously.

2.3 Approach

In this section the approach of the regulative cycle of Van Strien will be explained into detail. The research is an extensive case study of Royal Haskoning. “Qualitative methods are those that are oriented at the discovery of qualities of things, that is, the properties of objects, phenomena, situations, people, meanings and events.” (Van Aken, 2007). Therefore analysis will be done in a qualitative way by different sorts of information generated from the company Royal Haskoning.

In this section first the approach to create the problem definition from the problem mess is explained. Second the analysis & diagnosis phase of the cycle is explained. And finally the approach to generate a suitable design & change plan is explained.

Problem definition

To start this research the problem mess needs to be organized. Royal Haskoning is a company with more than 10 divisions. Therefore a selection of divisions is made in dialogue with the supervisor of Royal Haskoning. The focus will be on the five building divisions; Building Management & Consultancy, Architecture & Building, Environment, Spatial Development, Building Services, Industrial installations.

During the creation of the problem definition all problems, which are related to sustainability will be taken into account. In that way, all factors retaining sustainability will be present in this so called problem mess.
The collection of data to create the problem definition will be done by interviews and other available information of Royal Haskoning (website, annual report, intranet). To ensure enough mixture in interviewed, different professions and different management functions are interviewed. For an overview see the appendix 3.

The interviewer will organize an open type of interview. This means the interviewer does not structure the interview into detail. The only structure is obtained by the question “Why do you think we use so few sustainable techniques?” The interviewer will try to find the opinion of the interviewed about the sector and the company Royal Haskoning. The interviewer also tries to participate as less as possible in the interview, in this way the information is not biased by the interviewer.

The preliminary analysis of the collected information will be done by the creation of an Ishikawa diagram. This so called fishbone diagram is developed as a method for identifying and clarifying the underlying causes of a problem. The functionality is a quality improvement tool used for problem solving within industrial processes. An Ishikawa diagram can help making decisions about a process when it is out of control (Mitra, 2008). The Ishikawa diagram shows the causes found in the available information, which represents the validation of the problem.

In this section the restriction in phases needs to be made. The researcher will score the times that sustainability is already implemented in the phases of the building process and will score the times that sustainability is desired in the phases of the building process. The restriction of the process is made by a comparison between these current and desired situation. The phase of the building process which has the most potential will be chosen.

Finally the problem definition, phase 2 of the regulative cycle, needs to be formulated. The focus of the Ishikawa diagram is on sustainability in the broad view. The problem definition needs a smaller view; therefore one part of the diagram results in the problem definition. The selection of this part will be made by the suitability of the factor to the research goal and in cooperation with the supervisors.

Analysis & diagnosis

In the third phase of the cycle a lot of data is needed. The already used data will be analysed again, but now focused on the problem definition. The found factors will be placed in a dependency diagram, obtained by the Porras method. Complexity in problems makes it complicated to exactly give the factor of the problem, the Porras method helps distinguishing core problems and sub problems. In short “Stream Analysis is a mechanism for mastering problems that block effective (organizational) functioning” (Porras, 1987). The Porras method suggests ordering all factors in a matrix. The matrix will be filled in with a registration of relations between them. Finally the matrix gets transformed into a dependency diagram.
The second part of this phase is revaluing the created dependency diagram by literature. In this diagram all factors and relations between them are placed together resulting in a reliable diagram. The phase is closed by the selection of one factor from the reliable diagram, which is going to be designed. The selection of this factor is based on the possible influence by the researcher, suitability to the methodology and fit to the problem definition.

**Design & change plan**

The fourth phase of the regulative cycle is creating a design and a change plan. To start designing, first the functional specifications of the design need to be created. These specifications help to create a design that is suitable to the problem, to the situation and to the users.

The design itself is a solution to the problem definition, suitable to the requirements and practice. The design will make clear what needs to be done, by whom and when. It indicates the design implies a strategy, a participants-overview and a process. The design needs to be realistic; therefore it will be tested by the use of discussion with designers of Royal Haskoning.

The change plan is a plan to implement the design in the organization Royal Haskoning. It helps to realize the object design, thinking about actions to be taken and actors who are involved (Van Aken, 2007). The first part of the change plan is the preparation part; it explains what should be done before taking action. The second part is a plan to take action; it explains when, who needs to take which action.

### 2.4 Conclusion

This section explained the methodology, the regulative cycle of Van Strien. The analysis is done in a qualitative way by different sorts of information (website, annual report, interviews, et cetera). The first and second phases of the cycle are creating a problem definition out of the problem mess. During the creation of the problem definition all problems which are related to sustainability will be taken into account. An Ishikawa diagram is used to identify all factors retaining sustainability. In this phase also restriction in process phases is made.

In the third phase of the cycle the analysis and diagnosis will be made. Again the generated data is analyzed, but now focused on the problem definition. The result is a dependency diagram of the factors retaining sustainability. This diagram is completed by selected literature, what resulting in a reliable diagram. Finally one factor from the reliable diagram is chosen to be designed.

The fourth section of the cycle is creating a design and a change plan. First the requirements for the design will be studied. Second the actual design is spoken, subsequent the test by discussion with designers is presented. The final part is a change plan. This makes clear what should be prepared before real action is taken. The action plan will make clear when who needs to take which action.
3 APPLICABLE LITERATURE

3.1 Introduction

In this chapter all applicable literature will be discussed, literature from journals and books. First the definition of sustainability is made explicit along with related definitions. In section 3.3 the urgency of sustainability in construction is expressed. In the subsequent section literature is discussed suitable to the preliminary cause and effect model. In the final section literature suitable to the design is expressed.

3.2 Sustainability

The attention to sustainability is evolved during time. Several initiatives have been taken to reflect the effects of human activity on the earth. But still there is an unsolved problem: what is sustainability and how can we measure it? According to Ducey and Larson (1999) this is a problem what arises because of different perceptions of sustainability, of different value-appreciations, of different information available and so on. Beside they state that making decisions about sustainability is difficult because we make decisions based on subjective information, uncertainty or ambiguous. Also Phillis and Andriantiatsaholoiniaina (2001) state that this is difficult; they state there are many factors (ecology, social, politics and economy) influence sustainability. The biggest challenge is to make the right decisions, because of the balance between short and long effects (Ducey and Larson, 1999).

Anyway before further exploration of the problem statement several definitions need to be clear. As expressed before the used definition of sustainability is the one of the Brundtland Report (1987); “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Glavič and Lukman (2007) have done a literature survey about terms of sustainability and summarized these definitions in a paper. Some of them will be used and are repeated here: “Eco-efficiency is the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with the earth’s estimated carrying capacity. Life cycle addresses all stages and the life time of products, their environmental impacts as well as services, manufacturing processes, and decision-making. Cradle to cradle is a paradigm, based on principles in which materials are viewed as ‘nutrients’ circulating in closed loops” (Glavič and Lukman, 2007).

Cradle to Cradle is a philosophy explained in the book Cradle to Cradle (2007). Braungart and Donough, the authors of the book, opine that the current environment policy means too much debt-management, which tries to find the answers in consuming less and minimizing the rest (Cradle to Cradle, 2007). Cradle to Cradle (C2C) is a clear philosophy; devise and develop products on the basis of safe and entirely reusable raw materials. The current spiral, of exhaustion of natural stocks, of waste and of clogging can be broken in this way. So eco-efficiency must be replaced by eco-effectiveness. Striking point of the authors is the fact that “less-bad” is good, we don’t need to change completely at ones (Cradle to Cradle in vogelvlucht).
3.3 Construction and sustainability

In the preceding is explained that sustainability is difficult to measure and the philosophy of C2C is explained. Still the relation of construction and sustainability is unclear. According to Phillis and Andriantiatsaholimaina (2001) sustainability in construction is an issue because there are several natural systems going to collapse because of the growing global economy. Their question is: “How to assess, build, and maintain a sustainable economy that will allow the human society to enjoy a sufficiently high standard of living without destroying its natural and biological support?” Their opinion is that this needs to be done with sustainable developments.

Mlecnik (2007) state that about 40% of the total energy consumption is used in the built environment. In the paper of Herbrigs and Peschier (2007) is stated the construction sector is responsible for 40% of the total waste production in the Netherlands. Also World Business Council on Sustainable Development (WBCSD) (2007) announced the same sort of information: “Buildings are responsible for at least 40% of energy use in most countries. The absolute figure is rising fast, as construction booms, especially in countries such as China and India. It is essential to act now, because buildings can make a major contribution to tackling climate change and energy use.” Therefore creating sustainable buildings is urgent.

Building sustainable means: Creating a building in which there is a balance between people, planet and profit, also called the triple bottom line. The statement of WBCSD is: "Sustainable development involves the simultaneous pursuit of economic prosperity, environmental quality and social equity. Companies aiming for sustainability need to perform not against a single, financial bottom line but against the triple bottom line." This statement makes clear there is a desire by multiple parties (in WBCSD are several big companies represented) to develop sustainable.

Before creating a sustainable building it needs to be clear how this can be measured. Several tools are designed to measure sustainability in diverse ways; examples of tools are LEED, BREEAM, GPR. The target of these tools is setting benchmarks to give a quick view on the sustainable-performance of a building.

3.4 Literature for analysis

The current market is changing fast, globalization claims action (Kotter, 1996). The globalizing economy creates more risks and more opportunities for everyone. She forces companies to accomplish improvements, not only to compete and to achieve success, but also to survive. According to Hong-Minh and others (2001) “Ever-increasing competition within the construction industry is the stimulus that has forced companies to respond more efficaciously, efficiently and selectively to customers' requirements”. Also Pektas and others (2006) see that the current competitive market will lead to an increase of the awareness of more efficiency of processes.
Because of the changing market companies need to distinguish themselves of others, this could be done with implementing sustainability. Implementing sustainability can be seen as an innovation, because it’s perceived as a new implementation (Rogers, 2003). Kürzinger (2004) concluded why it is so difficult to implement innovations “Organizational weaknesses, resistance to change, routine behaviour and risk aversion are among the internal reasons for a lack of widespread implementation in a large number of companies of many of the cost-saving & profit-enhancing measures with positive environmental impacts (win-win-options)”.

The traditional building process is built out of several phases: initiative, definite, design, realize, after care (Maas, 2004). In the initiative phase the principal comes aware of the fact he wants to realize a new building. In the definite and design phase he will create a schedule of requirements and an actual design of the building. The schedule of requirements is defined by Maas (2004) as the (content) order to the designers; it must be possible to create designs with potential alternatives. “At minimum the schedule of requirements must contain main points and restrictions with respect to the new building to the functions and remaining location-specific conditions and to the financial framework “(Maas, 2004). In the third section the building gets a final design, which is a design what makes explicit: construction, building installations, materialization and detail (Maas, 2004). The fourth section in the process is the realization of the building and in the final section the principal will use the building and some after-care will take place.

The market is not static anymore it has a dynamic question to accommodate, Brink and ten Dam (2009) state that organizations are constant evolving. “The static offer to housing must be elastic to react on these dynamics. Important starting-point for elasticity (or adaptive capacity) is diversity in housing.” (Brink and ten Dam, 2009). This can be obtained by a more integrated approach to create a sustainable building. In figure 5 Brink and ten Dam (2009) have proposed a process model of participation of consultants in the building process. In the first phase Manage and usage the consultant help with ascertain the awareness of the usage of the building. In the second phase, Initiative and definition, they help by defining the schedule of requirements. In the Design phase they help implementing the schedule of requirements in the blue print. And finally the consultant help in the Realisation phase by observing the usage of the building and advising to start phase Manage & usage again.
Brink and ten Dam (2009) state that an integral advisor is wanted to ensure the proposed process model. Some advantages of the model are indicated. First the integral advisor ensures a tune between the different parties involved in different phases of the process. Second in each phase the best solution is consolidated because the integral advisor is able to judge qualitative, quantitative and financial aspects. Third the integral advisor knows the substructure of the documents, instead of only the facts of the documents.

Obtaining sustainability is difficult to realize because it is a social process (Adamides and Karacapilidis, 2006). Adamides and Karacapilidis (2006) state that teams which create the building are important "The use of cross-functional teams with diverse occupational and intellectual backgrounds increases the likelihood of combining knowledge in novel ways". These teams function optimal when there is enthusiasm, ambition of the principal and enough power to ensure the solution (Verlinden, 2008). Within the teams the social interaction is important, which can be obtained by trust (Pektas et al., 2006, Hong-Minh et al., 2001, Kürzinger 2004, Verlinden, 2008). In the construction sector people need to work in teams, supported with tools (Kürzinger 2004); such as business planning, marketing strategy and systematic documentation. Unfortunately these tools seem not to fit.

