

Soft methods in small firms

IMM / Informatics and Mathematical Modeling

Temenuzhka K. Evers

Kgs. Lyngby 2005
IMM-THESIS-2005-50



Soft methods
in
small firms

Temenuzhka K. Evers

Kgs. Lyngby 2005

Abstract

This paper proposes a model for solving problems in small companies. The problems that are addressed are related to strategy and planning. The proposed model is especially effective in decision-making situations characterized by uncertainty and complexity. This Thesis applies a multi-methodological approach to develop a problem-solving framework. Managers in small companies could then use this framework to identify the factors, which require understanding and learning within the often-complex environment of modern organizations to ensure effective performance in the process of problem solving.

The proposed theoretical framework is based on the relevant theory and analysis of practical cases, where soft methods have been applied. Strategic Choice Approach is the central methodology used in the framework, as it is a tool for managing complexity and uncertainty in small firms. It is a planning approach that can structure the problem and it is a decision-focused method. To support the SCA in the problem solving process several different methodologies have been applied in the four modes of the main method.

The final result of integrating different methods in a soft approach is the development of a soft multi-methodological framework for complex and ill-defined problems, regarding strategy and planning in small organizations.

Abstrakt

Denne afhandling foreslår en model for, hvordan man kan løse problemer vedrørende strategi og planlægning i små virksomheder. Den foreslåede model er særligt effektiv i usikre og komplekse beslutningssituationer. Afhandlingen anvender en tilgang baseret på flere forskellige metoder til at udvikle en ramme for problemløsning. Lederne i små virksomheder kan så anvende denne ramme til at identificere de faktorer, som kræver forståelse og læring i det som oftest meget komplekse miljø, som omgiver moderne organisationer. Herved sikres effektiv problemløsning.

Den foreslåede teoretiske ramme er baseret på relevant teori og analyse af praktiske cases, hvor man har anvendt "bløde" metoder. Strategic Choice Approach er den centrale metode i den foreslåede ramme, da det er et værktøj til at styre kompleksiteten og usikkerheden i små virksomheder. Det er en planlægningstilgang, som kan strukturere problemet, og det har fokus på beslutninger. Som støtte for SCA i problemløsningen anvendes en række andre metoder i de fire faser af den centrale metode.

Slut-resultatet, hvor flere forskellige metoder integreres i en "blød" tilgang, er udviklingen af en "blød" ramme baseret på flere metoder, som kan anvendes til at løse komplekse og uklart definerede problemer vedrørende strategi og planlægning i små organisationer.

Acknowledgments

I am very grateful to my friends and family who supported me during this research.

During the process, I had the opportunity and chance to rely on two people, who read my work as it progressed. I would like to thank my advisor Ass. Prof. René Victor Valqui Vidal whose experience and enthusiasm kept me focused during a particularly difficult stage and to my co-advisor Ass. Prof. Lene Sørensen who so willingly provided her skills and expertise.

21 July 2005

Temenuzhka Kirilova Evers

Table of contents

Part I	7
1 Introduction	7
2 The Purpose of the Thesis	9
2.1 Problem Identification.....	11
3 Choice of literature	14
4 Delimitation	15
5 Methodology	17
6 Structure of the thesis	20
Part II Problem solving and multi-methodology	22
7 Problem solving process	22
7.1 What is a problem.....	22
7.2 Types of problems.....	23
8 The idea of multi-methodology	25
8.1 The history of pluralism.....	25
8.2 Desirability of combining approaches.....	25
8.3 Technique, methodology, paradigm.....	28
8.3.1 Definitions.....	28
8.3.2 Rational, critical and creative approaches.....	28
8.3.3 Soft methodologies.....	29
8.3.4 Hard methods.....	29
8.3.5 Creative approaches.....	30
8.3.6 Critical approaches.....	31
8.4 Small organizations and problem solving approaches.....	31
8.5 Importance of creativity for small organizations.....	33
8.6 Barriers for using soft operational methodologies.....	35
8.7 Summary.....	36
9 Learning process	38