In the construction sector can be spoken about collaborative design because teams consist of different professions (Pektas et al., 2006). As stated before teams need to have trust among the members, therefore the relation needs to be based on: commitment, openness and mutual understanding (Hong-Minh et al., 2001). Mutual understanding is difficult because different professions need to work together. Good communication is therefore crucial, because each profession makes his own decisions which have influence on other decisions (Verlinden, 2008), what can be called interaction. Also Lloyd (2000) states designing has to do with social interaction. "Team performance depends on individual behaviors and interpersonal interactions as well as technical competence" (Fitzpatrick and Askin, 2005). The importance of collaborative design can be illustrated by the metaphor of Godfrey Saxe about a blind-men-club who meets an elephant (figure 6). The men were touching the elephant and all did thought they were touching something else. The man who touches the tail thought it was a rope; the knee was seen as a tree and so on. If they communicated and explained what they felt, they would have known it was an elephant. This example suits with Lloyds (2000) statement, it is important to work as a team to overcome this type of communication problems.
Interaction will lead to the best design; if interaction is possible every profession can get the opportunity to react on others ideas and implement his knowledge (Verlinden, 2008). Caluwé and Vermaak (2006) explain interaction by the following characteristics: inspiration, openness & respect, vitality, collectivity of ambitions, consensus & conflict willingness, imitative & action, learning capacity. Rogers (2003) "Interactivity is the degree to which participants in a communication process can exchange tools in and have control over their mutual discourse."

Knowledge plays a role within the team (Verlinden, 2008). The individuals have diverse backgrounds, skills and cognitive spheres what results in different sorts of available information (Adamides and Karacapilidis, 2006). Adamides and Karacapilidis (2006) also state individuals have their own role and their own profession language. Important is that all the members of the team do not forget they are creating for a customer, in that way they have the same goal to obtain. (Hong-Minh et al., 2001).

Communication is an iterative process; when new knowledge becomes available, decisions should be revised (Pektas et al., 2006). This process is therefore difficult to plan and budget (Verlinden, 2008). These iterative steps can be made if the mind-set of the teammembers allows it (Hong-Minh et al., 2001). Only with that mindset it is possible to talk about critical factors, influences and other things to create a good view on the project (Pektas et al., 2006).

Rogers (2003) explains in his book that the diffusion of the process as "an innovation is communicated through certain channels over time among the members of a social system", this statement covers the preceding. Important for the implementation of sustainability is you have to deal with social processes, with a lot of different people, with the relation between these peoples and with the communication between them.

3.5 Literature for design

Mendler and others (2005) suggest in their book "The HOK Guidebook to Sustainable Design" a new approach of these phases. They want to create sustainable buildings and have created their own phasing. They suggest: 1 project definition, 2 team building, 3 education & goal setting, 4 site evaluation, 5 baseline analysis, 6 design concept, 7 design optimization, 8 documents & specifications, 9 bidding & construction, 10 post occupancy. In some way this is a fill in of the traditional building process, but also there are some differences; like the teambuilding and design concept.

The design studio QuA has experiences in specializing 'Brand Environment Design'. "Brand Environment Design (BED) makes a brand visible on all levels. Designing from the core disciplines: architecture, interior architecture, graphic design and multimedia, QuA develops all activities that support clients in building and maintaining an effective and consistent brand image." (www.qua.nl). QuA has an interesting view on designing, they think you have to divergent to several ideas, convergent to one concept and then make the concept defined simply and decisively to be able to edit and check the objectives (diagram 1).
Editing and checking can occur when the concept is designed SMART; what stands for Specific, the objective must be univocal; Measurable, under which (measurable/noticeable) conditions the objective has been reached; Acceptable, the target group and/or management will accept this objective; Realistic, the objective must be feasible and Time-tied, when (in the time) it must be reached.

The design needs to stimulate one factor. This stimulation can be found in open innovation or in a cooperation model. An open innovation is advancing technology by external as well as internal ideas and paths to market (Chesbrough, 2004). "Open innovation assumes that internal ideas can also be taken to market through external channels, outside a firm’s current business, to generate additional value" (Chesbrough, 2004). Slowinski et al. (2009) state that firms are not capable anymore to deliver breakthrough products, the state “A new model is rapidly emerging in which firms collaborate with other world-class organizations in an open model to jointly develop the next generation of goods and services” (Slowinski et al., 2009).

Fredriksson (2005) has used the definition of a cooperation model: which collects, from different perspectives, of recommended strategies, activities and methodologies for working together to create changes. In her researched she has found some clues to a cooperation model, which are involvement, activity, leadership and communication. Pino and Katsenes (2007) have found that “The cooperation model has translated to successful partnership efforts throughout the state”. They used a model where several actors which were forced to cooperate.
The cooperation model is equally relevant to business model design phases, according to Braet and Ballon (2008). In their opinion cooperation between various stakeholders is necessary. Therefore they have defined business model design phases, which are: 1. Organization design phase. 2. Technology design phase. 3. Service design phase. And 4. Financial design phase. "This framework emphasizes organization design as the starting point of any business modelling or cooperation modelling. This is especially relevant in cases where convergence between various stakeholders and sectors increases the strategic importance of organizational design significantly." (Braet and Ballon, 2008)

The design will be executed in a team. Creating a building is a multidisciplinary task, according to Denton (1997): "team working can enable individuals with a range of knowledge and skills to work together and solve problems or realize opportunities that an individual specialist could not." Ind and Watt (2006) make clear: team working needs a formal structure otherwise vulnerable, confused, and isolated feelings come which oscillate between defensive and aggressive behaviour.

The creativity of teams can be confirmed when the impact of personal characteristics and environmental factors are taken into account (Kratzer et al., 2008). "The study indicates that it is not the leaders strongly involved in internal networks that stimulate teams towards creativity, but rather the leaders who are able to gather the necessary information and knowledge outside the team and to distribute this intelligently within the team." (Kratzer et al., 2008). They state that the choice of a team leader should be based on managerial capabilities rather than on professional expertise.

The design-strategy can be form in a charrette. The National Charrette institute (NCI) explains what the French word "charrette" means "literal it means cart, but now it is often used to describe the final, intense work effort expended by art and architecture students to meet a project deadline."
The term is originally used on the École des Beaux Arts in Paris during the 19th century, proctors moved by with a cart and the students needed to deliver their design, they frantically needed to finishing touches their work (www.charretteinstitute.org).

The NCI poses advantages to use charrettes: it saves time & money and increases probability for implementation. This will be reached by: time-compressed design sessions, reduced rework through short design feedback loops, broad support from citizens, professionals, and staff, multi-disciplinary teamwork, early focus on engineering and finance, bringing all decision makers together for a compressed period of time (www.charretteinstitute.org).

Tanaka et al. (2008) also state the use of charrettes. "Usually, charrettes take place towards the beginning of a community planning process, but they can occur at any stage where public visibility of the design process is useful, or when it is useful to generate a lot of energy in the planning process" (Tanaka et al., 2008). They stated that charrettes participants include the community organizations, residents, property owners, as well as professionals; everybody who has to deal with the design. These participants will work for at least one day on drawings and programming ideas based on maps, visits to a site, inspiration from precedents elsewhere, and other local information.
The charrette needs to be filled in with actions; suggested actions are sketch designing and storytelling. Sketch designing is creating a design by visual representations. Goel (1995) states that the way of working nowadays requires the thought to be precise, rigid, discrete, and unambiguous, but our thoughts aren’t that defined. Goel states that “working through the symbol system of sketching” enables us to capture and create ideas. The underlying themes regarding the role of sketching in design is pointed out by 1) supporting a re-interpretive cycle in the individual thinking process, 2) enhancing the access to earlier ideas (Lugt, 2005).

Whyte et al. (2008) has found out that visual practices play an important role in the project-based. “Visual practices provided a bridge between project work and wider organizational processes.”

Kim (2007) has done researched on the capabilities used by expert designers and novice designers. “Expert designers decided design concept later than student designers and the later the design concept is decided, the more creative the product made.” Lloyd (2000) noted that “activities which are often thought of as individual—drawing, sketching, listing requirements, etc.—add to the narrative of a particular design project by producing objects for communication and discussion, and these objects contribute to the ongoing discourse.”

The second action in the charrette is storytelling. Gabriel (2000) explains in his book that myths, stories, and folklore are part of the fabric and life of all organizations. They enable people to understand, identify, and communicate about the organization. Lloyd (2000) has observed “storytelling to be a mechanism that aids the construction. The consequences are that a language is ‘invented’ which allows a description of the ongoing experience of that product and design process.” When the experience is told and re-told a language is created what helps to negotiate about the factors influencing the design. There are social key points of the design (meeting, talk with the customer, a chat among several engineers) and technical key points (cycle time, the thickness of coating) which will be easier to discuss in a common language.

During the design several ideas can be generated by the team. To chose the best option Multi Criteria Analysis (MCA) can be used. MCA is a non-monetary evaluation method (by several criteria) to make a choice between several discreet alternatives. Discreet means the options are independent of each other and the number of alternatives is limited. Non-monetary means the impact of the alternatives can not be expressed in money (Beinat, 1997 and Hellendoorn, 2001).

According to Hellendoorn (2001) several characteristics can be recognized in MCA, which are; * measurable in several entities * weighting of criteria * overview of the alternatives. MCA is difficult because of an information gap; beside that several methods are known. ReinsDAGen (2007) states that starting a MCA only is possible if the alternatives are well thought-out, the factors are consent with the participants and the need of the MCA is clear. This need could be low for example if immediately is clear that one option is the best or when the weighting of the criteria is impossible to define.
In the paper of Pohekar and Ramachandran (2004) is indicated that the application of Multi-Criteria Decision Making (MCDM) methods is changed to socio-economic scenario. "Increasing popularity and applicability of these methods beyond 1990 indicate a paradigm shift in energy planning approaches." (Pohekar and Ramachandran, 2004). They state that the Analytical Hierarchy Process is the most popular technique which is followed by technique called PROMETHEE and ELECTRE.

Pohekar and Ramachandran (2004) also explained some methods. A small summary is created here. Analytical Hierarchy Process: "The essence of the process is decomposition of a complex problem into a hierarchy with goal (objective) at the top of the hierarchy, criterions and sub-criterions at levels and sub-levels of the hierarchy, and decision alternatives at the bottom of the hierarchy." PROMETHEE: "This method ranks alternatives, combined with the ease of use and decreased complexity. It performs a pair-wise comparison of alternatives in order to rank them with respect to a number of criteria (usual criterion, quasi criterion, criterion with linear preference, level criterion, criterion with linear preference and indifference area, and Gaussian criterion)". ELECTRE; "This method is capable of handling discrete criteria of both quantitative and qualitative in nature and provides complete ordering of the alternatives."

The design is a suggestion to change the building process. This suggestion also needs to be embedded in the organisation therefore change management is needed. According to Kotter (1996) a change within a company can be divided into eight phases see figure 7. According to him these phases need to be executed in this order to obtain a good change. He also states several mistakes, like: too much self-satisfaction, no sufficiently powerful leading coalition, underestimates the strength of vision and so on.

<table>
<thead>
<tr>
<th>John P Kotter’s “Eight steps to successful change”</th>
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<tr>
<td><strong>Increase urgency</strong> - inspire people to move, make objectives real and relevant.</td>
</tr>
<tr>
<td><strong>Build the guiding team</strong> - get the right people in place with the right emotional commitment, and the right mix of skills and levels.</td>
</tr>
<tr>
<td><strong>Get the vision right</strong> - get the team to establish a simple vision and strategy, focus on emotional and creative aspects necessary to drive service and efficiency.</td>
</tr>
<tr>
<td><strong>Communicate for buy-in</strong> - Involve as many people as possible, communicate the essentials, simply, and to appeal and respond to people’s needs. De-clutter communications - make technology work for you rather than against.</td>
</tr>
<tr>
<td><strong>Empower action</strong> - Remove obstacles, enable constructive feedback and lots of support from leaders - reward and recognise progress and achievements.</td>
</tr>
<tr>
<td><strong>Create short-term wins</strong> - Set aims that are easy to achieve - in bite-size chunks. Manageable numbers of initiatives. Finish current stages before starting new ones.</td>
</tr>
<tr>
<td><strong>Don’t let up</strong> - Foster and encourage determination and persistence - ongoing change - encourage ongoing progress reporting - highlight achieved and future milestones.</td>
</tr>
<tr>
<td><strong>Make change stick</strong> - Reinforce the value of successful change via recruitment, promotion, new change leaders. Weave change into culture.</td>
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*Figure 7 Eight steps to successful change (Kotter, 1996)*
Change management is also described by Caluwé and Vermaak (2006). They have created a theory in which actions, organizations and persons are typified by colours. An overview of these types is created in Appendix 4. "Aannames van de vijf kleuren". The colours are a tool for choosing the most promising change for a certain problem in a certain organization. They state that first a broad diagnosis of the sting of the question or the germ for the change need to be created. The sting refers to where the problems come from and what she maintains. The germ refers to a possible pretext for renewal that can achieve a positive impact.

These sting and germ will be typified by colours; the solution, problem, organization and so on need to match by colour. The colours are explained several times in the book, the questions belonging to the colours can be found in the Appendix 5. "Vijf woordenboekjes voor vijf veranderkleuren". According to Caluwé and Vermaak (2006) it is important to know what colour the different parts of the change have. It is not strange to have problems when a Green organization wants to change by the use of Red methodologies. They state you have to analyze what the matching colours are and then find a suitable solution. This change approach is more than just "do it", the authors also thought about values, standards and manners of thinking which people are used or attached to.

Rewarding is necessary to lead succeed the plans of the change management. According to Mackay (1992) it is important to give every individual an own task, because everyone is unique. Mackay also stated that people need to feel a sense of excitement and need to be encouraged to think and not just work. Harrington-Mackin (1994) states that the team needs to motivate performance. Beside that the team needs to get reviewed what must reinforce. The organization also needs to value the whole team instead of the individual persons (Dickinson and Isaac, 1998). "Rewarding people in team environments base don relative levels of giving significantly increases contributions to the team with less polarization of giving than when rewards are base on absolute levels of giving." (Dickinson and Isaac, 1998).

According to Harrington-Mackin (1994) rewarding needs to be done in 2 ways, external rewarding and internal rewarding. Examples of extern are; payment, bonuses, plaques, notes, publicity and so on. Examples of internal are; satisfaction from accomplishing the team goal, sense of well-being deriving from strong work relations, creative challenges, increased responsibility, learning opportunities and so on.
This chapter is started with the explanation of sustainability. The used definition of sustainability is; “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” of the Brundtland Report (1987). In this report there will be focussed on the philosophy Cradle to cradle, which is “a paradigm, based on principles in which materials are viewed as 'nutrients' circulating in closed loops” (Glavič and Lukman, 2007). Cradle to Cradle (C2C) is a clear philosophy; “devise and develop products on the basis of safe and entirely reusable raw materials” (Cradle to Cradle, 2007).

In the third section literature of the relation between construction and sustainability is discussed. The World Business Council on Sustainable Development (WBCSD) (2007) announced: “Buildings are responsible for at least 40% of energy use in most countries. The absolute figure is rising fast, as construction booms, especially in countries such as China and India. It is essential to act now, because buildings can make a major contribution to tackling climate change and energy use.” In the subsequent section problems due to the implementation of sustainability in buildings is expressed.

The last section provides literature about the design, the used definition of a cooperation model: it collects, from different perspectives, of recommended strategies, activities and methodologies for working together to create changes (Fredriksson, 2005). The design also includes charrettes “a final, intense work effort to meet a project deadline” (www.charretteinstitute.org), filled in with sketch designing and storytelling. Finally the theory of Kotter (1996) and the colour-theory (Caluwé and Vermaak, 2006) are presented, together with rewarding.
4 ANALYSIS

4.1 Introduction

The regulative cycle of Van Strien (Van Aken, 2007) suggests to start with creating an overview on the so called problem mess. Therefore an Ishikawa diagram will help to create insight. The second phase of the regulative cycle is creating a problem definition from the problem mess, the problem is chosen from the Ishikawa diagram. In section 4.3 the model created during analysis is expresses, preceding on this model clarification of the process is given. Subsequent the model get revalued with literature, this means the model gets a theoretical background. In the fifth section the choice from the obtained factors will be expressed. And finally the diagnosis about implementation of sustainability in the building process is discussed.

4.2 Overview of the problem mess

In the first phase of the regulative cycle of Van Strien the problem mess needs to get organized. This organization helps to create oversight on the whole problem, in that way a good problem definition is created. As stated in the second chapter the collection of data is done by interviews and other available information (website, annual report, interviews, literature, intranet, intern papers). This information is organized in an Ishikawa diagram, which represents the identification and clarification of the underlying causes of the problem found in the available information.

The Ishikawa diagram (figure 8) consists of one main line with four lines connected to it. The end of the main line represents the problem, no sustainable result. The lines connected to the main line represent the found factors. The location of line indicates how important it is (close to the problem is more important). The first line is called Principal, the second Co-operation in the sector, the third Royal Haskoning and the last one Certification.

Figure 8 Ishikawa diagram
The nearest line to the problem is called Principal and has to do with the assignment of the principal. The first factor of this line is low priority of sustainability of the principal; "Our principals see sustainability as an addition" (Specialist interviewed). Second factor is difficult to assess sustainability into money; principals expect a reclaim of their money in about five years. Unfortunately sustainability can't be calculated very well, it can be compared with the impossibility of expressing happiness into money. The next factor is called no MVO (Maatschappelijk Verantwoord Ondernemen); principals don't always state the triple bottom line (people, planet & profit) in their vision & mission and in that way do not care about sustainability. The last factor is the moderate type of principal, principals are more often moderate types; they avoid risks. "Principals do not desire new techniques; they want to be sure about their investment." (Advisor interviewed). “The type of our principals is moderate; they do not want to take any risk” (Specialist interviewed).

The second line is called Co-operation in the sector and has to do with the conservative behaviour of the sector. Integral working has to do with co-operation between parties. Unfortunately the behaviour in the sector holds this back. Sustainability will be obtained if everything fitting together; therefore people have to cooperate in early stages of the design process what is not the case in the traditional building process (Maas, 2004). The second factor is called conservative; just a few people dare to implement sustainable techniques; often only proven techniques are used. The last factor is called bad process; the process of creating a building is indistinctive and therefore difficult to predict and manage.

The third important line is indicated as Royal Haskoning, the environment of the employees of Royal Haskoning. The factor structure indicates there is influence of directing the company by divisions. Sustainability can be obtained if the sustainability themes (figure 3) reinforce each other, they all have to match. The board of management stimulates to work integral between different divisions by the Business Balanced Improvement Card (Royal Haskoning, 2008). The second factor has to do with culture; knowing everybody is impossible, especially for young people. Because of this lack of network people work traditional instead of across division boarders. The third factor has to do with the philosophy Cradle to Cradle; this philosophy is not ready to use in practice for building design, therefore employees do not understand the implementation into their projects. Finally Royal Haskoning has a lot of different employees with their own doubts about sustainability. “There are colleagues who state that sustainability is a marketing trick” (DAG interviewed).

The last indicated line is called Certification. Sustainability is measured in divers ways to give a view of the sustainable-performance of the building (examples of tools are LEED, BREEAM, GPR). Unfortunately the impact of details are not clear in the tool, "I do not know what exactly happens if I switch to concrete instead of metal" (DAG, interviewed). Beside this practical problem the tools are not always applicable, because they are not created for that type of building, for that location and so on. And finally the tools are not comparable to each other.
Before moving further the term building process needs clarification. The building process consist of five phase (figure 9 and section 3.4). In the traditional building process the principal gets aware that he needs a new building and he creates a schedule of requirements. The schedule of requirements is defined by Maas (2004) as the (content) order to the designers; it must be possible to create designs with potential alternatives. “At minimum the schedule of requirements must contain main points and restrictions with respect to the new building to the functions and remaining location-specific conditions and to the financial framework “(Maas, 2004). Designers are defined as architect, engineer and environmental scientist. Subsequent the principal charges an architect to create a design and asks designers to define the design into detail. The third part is actual realizing the building and finally the principal will use the building (potential after-care) (Maas, 2004).

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Definition</th>
<th>Design</th>
<th>Realisation</th>
<th>After care</th>
</tr>
</thead>
</table>

Figure 9 Traditional building process (Maas, 2004)

Royal Haskoning wants a more integrated approach to create a sustainable building, stimulated by the Business balanced improvement card of 2009 (Royal Haskoning, 2008). In figure 5 section 3.4 a process model creates the suggested participation of consultants in the process (Brink and ten Dam, 2009). Royal Haskoning wants to help the principal in the beginning of the process, as stated in section 1.3 the division Building Management & Consultancy desires to help the principal by the creation of the schedule of requirements. According to Royal Cradle applying sustainable techniques has to do with working integral, willingness to succeed in sustainability and everybody having the same philosophy. This means the traditional building process is not suitable anymore and a change in the process is desired.

The change in the traditional building process focuses on one phase; otherwise the change is too complicated. This phase needs to have potential to implement sustainability. In figure 10 this potential is analysed by an overview of moments when sustainability is present and when desired. In the upper arrows indicate a moment when sustainability is currently implemented, the lower arrows indicate the desired moment of implementation of sustainability in the project. These arrows are moments suggested by the interviewees (an arrow is placed if interviewees stated that moment). The most promising moment to implement sustainability is the phase which indicates the most upper and lower arrows. This moment seems to be the definition phase, therefore the restriction of the process will be the definition phase.
The insight in the problem mess presented in the Ishikawa diagram in figure 8. It is clear that four areas of the problem are found; Principal, Co-operation in the sector, Royal Haskoning and Certification. A good sustainable project is indicated being a result of reinforcement on each other of the sustainability themes (figure 3), they all have to match. Finally there is also made a restriction to the process; there will be focused on the definition phase. The goal results in: Change the definition phase of the building processes of Royal Haskoning to realize projects which achieve sustainability.

4.3 The preliminary cause and effect model

The problem mess is ordered using the Ishikawa diagram. In section 4.2 is chosen to focus on the definitions phase, so the goal is: Change the definition phase of the building processes of Royal Haskoning to realize projects which achieve sustainability. In this section the term project will get clarification. Subsequent the preliminary cause and effect model will be explained.

The term project needs clarification because it can mean a lot of different things. Prince2 defines a project as a finite process with a clear beginning and end. They advice a product based planning which is based on the products which (interim and to the end) must be produced (www.prince2.com).

In this research the project starts when the principal becomes aware that he needs another accommodation and ends when the accommodation is dismissed. If a principal has taken sustainability in his vision and mission, this means the principal wants his ongoing process to be sustainable. This research focuses on the project and therefore needs to be sustainable as well. See figure 11 for a visual representation of the term project.

The third step in de cycle is 3. Analysis & diagnosis. This will be done by the use of the Porras method (Porras, 1987). Porras suggests placing different factors in a matrix and register the relation between them. By the use of the matrix a dependency diagram of all factors can be made (explained in section 2.3).
The preliminary cause and effect model (figure 12) gives an overview of the factors which influence a sustainable result. These factors are distinguished from the already used data (website, annual report, interviews, literature, intranet, intern papers), but now focussed on the new goal.

The first relation found is *no implementation of techniques*. This factor determines a sustainable result only can be obtained if techniques are implemented. The three factors which influence this implementation of sustainable techniques are called: *Bad start of the design phase*, *no suitable budget* and *conservative sector*. The first factor is about the creation of the design, started with the creation of a vision and a concept. The second factor, *no suitable budget*, has to do with the available money for the whole project and the distribution of the budget on the project. The final factor, *conservative sector*, has to do with the attitude of employees.

In figure 12 the green blocks represent the factors found related to each other by arrows. The blue blocks represent the factors found related to each other by arrows, but not amendable by Royal Haskoning because they are factors of the principal.

![Diagram](image)

Figure 12 Preliminary cause and effect model

The three factors which influence the implementation of sustainable techniques are discussed below. The first factor is called *bad start of the design phase* and has to do with making explicit what is wanted by the principal and consultants. A good start is important otherwise the change of success to obtain sustainability is small. This factor is split up into *no vision* and *no concept*.
The design process is easier if the designer knows what to do; therefore a vision and concept are needed. The factor no vision gets influenced by the factor unclear ambition of principal and no C2C vision available. Unclear ambition of principal indicates that principals do not exactly know what they want. "The principal does not have a clue of the options" (Project manager interviewed). The factor no C2C vision available has to do with the situation where a philosophy is wanted to be implemented but no application is created.

The factor no concept is important, because that will be the basis of the SMART design. This factor gets influenced by the factors inconsistent decisions and effort for concept thinking. The factor inconsistent decision occurs because the factor vague decision factors is presented. "How can an expert make a good decision, if he does not know the criteria of a good design?" (Advisor interviewed). The criteria are not clear because no C2C vision is available.

The second factor related to no concept is effort for concept thinking. "An constructor is not used to think in concepts like an architect" (Architect interviewed). In figure 12 the factor effort for concept thinking is divided into own language and difficult to work integrated. Different languages can not communicate "An architects defines floor high different then a constructor, but the word is the same" (Architect interviewed)." Difficult to work integrated has to do with different professions, each with their own visions on the problem and too little time for meetings to work together.

The second factor which influences no implementation of techniques is the factor no suitable budget; with the related factors techniques not implemented in planning and techniques difficult to express in money. The implementation of sustainable techniques should be taken into the planning. "These techniques require more time and money then conventional techniques, but no extra time or budget is reserved" (DAG interviewed) Second the principal wants to see a reclaim of money, but a sustainable technique is difficult to express in money (see section 4.4 Overview of the problem mess for this explanation).

The last factor which influences no implementation of techniques is conservative sector. According to employees the construction sector doesn't dare to take risks. The sector creates buildings with proven techniques, resulting in routine actions. To come to a sustainability building, new techniques should to be used.