	5
9.1 Brainstorming.....	38
9.2 Mind mapping.....	39
9.3 SWOT.....	40
9.4 PEST.....	41
9.5 Porter’s five forces.....	42
9.6 Cognitive mapping.....	43
9.7 Strategic Choice Approach.....	44
9.8 Multi-criteria analysis.....	48
9.8.1 PrOACT.....	50
9.9 Scenario methodology.....	51
9.10 Summary.....	52
Part III Soft approaches in practice.....	53
10 Soft methodologies in practice-the case of Kirby.....	53
10.1 Introduction.....	53
10.2 Methodological approach.....	54
10.2.1 SWOT.....	56
10.2.2 SCA.....	58
10.2.3 SODA.....	60
10.3 How to make better decisions.....	60
10.4 Summary.....	62
11 Mixing methods in practice.....	64
11.1 Introduction.....	64
11.2 ISS Development at Sainsbury’s Supermarkets (Ormerod, 1997).....	65
11.3 Customer service Strategy at Severn Trent Water (Ormerod, 1997).....	67
11.4 Cases where SCA has been applied.....	68
11.5 Summary.....	71
Part IV Building a model.....	73

	6
12 General model for solving complex problems in small organizations.....	74
12.1 Introduction.....	74
12.2 Choosing a central approach.....	74
12.2.1 SCA.....	76
12.3 Application of SCA.....	78
12.3.1 Shaping mode.....	78
12.3.2 Designing mode.....	82
12.3.3 Comparing and choosing modes.....	84
12.4 Framework for solving complex and ill-defined problems in small companies.....	86
 Part V.....	 89
13 Conclusion.....	89
14 Future research.....	91
 Bibliography.....	 92

Part I

1. Introduction

The work of managers and scientists - the work that steers the course of society and its economic and governmental organizations - is largely work of making decisions and solving problems. It is work of choosing issues that require attention, setting goals, finding or designing suitable courses of action, and evaluating and choosing among alternative actions. The first three of these activities--fixing agendas, setting goals, and designing actions - form problem solving; the last two- evaluating and choosing - form decision making.

The large enterprises have many years' academic and scientific interests but now the situation has turned to a strategic behavior of the small and medium size enterprises. It is not only caused by the explosion of new startup firms but also by the important role of small companies for the economic development, welfare and well being of most countries.

Small firms suffer from a different set of problems than larger firms. Small organizations, for example, tend to lack resources whereas larger firms tend to have more resources but may be less ready for a wholesale adaptation in times of radical changes. These limitations do not mean that one is more innovative than the other. The sheer availability of resources presumes that larger firms should be able to innovate along product, process, positioning and paradigm lines more often.

The main purpose of this research paper is to make a soft multi-methodological framework for solving complex problems in small companies. Management under high levels of uncertainty and complexity is full of dilemmas and paradoxes. A model for solving complex and ill-defined problems may provide some guidelines in an effort to introduce certainty as a reduction of complexity.

As Sørensen et al. (2004) discussed small companies do not have experience in using soft methods neither have they heard about soft OR. However, small enterprises could only benefit from the structural support and understanding about the problematic situation provided by the soft methodologies.

One fact about small business is certain: business owners and managers encounter challenges that require problem-solving skills. Those who can employ the fundamentals of problem solving and decision-making are best equipped to outlast the problem and find a solution.

2. The purpose of the thesis

Large numbers of small companies¹ in all industries face problematic situations every day. They could be related to the development of a new technology, organizational changes, a formulation of a strategy, visions, planning, or a problem solving in general (Vidal, 2002).

The key to a successful growth and a development of small firms lies in their ability to respond flexibly and fast to market changes and customer needs. Therefore, finding solutions for the problems, that arise every day can help the small organizations to focus on how they can be more efficient, what can be forecast as likely to happen over the next few years.