The preliminary cause and effect model did not change anymore after some time. Adding new information did not change the model anymore. This moment the model became static and can be seen as a representative model of the information. The second step in the process is finding out what is said about the relations and information in literature.
4.4 The model revalued with literature

The phase Analysis & diagnosis of the regulative cycle of Van Strien is continued by revaluing the created dependency diagram by literature. The information found in papers, discussed in Chapter 3, will shape the preliminary cause and effect model into a revalued model. The difference between the models can be found in appearance and disappearance of factors and relations between them.

The first factors related to No sustainable budget are not changed. The revalued model has the same factor no implementation of techniques and the factors Bad start of the design phase and no suitable budget. The first change is change is the factor Conservative sector changed in Willingness. The revalued model is explained into detail in this section.

![Image: Revalued model](image)

**Figure 13** Revalued model

First the factor Bad start of the design phase is discussed. Related to this factor is the factor no vision, which gets influenced by the factor unclear ambition of principal and No C2C vision available. The factor unclear ambition of principal is confirmed by Kürzinger (2004) “Organizational weaknesses, resistance to change, routine behaviour and risk aversion are among the internal reasons for a lack of widespread implementation in a large number of companies of many of the cost-saving & profit-enhancing measures with positive environmental impacts (win-win-options)”. This indicates the principal has less organizational power to ensure sustainability because of the unclear ambition and vision. Also Verlinden (2008) states that there need to be enough power to ensure ambition.
The second factor influencing no vision is the vision of Royal Haskoning about C2C. Royal Cradle is evolving in the creation of this vision, but now there is not yet an applicable vision of C2C. This factor is also confirmed by Kürzinger (2004) because again the organization needs to have power to ensure sustainability. The factor no C2C vision available also influences the factor no concept. The evolving activities of Royal Cradle create an applicable vision of C2C, what influences the ability to create the concept.

The second factor related to no concept is called boundaries; the WBCSD (2007) stated that "Behavioural, organizational and financial barriers stand in the way of immediate action." Beside these factors, also Phillis and Andriantiatsaholinaina (2001) speak about boundaries. They collected called them ecology, social, politics and economy. The block boundaries is important because these factors block the creation of the concept.

The final factor related to no concept is called effort for concept thinking. Adamides and Karacapilidis (2006) state that teams which create the building are important "The use of cross-functional teams with diverse occupational and intellectual backgrounds increases the likelihood of combining knowledge in novel ways". Concept thinking is influenced by the backgrounds, skills and cognitive spheres specific for each profession (Adamides and Karacapilidis, 2006). Therefore the block difficult to work integrated is confirmed.

The factor difficult to work integrated can be split into communication and interaction. Good communication is essential because each profession makes his own decisions which have influence on other decisions (Verlinden, 2008). Beside that the differences stated by Adamides and Karacapilidis (2006) (backgrounds, skills and cognitive spheres) need to be used and communicated to "increases the likelihood of combining knowledge in novel ways" (Adamides and Karacapilidis, 2006).

The second part of working integrated is interaction. Lloyd (2000) states designing has to do with social interaction. "Team performance depends on individual behaviours and interpersonal interactions as well as technical competence" (Fitzpatrick and Askin, 2005). The social interaction within teams can be obtained by trust. Trust plays an important role because the relation needs to be based on: commitment, openness and mutual understanding (Hong-Minh et al., 2001). A good relation can be obtained with trust (Pektas et al., 2006, Hong-Minh et al., 2001, Kürzinger 2004, Verlinden, 2008). Interaction will lead to the best design; every profession can get the opportunity to react on others ideas and implement his knowledge (Verlinden, 2008). Rogers (2003) "Interactivity is the degree to which participants in a communication process can exchange tools in and have control over their mutual discourse."
The second factor related no implementation of techniques is no suitable budget. The budget seems to be difficult to set because of the iterative process. When new knowledge gets available decisions need to be revised (Pektas et al., 2006). This process is difficult to plan and budget (Verlinden, 2008). Beside also financial barriers are limiting organizations for immediate action. (WBCSD, 2007). Ducey and Larson (1999) state that it is difficult to make decisions to achieve success, because they are based on subjective information, uncertainty and ambiguous. This results in the blocks Techniques not implemented in planning and Techniques difficult to express in money.

The last factor related no implementation of techniques is called willingness. Willingness gets influenced by MVO and by Routine. MVO means caring for the triple bottom line; in this situation that means creating a building balanced between people, planet and profit. Kürzinger (2004), as stated before, concluded that implementation of sustainable techniques is difficult because there is resistance to change, routine behaviour and risk aversion for measures with positive environmental impacts. He also states that the tools to come to this implementation are not suitable. To overcome this routine the design teams need to have enthusiasm and enough power to ensure the solution (Verlinden, 2008). Pektas and others (2006) state that there needs to be a mindset in the team where it is possible to talk about critical factors, influences and other things to create a good view on the project. Therefore the factors tools applicable, enthusiasm and influence are edited.

4.5 Choice of factors

Several factors which influence sustainability are found in the revalued model. Some factors can get influenced by the researcher, some factors can not. The researcher is part of the division Building Management & Consultancy. The members of this division create cooperation between people and organizations to get the best result. By speaking the different languages they are capable to think about the content of proposals & solutions (www.royalhaskoning.com). In that way they can explain and stimulate the process, but they are not capable to change internal states of mind or the building process executed by others.

The factors which could be influenced are indicated in figure 14. The factors are: Unclear ambition principal, no C2C vision available, Communication, Interaction, Techniques not implemented in planning, Techniques difficult to express in money and No applicable tools. The factors Boundaries, Enthusiasm and Influence are not part of the changeable factors; boundaries are set by other parties, enthusiasm and influence are intern states of mind which are executed by others and difficult to change.

The special interest group Royal Cradle makes the C2C philosophy applicable to stimulate implementation. They hope to create best practices and guidelines. This stimulation has affection to the factors no vision and no concept. In that way Royal Cradle already started to change the factors: Unclear ambition principal, no C2C vision available, Communication, Interaction.
The remaining changeable factors are: Techniques not implemented in planning, Techniques difficult to express in money and No applicable tools. The factor Techniques not implemented in planning can be solved at moment when is clear how much time, risk and money they take. The factor Techniques difficult to express in money can be solved by convincing principals to implement techniques with best practices or with founded research. The final factor No applicable tools can be solved easily, create suitable tools (implement suggestions from BREAAM or LEEDS).

This research focuses on the definition phase of the building process. The factor bad start design phase is a crucial output of the definition phase. Therefore this part is chosen to be changed. The factor unclear ambition principal could be solved by a good conversation and some explanation about the opportunities about sustainability. No C2C vision available will be changed by Royal Cradle. They develop an explanation of the sustainability themes to develop more content to be used in projects (see section 1.3). The factors Communication and Interaction influence the explanation and stimulation of the building process. The division Building Management & Consultancy creates cooperation between people and organizations to get the best result, what is obtained by the influence on communication and interaction.

In consultation with Royal Haskoning and supervisors the decision is made to change the factor Interaction. This factor fits to the predefined problem and can be influenced with the suggested methodology.
4.6 Examples

In this section examples of the implementation of sustainability are discussed. During analysis several sorts of information are used, but until now no examples where implemented. The examples make clear that interaction is a crucial part of the design for sustainability. They support the diagnose in section 4.7. The examples are discussed based on the problems in the definition phase of the building process of Royal Haskoning to create a sustainability based on process or interaction.

Example A

The principal of example A has a own clear opinion about their project. She wanted to have a building suitable to the budget, creating an excellent environment for her employees. There is an ambition of sustainability, but the principal is anxious that it will exceed the budget and therefore she does not want to make the sustainability requirements explicit.

Royal Haskoning started example A with investing what is needed in the building. She wanted to have clear what the real assessment of the principal was with the stated boundaries (time, money, space, location and so on). This information is generated during meetings at the office of this principal. For the final decisions the head-office needed to give the decision, these meetings were mostly by telephone due to the fact that the adviser of the principal is abroad. The principal was leading during these meetings.

The design freedom in this example was big, but the introduction of sustainability was only on a abstract level. Beside the principal did not want to focus on sustainability more in dept. This resulted in a schedule of requirements without SMART sustainability requirements. The ambition is formulated in a commitment of the designers to achieve sustainability. In this situation the designer needs to consider sustainability, but is not fully imposed to reach a certain goal.

Example B

In this example the assessment for Royal Haskoning was to create a proposition for planning the inner-city. The principal his ambition to sustainability was a prominent target. This target was formulated abstract, because he did not have the technical knowledge to specify the target. During this pre-qualification the principal wanted to see if the contractor was capable to create a building sustainable in all the respects.

For this example Royal Haskoning was asked to create a proposition, which contained all the asked information, like references and abilities. All the designers of Royal Haskoning were asked to create an opinion about the example, all the themes were represented. Royal Haskoning made clear they have all the knowledge and expertise, but they showed insufficiently the vision on the whole project in the way the principal wanted. The principal wanted to have one vision on all the parts, unfortunately Royal Haskoning presented the vision too fragmented on themes.
Example C

The principal of this example is even clearer in his ambition. No discussion about sustainability, it has to be in the project as much as the budget permits. The principal his ongoing process is based on sustainability, so also the new office needs to be sustainable.

The principal had decided to create a new office and had a clear view on what sustainable means to him. The second step in his opinion is creating a design, so he searches for an architect which is capable of designing a sustainable building. Royal Haskoning had the function of designing the installations; they had also their first ideas generated before they discussed it to the other designers.

In this example a traditional way of working is used. The architect wanted to succeed in the project in terms of sustainability. This success also depends on the energy design of the designers of Royal Haskoning. The architect was flexible in his design to interact with the designers of Royal Haskoning. They both have changed their design in favour of each other parts of the design.

These examples make clear that interaction is a crucial part of the design for sustainability. In example A the principal did not dare to define facts instead he created a commitment for the designers. Unfortunately this is no guarantee sustainability will be implemented by the designers. In example B it resulted to be difficult to create one vision in which all the designers have presented their ideas. In the final example the interaction between designers resulted to be the best option to create a sustainable project.

4.7 Diagnosis

A diagnosis is the action to find a cause of a consequence by means of the phenomena acting. The focus of the analysis was sustainability in general, later traced into sustainability in the definition phase of the building processes of Royal Haskoning. The found causes are several factors which influence sustainability; which are Unclear ambition principal, no C2C vision available, Communication, Interaction, Techniques not implemented in planning, Techniques difficult to express in money, No applicable tools, Enthusiasm and Influence.

In the fourth section the goal is analyzed into detail. During conversations with employees the model seemed to be correct, but no information besides the information of Royal Haskoning was used. Therefore some literature was searched. This literature has resulted in a final model; a model which makes explicit what the proven problem of Royal Haskoning is.

The most remarkable factor in this area is bad start design phase. This factor is influenced by the factors no vision and no concept, which are related to the factors Unclear ambition principal, no C2C vision available, Communication and Interaction. The factor bad start design phase get disturbed by the related factors. One is selected to be re-designed; this is Interaction in the definition phase of the building process of Royal Haskoning.
5 DESIGN

5.1 Introduction

In this chapter the design to obtain a change is presented. The design is a cooperation model to realize projects which achieve sustainability. It will be used in the definition phase of the building process of Royal Haskoning. The requirements are specifications which need to be reached; therefore these will be expressed in the subsequent section. In section 5.3 the actual design is presented, it is created in complementation with literature and in discussion by designers of Royal Haskoning. The subsequent section presents the tests of the design, done by designers (implemented in the design). In the fifth part a change plan to implement the design is created. In the final section the conclusion is expressed.

5.2 Design specifications

The goal of the design is to impose the implementation of sustainability in the definition phase of the building process. In section 4.2 is stated that a good sustainable project is indicated being a result of reinforcement of the sustainability themes (figure 3) on each other, they all have to match. Adamides and Karacapilidis (2006) state that the teams which create buildings are important “The use of cross-functional teams with diverse occupational and intellectual backgrounds increases the likelihood of combining knowledge in novel ways”. This interaction is also the chosen factor to be redesigned, together with the goal this is input for the design.

Van Aken (2007) states what requirements are: “Specifications in the form of performance demands on the object to be designed, from the viewpoint of the user, unconditionally and the solution space”. The design needs to stimulate interaction between designers to implement sustainability. Three types of requirements are created; first the urgency for the user needs to be clear, second the actual design needs to be easy to understand and final the process needs to change as little as possible. The components of these types are listed in figure 15.