Finding the right answer to your problem is not always as easy as it probably sounds. Small companies face a complex situation (mess) every day. Different approaches, methodologies² and techniques can support the problem solving process. The approaches could be quantitative (hard), qualitative (soft), participative (critical), innovative (creative) or a combination of them (multi – methodology) (Vidal, 2002). Multi-methodology is a relatively new in the domain of Operational research (OR) but has shown that it has its own place and has made a lot of contributions for solving practical problems in the real world.

Almost every problem that we face is so complex that just using a mathematical model, a method or a single methodology will not help to solve it. Combining different methodologies will help the decision-makers of the small organizations to find an explanation of how to solve complex problems, which leads to understanding and this understanding leads to improvement.

¹ Enterprise that employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million. (Official Journal of the European Union 06.05.2003)

² The system of methods and principles used in a particular activity, science, etc.

Small organizations deal with messy, unstructured problems, which are mix of personal, social and material elements. And these types of problems cannot be fully represented mathematically with the traditional methods. When we deal with a problem situation we should identify first the problem. Problems could be characterized in many ways, such as complex and simple; well-defined or ill-defined.

Small companies operate under high levels of uncertainty and complexity. Often managers and employees in small enterprises do not have a clear view and an idea about the problematic situation in the company (Sørensen et al., 2004). It depends on the knowledge of the individuals and their experience how well they are able to define a problem. Usually it is a difficult task and sometimes even impossible for the decision-makers of a small organization to recognize and define the problem (Sørensen et al., 2004). The main reasons typically are: lack of knowledge in the whole organization; lack of resources, such as human and capital; lack of time.

One of the issues that arise in the small enterprises is how they can deal with these complex and ill-defined problems, regarding strategy and planning under the pressure of uncertainty. And are there some tools that can support them? How can the combination of different approaches support the problem solving process?

Therefore the purpose of this thesis is as follows:

Which methodologies can support the ill-defined problems, regarding strategy and planning in small companies?

How can Multi-methodology be used in this process?

There is a gap in the literature about how to deal with the problems in small companies and therefore this project is a helpful guide for managing this issue.

Problems can vary for example from strategy and planning to implementation of a new technology, etc. My motivation is not to give a model that solves the problems in small companies but rather a model that shows the way to do it and gives an understanding of how to deal with the messy situations; how to use methodologies and combine them in a useful set of multi-methodology, which can benefit the company's competitive advantage and make the company learn to deal with problem situations in general.

2.1 Problem Identification

By combining different methodologies a general model for solving problems in the small firms can be formulated. After I read the article "Using soft OR in a small company - The case of Kirby" from Vidal, Sørensen and Engstrom (2004), I spoke with two of the authors, read cases from Ormerod (1997a, 1997b, 2001) and also cases from Friend and Hickling (2005) I came up with the idea that a general model of a soft multi-methodology can be developed for dealing with and for solving some of the problems in small organizations. As the different types of methods address different types of problems I have to specify what kind of methods I will use in the model and what types of problems they can address. The central methodology in the case of Kirby (Sørensen et al., 2004) has been Strategic Choice Approach, but there have been used also SWOT³ analysis and SODA⁴.

The idea, which comes up after analyzing the case of Kirby (Sørensen et al., 2004), the cases from Ormerod (1997a, 1997b), the cases of applying different soft methodologies described by Rosenhead and Mingers (2001), the cases from Friend and Hickling (2005) of using Strategic Choice Approach is that soft methodologies can be used to develop a general model, and the end result will be a single multi-methodology model for solving ill-defined, complex problems regarding strategy and planning in small companies, where uncertainty is one of the main factors affecting the final decision.

³ Strengths, Weaknesses, Opportunities, Threats

⁴ Strategic option development and analysis

I choose to use soft methodologies, because they are problem structuring, easy to use, can be mixed or combined to follow a problem solving process, can be used by groups with different backgrounds and learning is a part of the process (Sørensen, 2004). Soft methodologies engage participants in a learning process because the essence of soft approaches is participation and interaction. In this way small organizations can overcome the limited resources regarding knowledge.