<table>
<thead>
<tr>
<th>1. Clear urgency</th>
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</thead>
<tbody>
<tr>
<td>• tell the vision at once</td>
</tr>
<tr>
<td>• overview clear at once</td>
</tr>
<tr>
<td>2. Actual design</td>
</tr>
<tr>
<td>• brief</td>
</tr>
<tr>
<td>• simple</td>
</tr>
<tr>
<td>• clear</td>
</tr>
<tr>
<td>• trigger the user</td>
</tr>
<tr>
<td>3. Building process</td>
</tr>
<tr>
<td>• fit into current process</td>
</tr>
<tr>
<td>• applicable to different people</td>
</tr>
<tr>
<td>• as little change as possible in</td>
</tr>
<tr>
<td>current process</td>
</tr>
<tr>
<td>• as little as possible costs</td>
</tr>
<tr>
<td>• supplement on current process</td>
</tr>
</tbody>
</table>

Three important users for the design can be proposed. Consultants and designers are first. Second the principal, who is involved in the process and finally the management of Royal Haskoning. Following the clarification of these users is expressed.
The consultants and designers present in the definition phase of the building process are the users of the design. These people can be employees of Royal Haskoning, but also employees of other companies. The design needs to stimulate them to implement sustainability. Besides this stimulation the design can help them to explain the creation of the building-design to the principal; it helps to explain why sustainability is important and how the implementation takes place.

The principal is not an actual user. He is interested in the design, because in that way, he will be able to maintain an overview on how quality is obtained. This quality is made obvious by the way designers make explicit how and why certain choices are made. For the principal it is congenial to know how concepts and ideas are generated, in that way the power of a building-design is immediately clear.

The last important user of the design is the management of Royal Haskoning. Section 1.3 clarified the management structure (consisting of DAG, DD and BOM). The created design will stimulate the implementation of sustainability by interaction between the designers of a building. These designers therefore need to work across the division boarders, which is stimulated by the Business Balanced Improvement Card 2009 (Royal Haskoning, 2008).

5.3 Design

The goal of the design is to stimulate the implementation of sustainability in the definition phase of the building process. A good sustainable project is indicated being a result of reinforcement of the sustainability themes (figure 3) on each other; they all have to match as stated in section 4.2. This match is influenced by the factor interaction (section 4.5) and can be imposed by a cooperation model. A cooperation model is a model to create changes which collect different perspectives, activities and methodologies for working together according to Fredriksson (2005). Pino and Katsenes (2007) have found, that a cooperation model is a successful partnership. Braet and Ballon (2008) state cooperation between various stakeholders is necessary.

Alternatives to stimulate interaction in the building process are open innovation and a new contract form. The first alternative is open innovation: “Open innovation assumes that internal ideas can also be taken to the market through external channels, outside a firm’s current business, to generate additional value” (Chesbrough, 2004). In the building sector this would mean that different designers will meet each other to create a new excellent building. Slowinski et al. (2009) states: “A new model is rapidly emerging in which firms collaborate with other world-class organizations in an open model to jointly develop the next generation of goods and services”. This alternative is not an option for Royal Haskoning, because they are already stimulating open innovation by cooperation with different parties (like Roxit, Stichting Rotterdam Sustainability Initiative or Erasmus University Rotterdam) (www.royalhaskoning.com).
The second alternative is about the contract of the designers. In the current building process designers sign a contract in the design phase, but the interaction is already needed in the definition phase. This interaction could be stimulated if the contract would be signed in the definition phase instead of the design phase. The consultants of the division Building Management & Consultancy do not decide this is on their own. They are depending on the principal's wishes and decisions. Therefore this second alternative is not an option. The best way to stimulate interaction by Royal Haskoning is by a cooperation model. Therefore the design will be a cooperation model to stimulate interaction within participants of the designers in the definition phase of the building process.

The design is part of the building process of Royal Haskoning. Currently their building process starts with the order of the principal, see figure 16. During the initiative phase consultants study the order and the situation to create an overview of the possibilities in that specific situation.

In the second phase, the definition phase, consultants will arrange an ambition workshop; this is a meeting with the principal to discover the true order. In section 4.2 is stated, that the consultants also can help with the creation of this correct order (Brink and ten Dam, 2009). The output of the ambition workshop is insight in three topics; facts, focus and don'ts. Facts gives information about financial, qualitative and quantitative factors (safety, logistic, flexible, and planning); Focus gives information about money, drivers (costs, ecological, marketing) and relation between building and ongoing process; Don'ts are actions or techniques which are not possible or wanted. Besides this workshop the consultants investigate the situation, this means they check needed licenses, possible techniques, location specific facts, feasibility etcetera. The definition phase will end with the schedule of requirements, actual order to the designers (Maas, 2004), created from the ambition workshop and the research.

The third phase is creating a blue print of the new building. This means designers create a SMART formulated design, providing information about: construction, building installations, materialization and detail (Maas, 2004). The building will be created by the contractor during the realization phase. The last phase is the after care phase. In this phase the contractor will take care after the building during usage by the principal.
The design in this thesis focuses on the definition phase of the building process and redesigns the beginning of it by adding a cooperation session. The output of the session is called ordinantion, which is a story of the emergence of the new building (a vision and a concept). It is the base of the schedule of requirements and the blue print. This ordinantion is wanted, because a vision and a concept make it possible to let the sustainability themes reinforce on each other, they all have to match. The cooperation session will be implemented in the building process of Royal Haskoning. It will be part of the definition phase (see figure 17). The part of attention to sustainability is decided by the principal in the ambition workshop (focus), besides that there is also decided which specifications are SMART formulated in the schedule of requirements and which are not.

![Figure 17 Cooperation session; Consultants & designers present in definition phase](image)

The input of the design is the information generated in the ambition workshop: facts, focus and don’ts. Besides this information also the consultant and designers have content generated from research. This is information about the situation and the possibilities. In addition the knowledge of the consultants and designers is also input, their experiences help to create a new building.

The session stimulates cooperation during a session of 3 hours, see figure 18. The session contains an introduction, three charrettes and a choice of the best options. Creativity is needed to obtain reinforcement of the sustainability themes on each other, they all have to match. According to Kim (2007) the later the design concept is decided, the more creative product is made. In figure 17 is made clear the output of this session will not be the end of the definition phase, the schedule of requirements is the end of this phase. Maybe in the future the ordinantion can be the final part but that is up to the principal, he decides or the schedule of requirements needs to be formulated SMART (as current) or more abstract (as in the ordinantion).
The session starts with an introduction of 15 minutes by the consultant. The consultant will explain several parts: the order, the methodology to come to the ordinantion and introduces all the participants. The information of the order is the result of the ambition workshop and all the available information about the situation and the desired techniques. The methodology is creating an ordinantion in charrettes by the use of sketch designing and storytelling (explained in section 3.5). The charrette in this situation is a small, but intense moment of work to create an ordinantion bounded by a deadline. This ordinantion is created together by the designers; they need to communicate by sketching and storytelling. Finally all the participants are introduced, in that way everybody knows what to expect from each other.

The consultant is leading the complete session. Consultants state they speak the different languages; therefore they are the appropriate leader. Besides that, a leader ensures the formal structure, preventing behaviour like vulnerable, confused and isolated feelings (Ind and Watt, 2006). The consultant will also distribute the important information on paper, in that way the consultant is sure the designers can not forget facts. He also arranges all the needed materials for the session (like paper, pencils, markers, dictaphones, etcetera).

![Figure 18 Cooperation session](image)

The first charrette is started immediately after the introduction. The consultant gives the starting shot and states when the deadline is. The designers work to create the ordinantion and have to meet the deadline. When the deadline is reached the consultant collects the ordinantions and asks the designers to take a break of 10 minutes. During the break the designers are stimulated to think of other things than the order. This is obtained by food, an interesting movie, a book, or just by speaking about a different subject.

The second charrette will be exactly the same as the first one; a new ordinantion needs to be created. Also the break is arranged in the same way. The third ordinantion is again exactly the same as the first and second ones and also the break is arranged in exactly the same way.
The last part of the session is choosing the best ordinantion by Multi Criteria Analyses. If immediately is clear that one option is the best according to all the participants, MCA is superfluous (ReinsDAGen, 2007). If there is not one option obviously the best, MCA starts by creating a list of measurable entities and criteria (Hellendoorn, 2001). These will be placed in a matrix, to create an overview of alternatives. In that way the best ordination can be chosen. If this is still difficult, the computer program ELECTRE is recommended to use, to help making a choise (Pohekar and Ramachandran, 2004).

The participants in the design are a team of consultants and designers. Team working is important to use the knowledge and skills of all the individuals to realize the ordination (Denton, 1997). The users of the design are discussed in section 5.2. The consultants and designers will be the participants in the design; other users (principal and management) are connected to the design, because they are interested in the ordination. The way the participants work together is based on the methodology of QuA. They think designers have to divergent to several ideas, convergent to one concept and then make the concept defined simply and decisively to be able to edit and check the objectives (www.qua.nl). The first participant is the consultant, he finds out what the exact order of the principal is by the ambition workshop and research. The second participants are the designers. They have specific knowledge about state of the art techniques and the sustainability themes (see figure 3).

The output of the design is one ordinantion, the story of the emergence of the new building. As stated before the ordinantion is not the end of the definition phase. The story is the base of the schedule of requirements and/or the blue print. The story will give an interpretation about subjects which are needed to create the schedule of requirements and/or the blue print. The subjects are: the order and situation (financial, qualitative and quantitative factors (safety, logistic, flexible and planning)), focus of the principal (costs, ecological, marketing, relation between building and ongoing process) and absolute don’ts.

Currently the building process needs a schedule of requirements. The ordinantion give an interpretation of the subjects for this schedule of requirements, which can be SMART formulated or not. During time the schedule of requirements could be replaced by the ordinantion, because it is a good base for the blue print.

The use of this design is forced by the creation of a leaflet, see appendix 6. This leaflet contains the Elephant of Saxe; an unwanted mechanism, it contains a puzzle; because designers need to solve the assignment together and it shows an agenda; to make explicit people need to block a morning in their agenda together. The first page shows the input of the session, the second page how the ordinantion can be created and the last page the output of the ordinantion. This leaflet helps to communicate to the employees.
5.4 Tests

The presented cooperation session is created in consultation with employees of Royal Haskoning. Several employees are interviewed and asked for their vision about the session for the second time. During these conversations several critics and insights are expressed. These critics and insights are expressed below; these are already implemented in the design.

The first point of critic is about the opportunity to identify. The users discussed in section 5.2 need to be able to identify themselves with the suggested participants in the cooperation session. The opportunity to identify is important; otherwise they will not use the design. They will take it into account instead. The opportunity is created in the formulation of the participants. The formulation is in active verbs and fits to their daily work, in that way their willingness to identify is higher.

The second insight is about the implementation of the session. A building process consist of 5 phases (Maas, 2004), the design is intended in the definition phase. Employees made clear the design needs to fit into the current process, otherwise the change will be too big. The fit is obtained, because the input and output of the design is information which is already in the current process.

The third point of critic is about the urgency of sustainability. During the interviews it got clear that not everybody is aware of the urgency of sustainability. In the different offices of Royal Haskoning was always at least one employee complaining that sustainability is absurd. These people state that sustainability is a new marketing trick or it is embellished. The design does not focus on urgency, but it is important that everybody knows the urgency. The success of the design depends on the willingness of people to think about sustainability, in that way they are able to implement the model in their daily work.

The last insight is about the change in the process, from a traditional process to a process where all the designers are creating together. The most innovative design will be created if everybody’s knowledge is used (Adamides and Karacapilidis, 2006). According to designers it is difficult to obtain a process where designers interact with each other. This insight has resulted in the support which is a sort of checklist, created by the leaflet. In that way the interaction is not something that should be done, but what will happen if the design is used.

5.5 The change plan

"The change plan is the design of the process that is to realize the object design (in terms of the actors to be taken and the actors involved)" (Van Aken, 2007). The design that needs to be implemented is the cooperation session. To strengthen the implementation the change plan and a leaflet are created. The change plan consists of two parts, a preparation plan and an action plan. The preparation plan is about preparing the situation to the implementation of the design. The action plan is a list of actions to be taken to obtain the desired result. In between the expected problems are expressed. The plans will be expressed by validation of change management literature. The use two sorts of models is decided: the model of Kotter (1996) and the colour-theory (Caluwé and Vermaak, 2006).
Preparation plan

Kotter (1996) created a model to realize a change in a company, divided into eight phases (see figure 7). The first phase is ensuring the urgency; research the market and competition and ascertains (potential) crises and important chances. Royal Haskoning has already done this, in section 1.3 is clear that they want to distinguish themselves on the market by sustainability.

The second phase of the model of Kotter (1996) is creating a leading coalition. The special interest group called Royal Cradle is the leading coalition in terms of sustainability. The third phase is creating a vision and a strategy, this phase is started by the special interest group Royal Cradle. According to Kotter (1996) a new phase is not allowed to start when the previous one is not finished, therefore the focus is on phase three.

The third phase of the model of Kotter (1996) states a vision and strategy is needed to give direction to the change. Therefore the problem needs to be clear, the goal is “Change the definition phase of the building processes of Royal Haskoning to realize projects which achieve sustainability”. The problem will be explored by the colour-theory of Caluwé and Vermaak (2006). This theory is more than just “do it”; it is about values, standards and manners of thinking. The indicated colours of the theory are a tool for choosing the most promising change for a certain problem in a certain organization. Besides that the theory helps to communicate and to recognize the biases (Caluwé and Vermaak, 2006). In appendix “vijf woordenboekjes voor vijf veranderkleuren” the characterization of the different colours is expressed.

The problem is made clear by analyzing the collected data (already used for the analysis) by the use of the colour-theory. The characterization of the problem and the participants is made by the appendix. The goal is typified as a green. The colour green indicates a culture were people want to learn, try to develop and share knowledge. The problem became clear in the analysis, which has shown that a good sustainable project is a result of reinforcement of the sustainability themes (figure 3) on each other, they all have to match. The factor to be designed is interaction. The problem therefore is about sharing knowledge, willing to develop; being characterized as green.

The consultants present themselves as “speaking the different languages, think about the content of proposals & solutions and always work from their professional backgrounds, supported by specialists in many fields” (www.royalhaskoning.com). A red-culture is typified as a culture of attention to people, comfortable to work in and commitment; therefore the culture of the consultants is expressed in red.

A lot of different designers are employees of Royal Haskoning. During interviews the designers are characterized as people who have learned to be precise and rational. A blue-culture is typified as focus on results & details and independent of individuals, which are common terms for the culture of the designers. The culture of the designers is therefore characterized as blue.
The differences between the problem and the participants are clear by the ranking of the colours (Yellow-Blue-Red-Green-White, see appendix 4. "Aannames van de vijf kleuren"). The characterized blue designers are ranked further away of the green characterized problem than the red characterized consultants. The green problem is not changeable, but the related vision and strategy to overcome the problem can be translated into other colours. The biggest result is obtained if the vision and strategy of C2C are characterized in a blue way. The red consultants can switch easily to the green colour, because they speak the different languages. Phase 3. A vision and strategy of Kotter (1996) will therefore started by explaining the C2C vision and strategy in a blue-way.

Problems
Several problems can be expected by introduction of the cooperation session. The first problem can be found by the designers. In the preceding is explained that designers can be characterized by the colour blue. This colour indicates that designers are people who want prove, research, performance, result, creation and so on. This resistance can be a problem. In the analysis (chapter 4) is made clear that sustainability is difficult to assess into money. Designers can counteract, because they want to work in a safe and secure environment, being difficult to guarantee by sustainability.

The second problem is the switch to get the designers sooner in the process, also stated in section 5.3. In the traditional process the designer starts by creating a SMART design when he is contracted (Maas, 2004). In the new situation designers have to cooperate in the fuzzy front end of the design without a contract. People do not want to work without a contract. The third problem is also related to money. The designers which need to participate in the fuzzy front end of the design phase need to block one morning in their agenda. They need to be willing to do that, but time is money.

The fourth problem has to do with the guiding team: Royal Cradle is a special interest group active since the summer of 2008, consisting of people of different divisions. Royal Cradle wants to accelerate the use of sustainable techniques by working integral between different divisions. Kotter (1996) stated that the guiding team needs to consist of committed people mixed with diverse skills and levels. Currently Royal Cradle is not a fully steady team, because not all the members are always present. Kotter (1996) stated that this is a problem.

The final problem is a difficult problem; does everybody notice the urgency of the change? Without this urgency people think their way of traditional working is also sufficient, resulting in no change. Royal Haskoning already made clear they want to distinguish themselves by sustainability. But do employees account sustainability as a good way to distinguish on the market? This urgency needs to be clear and communicated to every employee; otherwise the change will not happen.
Action plan

The third phase of the model of Kotter starts by explaining the C2C vision and strategy in a blue-way, which needs to be done by Royal Cradle. When this C2C vision and strategy are clear the leaflet (appendix 6. Leaflet) needs to be defined so the whole organization can use it. The leaflet states why the ordinantion is needed, how this will be organized and what the management process is. The leaflet can only be defined if Royal Cradle has found designers to co-operate and therefore they need to stress the new way of working for them.

In diagram 2 a chronological overview of the actions is given. The actions are discussed chronological in the subsequent part. In diagram 3 an overview of all the actions is created, it makes clear when an action needs to be done, what needs to be done and by who.

Kotter (1996) states a new phase can only be started if the previous one is fixed. In this design some phases have overlap, caused by the differences between preparation, execution and turnaround. In diagram 2 is made clear how these phases are planned. This planning depends on the success of each phase; therefore the planning is just a global suggestion.

<table>
<thead>
<tr>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 7 8 10 11 12</td>
<td>1 2 3 4 5 6 7 8</td>
</tr>
<tr>
<td>Phase 3</td>
<td>Phase 4</td>
</tr>
<tr>
<td>Phase 5</td>
<td>Phase 6</td>
</tr>
<tr>
<td>Phase 7</td>
<td>Phase 8</td>
</tr>
</tbody>
</table>

Diagram 2 Chronological overview

The fourth phase is communicating the new approach of the process. First employees must know what the baseline of the change is; they need to be aware that Royal Haskoning wants to distinguish themselves on the market by sustainability. When this baseline is clear the new process, the cooperation session, should be communicated. And finally the method (sketch designing and storytelling) to realize more sustainable projects needs to be communicated. This communication should be done in several ways: first by the intranet called Bridge. Second in the magazine of the company called GroupWise. Third by workshops or lunch lectures. Fourth by attention in divisions and in advice groups. The people who need to do that are first the special interest group Royal Cradle, than other people led by Royal Cradle, third the Division Directors (DD) and finally the communication need to be done by the Director of Advice Group (DAG).

The fifth phase is about creating a base of empowerment, “Remove obstacles, enable constructive feedback and lots of support from leaders - reward and recognize progress and achievements” (Kotter, 1996). During the preceding phases this will also be created, but in this phase some special attention is given. This phase is reinforced by a revision of the leaflet, a more broadly guide book, created by Royal Cradle. The rewards and recognizes in progress and achievements can be obtained if small applications are created.
The management of Royal Haskoning also plays a specific role in this phase. First they need to facilitate the new way of working and need to excite their employees (Mackay, 1992). Second they can help the design to become a success by rewarding. Rewarding by valuing the whole team (Dickinson and Isaac, 1998) and value the individual tasks (Mackay, 1992). Valuing can be done by giving attention to the achievements for example in GroupWise or satisfaction from accomplishing the team goal. This rewarding can also be realized by external rewarding; for example payment, bonuses or plaques (Harrington-Mackin, 1994).

In the sixth phase small success needs to be generated. Successes can be found in projects where the method is used or projects where a new application of the method is created. These successes should be communicated to the employees and appraised by different people (management, DAG et cetera), by attention in GroupWise, a lunch meeting, but also by a reward in money or in appreciation by the management or by their DAG of DD.

The final two phases only may be started when all the preceding is accomplished. Planning these actions is almost impossible, therefore only some suggestions for these phases are given. The seventh phase is about consolidation of the changes in the company. This could be done by implementing the method in standard procedures or in formats. The final phase is about anchor, the new method in the management culture.

Diagram 3 Action plan

<table>
<thead>
<tr>
<th>Phase 3 - Get the vision right</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action</strong></td>
</tr>
<tr>
<td>1 Create C2C vision</td>
</tr>
<tr>
<td>2 Find designers to co-operate</td>
</tr>
<tr>
<td>3 Stress a new way of working</td>
</tr>
<tr>
<td>4 Define the design</td>
</tr>
</tbody>
</table>
### Phase 4 - Communicate for bur-in

<table>
<thead>
<tr>
<th>Action</th>
<th>Performer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicate urgency</td>
<td></td>
</tr>
<tr>
<td>1 Bridge</td>
<td>Royal Cradle</td>
</tr>
<tr>
<td>2 GroupWise</td>
<td>Royal Cradle</td>
</tr>
<tr>
<td>3 Workshops</td>
<td>Royal Cradle</td>
</tr>
<tr>
<td>4 Divisions</td>
<td>Led by Royal Cradle</td>
</tr>
<tr>
<td>5 Advise groups</td>
<td>Led by Royal Cradle</td>
</tr>
</tbody>
</table>

| Communicate new process | |
| 6 Bridge | Led by Royal Cradle |
| 7 GroupWise | Led by Royal Cradle |
| 8 Workshops | Led by Royal Cradle |
| 9 Divisions | Head of division |
| 10 Advise groups | Head of division |

| Communicate method | |
| 11 Bridge | Head of division |
| 12 GroupWise | Head of advisory group |
| 13 Workshops | Head of advisory group |
| 14 Divisions | Head of advisory group |
| 15 Advise groups | Head of advisory group |

### Phase 5 - Empower action

<table>
<thead>
<tr>
<th>Action</th>
<th>Performer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create guide book</td>
<td>Royal Cradle</td>
</tr>
<tr>
<td>Small applications</td>
<td>Designers led by Royal Cradle</td>
</tr>
</tbody>
</table>

### Phase 6 - Create short-term wins

<table>
<thead>
<tr>
<th>Action</th>
<th>Performer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention of success in</td>
<td></td>
</tr>
<tr>
<td>1 Advise groups</td>
<td>Head of advisory group</td>
</tr>
<tr>
<td>2 Divisions</td>
<td>Head of advisory group</td>
</tr>
<tr>
<td>3 Bridge</td>
<td>Head of advisory group</td>
</tr>
<tr>
<td>4 Workshops</td>
<td>Head of division</td>
</tr>
<tr>
<td>5 GroupWise</td>
<td>Head of division</td>
</tr>
</tbody>
</table>

| Value of success | |
| 6 Advise groups | Head of advisory group / Board of management |
| 7 Divisions | Head of advisory group / Board of management |

### Phase 7 - Don't let up

<table>
<thead>
<tr>
<th>Action</th>
<th>Performer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementing in standard procedure</td>
<td>Led by Royal Cradle</td>
</tr>
<tr>
<td>Implementing in formats</td>
<td>Led by Royal Cradle</td>
</tr>
</tbody>
</table>
5.6 Conclusion

In the first section the requirements of the design are defined. The design is a co-operation session for the consultants and designers of the building process, which suggests creating an ordinantion in the definition phase. The input for the co-operation session is knowledge about the ambitions of the principal, about the available techniques and about the opportunities. The output, the ordinantion, is a story of the emergence of the new building; some information will be discussed into detail and others will be superficial.

This design needs to become implemented in the organization Royal Haskoning. To come to a good implementation of cooperation sessions the eight phases of the theory of Kotter (1996) need to be completed. Royal Haskoning already finished phase one and two. In phase 3 of this model the vision and strategy need to get established. The problem to execute in phase 3 is defined into detail by the colour-theory of Caluwé and Vermaak (2006). Consultants are coloured red, the designers are coloured blue and the problem is coloured green. Suggested is to bring the blue designers closer to the green problem by translating the problem in a blue characterized. The implementation is ensured by a preparation plan and an action plan.
6 CONCLUSION & RECOMMENDATIONS

6.1 Conclusion

The goal of this graduation research is stimulating the implementation of sustainability in building processes of Royal Haskoning. The methodological cycle of Van Strien states to first create a problem definition of the problem mess. This is done in a qualitative way by different sorts of information (website, annual report, interviews, literature, intranet, intern papers). The identification of factors causing the problem is done by an Ishikawa diagram; these factors are called Principal, Cooperation in the sector, Royal Haskoning and the last one Certification. At the end of the second phase of the cycle (Defining the problem) the problem definition is made: Change the definition phase of the building processes of Royal Haskoning to realize projects which achieve sustainability.

In the third phase of the cycle (3. Analysis & diagnose) a diagram is created by the use of the already defined information. This diagram gives an overview on the factors related to each other and to the problem. The most important factor resulted to be bad start design phase, because this is crucial output of the definition phase. Therefore this part is chosen to be changed. This factor is influenced by the factors no vision and no concept, which are related to the factors Unclear ambition principal, No C2C vision available, Communication and Interaction. The factor bad start design phase is no big deal anymore if there is a vision and a concept as input for the design phase (possible if designers are present sooner in the process); now the related factors disturb the creation of it. One factor related to bad start design phase is selected to be redesigned; this is Interaction in the definition phase of the building process of Royal Haskoning. The choice is made, because this factor fits to the predefined problem and can be influenced by the organization of RH himself.

The fourth phase of the cycle is creating a design & change plan. The design is a co-operation session to ensure the presence of the designers in the fuzzy front end of design phase. The participants are consultants and designers of Royal Haskoning and other companies. The input for the co-operation model is knowledge about the ambitions of the principal, about the available techniques and about the opportunities. The output, called ordinantion, is a story of the emergence of the new building; some information will be discussed into detail and others will be superficial. It will be a basis for the schedule of requirements and the blueprint. Among other things it supplies information about the themes created by Royal Cradle, see section 1.3 figure 3.