The other reason for choosing the soft OR methods is that small companies operate in a dynamic and changing environment, deal with complex problems, closely connected with creativity and innovations. Traditional, mathematically based models cannot provide methods suitable for their needs.

Therefore the thesis is based on the following problem formulation:

**How to develop a soft multi-methodological model for solving ill-defined problems, regarding strategy and planning in small companies?
Which methodologies to combine?**

There is a wide range of approaches, methods and tools that can be used to evaluate alternative options or to make decisions. The manager/facilitator must find which approach is suitable for the given situation in the company he/she operates. Hiring an external facilitator for the organization is expensive. Most of the small businesses cannot afford it, because of the limited resources present in the small companies. Thus the big challenge for me is to present such methodologies, that could be easy to understand, learn and implement in problematic situations, that usually arise when dealing with new technologies, strategy, planning, etc.

Small companies have to deal not only with their own problems but also they must survive and be competitive under the pressure of the large enterprises and the high competition in the market. More and more researchers nowadays believe that one of the key factors for surviving and gaining competitive advantage in this changing environment is to be creative. Creativity could provide the means for coping with the change, helps to gain a competitive edge in these days of growing competition.

Michael Hicks (2004) has written:

“The world around us is more `turbulent ’ then it used to be, susceptible to rapid and often unpredictable changes. We need to be creative to survive in these conditions.”

Creative tools and Creative Problem Solving (CPS) process can be use when dealing with problem solving in general (Vidal, 2004). In the new business environment of rapid changes, high risk and uncertainty, developing a model for problem solving is critical. Creativity prepares managers to face the strategic uncertainties ahead and “is a way to cope with complexity” (Vidal, 2004). Creativity is combined with the ability to innovate, to take an idea and make it work in practice. This is the way many start-up companies have been established. Creativity is also a main factor for dealing with mess.

Many of the soft approaches are very creative as Soft System Methodology, others could contain a creative technique such as Brainstorming, which is a way to generate many ideas about a particular problem. Brainstorming could be a good input for SWOT or SCA, in other words it is suitable in the first stage of a problem solving process.

In this way I reach the second problem, which is related to the first one:

Which creative tools or techniques could support the soft methodologies used in the model for solving the ill-defined problems, regarding strategy and planning in the small companies?

3. Choice of literature

The literature used in this project is the article “Using soft OR in a small company - The case of Kirby” (Sørensen et al., 2004) from the *European Journal of Operational Research*, as well as the cases described by Ormerod in the book “Multi-methodology” by Mingers and Gill (1997) and “Planning under pressure – The Strategic Choice Approach” by Friend and Hickling (2005), and also articles and new research papers from Harvard Business Review, Journal of Small Business Management, where different empirical studies about small firms are discussed.

How the small firms can deal with complex problems, how methodologies can be used to solve them and which creative tools can support the methodologies are the main concern of the thesis. Two research papers are used: Dealing with Problematic Situation (Vidal, 2002), Creativity and Problem Solving (Vidal, 2004).

Notes and papers from the course “Tele Information: Strategy and Creativity”(Sørensen and Vidal, 2004) have been used to outline the methodologies, tools and techniques related to the thesis.

4. Delimitations

Limitations come from the fact that I am looking only at the small enterprises, companies with limited resources and capital that employ certain although limited number of people. Using a soft methodology requires a group and teamwork. In some organizations the number of employees is very small and this will be an obstacle for applying some of the approaches in such companies.

Mostly top managers in the small companies are the founders. The skills needed to start up a company do not necessarily include a lot of knowledge about soft methodologies and how they can be applied for solving complex and ill-defined problems. Therefore my task is to use approaches, which can be understood, applied and can engage the participants in a learning process later on in the real life cases.