The theory of Kotter (1996) is used to implement the design in the organization. See section 3.5 figure 7. Royal Haskoning already finished phase one and two. In phase three of this model the vision and strategy need to get established; this is the focus of this research. The problem to execute in phase three is defined into detail by the colour-theory of Caluwé and Vermaak (2006). They have created a theory in which actions, organizations and persons are typified by colours. Suggested is to bring the blue designers closer to the green problem by translating the problem in a blue characterization. The implementation of the design is ensured by a preparation plan and an action plan.
6.2 Main contributions

This research contains of two contributions, first the session to achieve sustainability and second the content of the session. The co-operation session contributes to the implementation of sustainability by stimulation of interaction between designers in the fuzzy front end of the building process. A good sustainable project is indicated being a result of reinforcement on each other of the sustainability themes (section 1.3 figure 3). This can be obtained by cooperation between designers. The created cooperation session should be used in the front end of the design phase between designer and consultant to create implementation of sustainability in the building to be designed.

Another contribution is the content of the co-operation session. Interaction between designers is important in all sorts of design processes. The suggested model contains a content which organizes a session with all the designers together. The session is built of three charrettes; these are small but intense moments of work to create a design bounded by a deadline. During these charrettes the participants design by sketch designing and storytelling.

The relevance for Royal Haskoning can be found in several parts of this research. First the analysis made clear what influences sustainability in this case. These factors are combined into four factors called: Principal, Co-operation in the sector, Royal Haskoning and Certification. The analysis finally resulted into nine factors which influence the definition phase of the building processes of Royal Haskoning to realize projects which achieve sustainability. The factors are: Unclear ambition principal, No C2C vision available, Communication, Interaction, Techniques not implemented in planning, Techniques difficult to express in money and No applicable tools.

The second practical contribution is the insight implementing sustainability is not an easy job. The media reported (LLiNK, 16-10-2008) that creating a sustainable building is an easy job. In section 4.4 is explained that a good sustainable project is indicated to be a project being a result of reinforcement of the sustainability themes (section 1.3 figure 3) on each other, they all have to match. The analysis showed that this matching is difficult to obtain, because different professions can not understand each other easily.

The third practical contribution is the change plan. This plan gives Royal Haskoning insights in the process to implement sustainability in their building process. The change plan suggests a vision, an action list and participants.

6.3 Limitations

The generalization may be limited, because the design is created for the management structure and culture of Royal Haskoning. Besides the change plan is created specific for Royal Haskoning. This change plan an action list is created in cooperation with the company and is suited to the situation. In other companies this action plan can be totally different because the used theories suggest another approach.
Also other companies can have the problem of interaction. Therefore the cooperation session is interesting to use in another company. Also the change plan could be applied in another company. The plan suggests actions to be taken to stimulate interaction, being the same in other companies despite the fact it is made for Royal Haskoning.

6.4 Further research

The methodological cycle which is used is the cycle of Van Strien. The focus of this research was up to the fourth phase of the cycle; phase 1, Problem mess; phase 2, Problem definition; phase 3, Analysis & diagnosis and phase 4, Design & change plan (see figure 4). Unfortunately the fifth and sixth phases (5. implementation 6. evaluation) are not being executed. To obtain the desired effect these phases should also be executed. Royal Haskoning therefore needs to execute these phases. Besides the execution it is also interesting to test the created design in the company. By further research the desired effect can be obtained by the design.

The second suggestion is to use the model in another sector. The design could be placed in early stages of product development by multi party creation. Imagine situations like the creation of a new domotics product or a place where pharmaceutical products for the home market are developed. Before implementing the model in another situation the session should be compared to other literature. The model could be compared with literature of design creation with multi parties under pressure, key words: creativity, time pressure, openness to experience, ‘pressure-cooker’

This research also created some new issues. What would be the design if another part of the Ishikawa diagram was chosen? Or what would be the design if another factor of the diagram was chosen? In that way still enough research is to be done.

This research was started in September 2008 and needed to be finished in March 2009. This research is done is six months, therefore the topics which are used in the solution are not investigated into detail. The topics which could be investigated further into detail are the factor interaction, the effect and the use of the charrette, change management in general and rewarding. Because of the lack of time these subjects are treated superficial, but a more thoroughgoing research is recommended.

6.5 Practical recommendation

The first practical recommendation is to implement the change plan. This solves a small part of the problems about sustainability. As stated in chapter 5 Royal Haskoning already started to change. They are trying to generate an applicable philosophy, by working together intensively on a project. In that way they hope to create some best practices and some guidelines. Still some hurdles need to be taken; they are in phase 3 of 8 of the change management model of Kotter(1996). See section 3.5 figure 7.
In the change plan the colour-theory of Caluwé and Vermaak (2006) is used. Royal Haskoning is distinguishing themselves on the market by sustainability. This distinguishing makes that they are constantly trying to be the best; this can result in a culture shift. The second recommendation is therefore to check the chosen colours; maybe they do not fit to the company anymore.

The last practical recommendation is less specific. The analysis showed several factors which can be changed to have influence on the implementation of sustainability. Only one factor is chosen to be modelled. The recommendation is to model the other factors also. The factors which could be changed are: Unclear ambition principal, C2C opinion, Communication, Interaction, Techniques not implemented in planning, and No applicable tools. In the change plan also suggestions for the C2C opinion are done. Still four factors should be changed, some of them are changing (Unclear ambition principal is tried to be solved by the ambition-workshop), but for some is not yet enough attention. The recommendation is to have a look to all these factors and to try to model them.
EPILOGUE

This research started by my personal believes. I stated that it is a pity that there are good sustainable techniques available, but hardly used. In the Netherlands a lot of new buildings are created, but sustainability is not always implemented. The focus of this research was obtaining a change in the building process to achieve more sustainable building.

I truly hope this research will help to overcome problems due to the implementation of sustainability, but it is more complex than just implementing the cooperation session. In this research I have stated several factors which influence the implementation of sustainability. The model is the solution to just one factor.

At the start of the graduation research I thought I was able to create guidelines to implement sustainability, but now I know implementing sustainability is far more difficult. All factors of sustainability relate to each other and all need to be changed at once, otherwise the implementation fails.

I'm proud I have created a solution. Several moments I thought it was impossible to create a solution; an overview of the factors was already difficult. During time I focused more and more, in that way the possibility rose to create a model.

The time to carry out the whole research was bounded to six months. In the beginning that looked a lot of time, but after a short the factor became limiting. The research started by studying literature and exploring Royal Haskoning. Shortly after the beginning I started to interview people, what resulted in a good exploration. The deadline is met because of a strict planning.

Summarized I have learned that an obvious solution may not be as simple as it looks like. I hope this research helps Royal Haskoning to implement sustainability more easily and that in Moergestel sustainable buildings will be created.

Maaike Wolfs
February 2009
Zwijndrecht
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Karreman, R., conversation, d.d. 3-10-2008

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Veerman, J., conversation, d.d. 11-9-2008

Vink, J., conversation, d.d. 2-10-2008

Wilde, H. vd, conversation by telephone, d.d. 26-9-2008
APPENDICES

Appendix 1. Contact information

Graduating student

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First supervisor

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Address Pav R0.31
Department Fac. Innovation Management

Second supervisor

Prof. dr. ir. B. de Vries
Phone 040-2472388/2262
Address VRT 9.10
Department Fac. Architecture

Supervisor of Royal Haskoning

Ir. E.A.M. ten Dam
Phone 010 4433666
Address George Hintzenweg 85
3009 AM Rotterdam
Appendix 2: Management
### Appendix 3. Overview interviews

<table>
<thead>
<tr>
<th>Divisie</th>
<th>Naam</th>
<th>Functie</th>
</tr>
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<tbody>
<tr>
<td>Ruimtelijke ordening</td>
<td>F. Duenk</td>
<td>Adviseur</td>
</tr>
<tr>
<td>Bouw Management</td>
<td>E. ten Dam</td>
<td>DAG</td>
</tr>
<tr>
<td></td>
<td>R. Karreman</td>
<td>DAG</td>
</tr>
<tr>
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<td>B. Brink</td>
<td>Adviseur</td>
</tr>
<tr>
<td></td>
<td>H. Buma</td>
<td>Adviseur</td>
</tr>
<tr>
<td></td>
<td>C. Simons</td>
<td>Project manager</td>
</tr>
<tr>
<td></td>
<td>R. Laurs</td>
<td>Project manager</td>
</tr>
<tr>
<td>Gebouw installaties</td>
<td>J. Veerman</td>
<td>Specialist</td>
</tr>
<tr>
<td></td>
<td>P. Luscuere</td>
<td>Directeur</td>
</tr>
<tr>
<td></td>
<td>H. Ruchti</td>
<td>DAG</td>
</tr>
<tr>
<td></td>
<td>E. Tober</td>
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</tr>
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<td>Architecture &amp; Building</td>
<td>D. Hauer</td>
<td>Architect</td>
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<tr>
<td></td>
<td>J. Janssen</td>
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<td></td>
<td>J. Vink</td>
<td>Architect</td>
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<td>Milieu</td>
<td>M. de Jong</td>
<td>DAG</td>
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<tr>
<td></td>
<td>R. Becqué</td>
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<tr>
<td>Extern</td>
<td>H. Eleved</td>
<td>Project manager</td>
</tr>
<tr>
<td></td>
<td>H. Wildenberg</td>
<td>Project leider</td>
</tr>
<tr>
<td></td>
<td>H. Bakker</td>
<td>Afdelingsmanager</td>
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Appendix 4. “Aannames van de vijf kleuren”

(Caluwé and Vermaak, 2006)

<table>
<thead>
<tr>
<th>Kleurtype</th>
<th>Dingen/mensen zullen veranderen, als je...</th>
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<tbody>
<tr>
<td>Geeldruk</td>
<td>belangen bij elkaar brengt</td>
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<tr>
<td></td>
<td>ze kunt overhalen tot het innemen van (bepaalde) standpunten/meningen</td>
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<tr>
<td></td>
<td>win-winsituaties creëert/coalities vormt</td>
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<tr>
<td></td>
<td>de voordelen kunt laten zien van bepaalde opvattingen (macht, status, invloed)</td>
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<tr>
<td></td>
<td>de neuzen kunt richten van de mensen die ‘ertoe doen’</td>
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<tr>
<td></td>
<td>ze in een onderhandelingsproces krijgt</td>
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<tr>
<td>Blauwdruk</td>
<td>van tevoren een duidelijk resultaat/doel formuleert</td>
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<tr>
<td></td>
<td>een goed stappenplan maakt van A naar B</td>
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<tr>
<td></td>
<td>keuzes baseert op inhoudelijke expertise en empirische bewijzen</td>
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<tr>
<td></td>
<td>de stappen goed monitor en op basis daarvan bijstuur</td>
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<td></td>
<td>alles zoveel mogelijk stabiel houdt en beheert</td>
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<tr>
<td></td>
<td>de omgevingscomplexiteit zoveel mogelijk reduceert</td>
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<td>Rooddruk</td>
<td>ze op de juiste manier prikkeft en motiveert</td>
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<td>het voor mensen aangenaam maakt (sociale settings)</td>
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<td>geavanceerde HRM instrumenten inzet voor belonen, motiveren, promoteren, status</td>
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<td>ze aandacht, respect, vertrouwen en erkenning geeft</td>
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<td></td>
<td>ze iets teruggeeft voor wat zij jou geven</td>
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<td>ze bewust maakt van nieuwe zienswijzen/eigen tekortkomingen (bewust onbekwaam)</td>
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<td></td>
<td>ze kunt motiveren om nieuwe dingen te zien/te leren/te kunnen</td>
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<td></td>
<td>ze in staat stelt eigen leerdoelen te stellen en het eigen leerproces mee vorm te geven</td>
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<td></td>
<td>geschikte (gezamenlijke) leersituaties kunt creëren</td>
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<td></td>
<td>ze helpt groeien</td>
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<tr>
<td>Witdruk</td>
<td>aansluit op de ‘natuurlijke weg’, de ‘roeping’ van mensen zelf</td>
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<td></td>
<td>ruimte biedt voor de eigen energie, inspiratie en kracht van mensen</td>
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<td></td>
<td>dynamiek/complexiteit wilt duiden en kunt zien waar ‘de tijd rijp voor is’</td>
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<td></td>
<td>eventuele blokkades wegneemt en conflicten optimaliseert</td>
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<tr>
<td></td>
<td>betekenis toevoegt aan de processen waar mensen in zitten</td>
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<tr>
<td></td>
<td>symbolen en rituelen gebruikt</td>
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Appendix 5. “Vijf woordenboekjes voor vijf veranderkleuren”

(Caluwé and Vermaak, 2006)

<table>
<thead>
<tr>
<th>Geeldrukdenken</th>
<th>Typische woorden</th>
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<td>Comité</td>
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<td>Conclaaf</td>
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<td>Actor</td>
<td>Depolitiseren</td>
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<td>Draagvalk</td>
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<td>Dubbelrol</td>
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<td>Agenda</td>
<td>Gezichtsverlies</td>
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<td>Alliantie</td>
<td>Intentie</td>
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<td>Beslisser</td>
<td>Macht</td>
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<td>Besluiten</td>
<td>Mandaat</td>
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<tr>
<td>Coalitie</td>
<td>Medestander</td>
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Typische motto's
Afhankelijkheid benadrukken
Besluitvormingskosten zichtbaar maken
Draagvlak creëren
Gezamenlijke visie ontwikkelen
Haalbare oplossingen zoeken
Neuzen richten
Onderhandelingsruimte bepalen
Onzekerheden induceren
Rand de tafel gaan zitten
Standpunten uitwisselen
Vrijblijvend weghalen
Win-winsituatie creëren

Typische spreekwoorden
Achter gesloten deuren houden
Als de ene hand de andere wast, worden ze beide schoon
Als het getij verloopt, moet men de bakens verzetten.
Als twee honden vechten om een been, loopt de derde er ras mee heen.
Die maar een klok hoort, weet niet of het voor een dienst of voor een dode is.
Een achterdeurtje openhouden
Elkaar de bal toespelen
Elkaar eens rustig in de ogen kijken
Het is beter de koning aan te spreken dan de minister
Het moeilijke alle hoofden in een zak te krijgen
Hij eet van twee walletjes
Hij fungeert als bliksemafleider
Hij heeft zijn stukken goed op het bord staan
Hij wil aan mijn baard leren scheren
Hoge bomen vangen veel wind
Iemand achter de bank schuiven
Je kruit droog houden
Men moet geen slapende honden wakker maken
Men moet weten te lichten en te zwaren
Met de ellebogen werken
Niet in je kaarten laten kijken
Om den wille van de smeer, likt de kat de kandeleer
Op de lange baan schuiven\wie de dochter wil hebben, moet met de moeder vrijen
Ze liggen samen onder een deken

H.A. Wolfs
<table>
<thead>
<tr>
<th>Blauwdrukken</th>
<th>Typische woorden</th>
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<td>Archiveren</td>
<td>Detailleren Keuring</td>
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<td>Beheersbaar</td>
<td>Doel Kwaliteits-controle</td>
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<td>Beslisdocument</td>
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<td>Beslissen</td>
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<td>Bevoegdheid</td>
<td>Fase Onderzoek</td>
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<td>Bewaking</td>
<td>Goedkeuring Opdracht-</td>
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<td>Boete</td>
<td>Hiërarchie gelever</td>
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<td>Informatie- Opdracht-</td>
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<td>bewaking nemer</td>
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Plannen
Prestatie
Project
Projectleider
Rapportage
Reductie
Resultaat
Stap
Taak
Taak-
geleding
Voortgang
Weerstand
Typische motto's
Aansturen van activiteiten en mensen
Afrekenen op resultaat
Anticiperend sturen
Beste oplossing bedenken en realiseren
Conflicten buiten de deur houden
Een goed plan is het halve werk
Eenduidige resultaten benoemen
Eerst denken, dan doen
Fouten vermijden
Heldere beheersafspraken maken
Onafhankelijk zijn van individuele mensen
Voorspelbare trajecten ontwerpen

Typische spreekwoorden
Allemans werk is niemands werk
Belofte maakt schuld
Dat klopt volgens Bartjens
De bal in de ploeg houden
De daad bij het woord voegen
Die in de wijngaard werkt, mag van de druiven eten
Een goed begin is het halve werk
Een man een man, een woord een woord
Er is altijd baas boven baas
Geen geld, geen Zwisters!
Geen woorden maar daden
Goed begonnen is half gewonnen
Goed is goed genoeg
Het betere is de vijand van het goede
Het doel heiligt de middelen
Hij is een man van de klok
Men mag een schaap wel scheren, maar niet villen
Men moet nooit zonder beschuit in zee gaan
Werken als een paard
Wie A zegt, moet ook B zeggen
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<td>Huisstijl</td>
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<td>Ideeënbus</td>
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<td>Junior</td>
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<td>Kwaliteit</td>
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<td>Lief-en-lead-pot</td>
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<td>Loopbaan</td>
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<td>Outplacement</td>
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<td>Potentie</td>
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<td>Promotie</td>
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<tr>
<td>Talent</td>
<td>Zorgvuldig</td>
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Typische motto's
Binding van mensen aan het bedrijf
Het leuk en aangenaam maken
Kansen voor mensen scheppen
Potentieelgesprekken voeren
Prikkels geven voor presenteren
Ruilverhouding stimuleren
Talenten aanboren
Van twee kanten bekijken
Verbonden zijn met een organisatie
Verlikkend perspectief schetsen
Zoeken naar de fit tussen mens en organisatie

Typische spreekwoorden
Baat het niet, dan schaadt het niet
Bij iemand rozen op het pad strooien
Dat talent mag niet braak blijven liggen
De bloementjes buiten zetten
De boog kan niet altijd gespannen staan
Die dikwijls te gast gaan, moet dikwijls noden
Die goed doet, goed ontmoet
Doe je dondertje goed, want je zietje zit erin
Een blieke medewerker is een productieve medewerker
Een goede buur is beter dan een verre vriend
Er gaat veel gevrij in een zakje
Goede woorden kosten geen geld
Het is een slecht dorp, waar nooit kermis wordt gevierd
Hij is de juiste man op de juiste plaats
Iemand zijn gemak en gerak geven
Met zijn neus in de boter vallen
Niets is zo belangrijk als een tevreden mens
Voor wat, hoort wat
Vrolijke waarden maken vrolijke gasten
Wie appelen vaart, die appelen eet.
### Erkend denken

**Typische woorden**

<table>
<thead>
<tr>
<th>Action learning</th>
<th>Effect</th>
<th>Leermiddel</th>
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<td>Leersituatie</td>
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<td>Betekenis</td>
<td>Experiment</td>
<td>Leren</td>
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<td>Facilitator</td>
<td>Lerende</td>
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<td>Feedback</td>
<td>organisatie</td>
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<td>Gedrag</td>
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<td>Ontwikkeling</td>
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<td>Kennisoverdracht</td>
<td>Opvoeding</td>
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<td>Debriefing</td>
<td>Leercyclus</td>
<td>Organisatie</td>
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<td>Leerdoel</td>
<td>Ontwikkeling</td>
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<td>Didacticus</td>
<td>Leermanager</td>
<td>Reflectie</td>
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<td>Uitwisselen</td>
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<td>Veiligheid</td>
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<td>Zienswijze</td>
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</tbody>
</table>
Typische motto's
Begrip krijgen
Bewust onbekwaam maken
Denken en doen koppelen
Door de leercyclus lopen
In de leerhouding krijgen
In groepen werken
Je mag/moet van fouten leren
Meester-gezelrelaties ontwikkelen
Organisatieontwikkelingsactiviteiten plannen
Perplex staan
Tot reflectie brengen
Van elkaar leren
Veilig leerklimaat maken

Typische spreekwoorden
Al doende leert men
Alle begin is moeilijk
Als oude honden blaffen, is het tijd om uit te zien
Bij de les blijven
Dat valt in een vruchtbare akker
De koe is gauw vergeten dat zij kalf is geweest
Een ezel stoot zich in het gemeen geen twee keer aan dezelfde steen
Ergens op zitten broeden
Goed is wel, maar beter wint
Het verstand komt met het ambt
Hij heeft al meer met dat bijtje gehakt
Iemand de kunst afkijken
Jonge rijzen kan men buigen, oude bomen niet
Met de billen bloot gaan
Oefening baart kunst
Vrienden mogen kijken, maar moeten vrienden blijven
Zoals de ouders zongen, piepen de jongen
## Witdrukdenken

Typische woorden

<table>
<thead>
<tr>
<th>Adaptief</th>
<th>Ecologie</th>
<th>Losmaken</th>
<th>Transformatie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beelden</td>
<td>Energie</td>
<td>Natuur</td>
<td>Uitdaging</td>
</tr>
<tr>
<td>Beleving</td>
<td>Evolutie</td>
<td>Non-interventie</td>
<td>Uitstraling</td>
</tr>
<tr>
<td>Betekenisgeving</td>
<td>Feed forward</td>
<td>Ontvouwen</td>
<td>Verbinding</td>
</tr>
<tr>
<td>Beweging</td>
<td>Gevoel</td>
<td>Open</td>
<td>Waarnemen</td>
</tr>
<tr>
<td>Bewust worden</td>
<td>Groei</td>
<td>Patroon</td>
<td>Wil</td>
</tr>
<tr>
<td>Blokkade</td>
<td>Helden</td>
<td>Pilot</td>
<td>Zelforganisatie</td>
</tr>
<tr>
<td>Chaos</td>
<td>Helen</td>
<td>Rituelen</td>
<td>Zijn</td>
</tr>
<tr>
<td>Complexiteit</td>
<td>Ideeën</td>
<td>Ruimte</td>
<td>Zingeving</td>
</tr>
<tr>
<td>Creativiteit</td>
<td>Identiteit</td>
<td>Stilte</td>
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</tr>
<tr>
<td>Crisis</td>
<td>Innerlijk</td>
<td>Stromen</td>
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<tr>
<td>Diaaloog</td>
<td>Innovatie</td>
<td>Symbool</td>
<td></td>
</tr>
<tr>
<td>Dynamiek</td>
<td>Kracht</td>
<td>Toeval</td>
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</tr>
</tbody>
</table>
Typische motto's
Conflicten als kans zien.
De weg is de herberg
Dialoog op gang brengen
Dynamiek ontwikkelen
Dynamisch evenwicht zoeken
Energie krijgen
Er zin in krijgen
Herkennen van complexe patronen
Mensen ontmoeten elkaar
Mensen ontwikkelen innerlijke zekerheid
Waarnemen en bewust worden
Zingeving bevorderen

Typische spreekwoorden
Als het hek van de dam is, lopen de schapen overal
De dag is nog niet ten avond
De gelegenheid te baat nemen
Elk vogeltje zingt zoals hij gebekt is
Er hangen nog meer dagen in de lucht
Het geluk ligt in een klein hoekje
Het is zoals het is
Het vat geeft uit, wat het in zich heeft
Hij laat de boeren dorsen
Komt tijd, komt raad
Men eet om te leven, maar men leeft niet om te eten
Men weet nooit hoe een dubbeltje rollen kan
Ruim baan maken
Veel beekjes maken een groot water
Vriezen we dood, dan vriezen we dood
Waar duiven zijn, vliegen duiven heen
Waar het hart van vol is, loopt de mond van over
Royal Haskoning wil haar positie in de markt versterken door uit te blinken in de markt met de toepassingen van duurzaamheid.

De implementatie wordt gemaakt door het bedenken van een ordinantie in een sessie. De ordinantie zal ervoor zorgen dat bij de start van het ontwerp duidelijk is wat duurzaamheid in het ontwerp zal zijn.
**HOE**

De ordinantie zal ervoor zorgen dat bij de start van het ontwerp duidelijk is wat het ontwerp zal zijn. De ordinantie zal er voor zorgen dat een verhaal over het gebouw verteld kan worden. In dit verhaal worden visie en concept voor het gebouw gemaakt.

**RESULTAAT**

Het resultaat is de ordinantie, het verhaal over het gebouw waarin de visie en het concept voor het gebouw bepaald wordt. De ordinantie wordt gebruikt om een goed programma van eisen op te stellen. Of wanneer de opdrachtgever deze wat abstracter wil houden kan het ook fungeren als input voor het bestek. Daarom moet de ordinantie informatie voor het programma van eisen en duurzaamheid bevatten. De formulering kan SMART maar ook abstract zijn.

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**MAKING THE CHARRETTES**

De term charrette komt van de "École des Beaux Arts" in Parijs. Wanneer studenten de deadline voor hun ontwerp bereiken, kwam de dokter met een kar die ontwerpen ophalen. Studenten moesten op dat moment hun werk afronden, want niet in de kar was geen beoordeling. In het Frans is een kar een 'can'.

Hieraan wordt een charrette gezien als een werkzaamheid van korte tijd, maar waar intensief gewerkt wordt om de harde deadline te halen.

**TIMING**

<table>
<thead>
<tr>
<th>8:00 START</th>
<th>8:05 CHARRETTE 1</th>
<th>10:45 DEADLINE</th>
<th>11:15 DEADLINE</th>
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<tbody>
<tr>
<td><strong>INTRO</strong></td>
<td><em>result. ordination workshops</em></td>
<td><em>Sketching &amp; Storytelling</em></td>
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<tr>
<td><strong>ELECTION</strong></td>
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</table>

**Verbaal vertellen**

Wie kent het niet, compleet naast elkaar heen praten omdat er verschillende defenties van een woord gebruikt worden. Zeker voor professionals is het belangrijk duidelijk hun vakjargon uiteen te zetten. Wanneer tijdens het maken van de ordinantie steeds met een verhaal uitgelegd wordt wat bedoeld is, bestaat er maar een kleine kans dat men elkaar verkeerd of niet begrijpt.

**Schets-ontwerpen**

Een beeld kan duidelijkheid bieden, waar duizend woorden niet genoeg zijn. Tijdens het maken van de ordinantie moeten verschillende professionals samen werken. Om samen tot de ordinantie te komen is schets-ontwerpen een snelle en makkelijke manier van communiceren. Daarom kunnen de ideeën geschetst worden, waarna andere professionals kunnen reageren.
Puzzle with design knowledge