Soft methodologies are based on consensus, meaning that the solution you come up with is based on consensus, which is not always true in the real life. Another assumption is that individuals in organizations are interested to understand and learn about the problem situation, which appears. Unfortunately the lack of knowledge about soft methodologies may convince the individuals in the organization to neglect these approaches and even not to participate in the problem solving process.

Another limitation is that small organizations have limited financial resources. Therefore it may be impossible for the firm to hire a facilitator, who can insure the support of the whole process of problem solving. The role of facilitator is critical for the final outcome of the problem solving process (Vidal, 2002). Then the question is whether the manager can be able to have the role as a facilitator? And the answer is yes, but he/she must be experienced in working with different methodologies and problem solving as a whole, with good knowledge about a number of approaches and an understanding about how to facilitate a group. Good technical skills are also required, if the company is working with some technology.

Due to the limitation of the time, it has not been possible to exploit the combination of using hard, soft and critical approaches in a model for solving complex problems regarding strategy and planning in small companies. Furthermore it has not been possible to apply the model in a real case study, but this theme could be continued in a master or Ph.D. project.

The development of a real problem solving process for a concrete company must be done in a close co-operation with the company, since the development of model needs a huge amount of data about the company.

5. Methodology

The methodological approach taken in this thesis involves a literature review, analyzing of a case and a development of a practical multi-methodological framework for solving problems in the small organizations. Each of these is briefly elaborated on below:

Literature Review

The literature review has primarily served to provide a background for both the theoretical foundation regarding problem solving in general and the development of a framework of multi - methodology. In terms of theoretical support a variety of methodological theoreticians were used in an attempt to provide the reader with a more complete understanding of the thesis. As for aiding in providing a methodological overview, a broad variety of literature sources were used to help establish a better understanding for the usage of soft methodology in problem solving.

Analysis of a case

With a primary study area defined as the problem solving in small organizations, it was deemed necessary to formulate and implement a case study in order to capture some understanding about how methodologies are used in practice when dealing with messy or problematic situations. The use of this information is added to build further an understanding of problem solving and decision-making, as well as the use of methodologies and to develop a general model of a multi-methodology for problem solving in small organizations.

Developing of a multi-methodological framework

Lastly, based on the Literature review and the cases an analysis of the necessary methods and methodologies for developing a framework for solving complex and

ill-defined problems regarding strategy and planning in small firms is made and a new multi-methodological framework is presented.

Speaking about problem solving we can distinguish two processes in contradiction: the first one creative and synthetic, and the second one rational and analytic. Creativity is needed for the problem solving (Vidal, 2004) but to manage the complexity and uncertainty in small companies in the dynamic and changing environment, analysis and rational thinking are just as important as creativity. Thus the above-mentioned processes are complementary.

I cannot provide a theoretical model that could be used completely in a specific firm and a situation. It does not mean that the theory does not work in practice. Every problematic situation is unique, as well as every firm is unique, therefore the theory can be used but must be adapted in a way suitable for the organization.

Small organizations face problems every day: environmental, financial, managerial, etc. As the surrounding environment is constantly changing, the small enterprises face even more complex problematic situations to deal with. A solution to complexity is to manage the things systemically. It means that the parts of a problem cannot be treated in isolation; you have to deal with them in concert and it is important to cope with both the components of a problem and how they interact with one another (Vidal, 2002). And applying the methodology to the thesis provides the following picture (Fig. 1):



Fig.1 Methodological approach in the thesis

My analysis of the theoretical and empirical material gathered from the cases aims to understand and explain the concept of multi-methodology and its desirability. Based on this analysis I developed a framework for solving ill-defined and complex problems with regard to strategy and planning in small organizations.

6. Structure of the thesis

The introductory part has sought to establish the basic points that methodologies could be used in a framework for solving some of the problems in small organizations. The aim of this thesis is to provide an explanatory model or framework for understanding and solving ill-defined and complex problems regarding strategy and planning in small companies, which operate under high level of uncertainty.

The following part (Part II) is devoted to explain the foundations on which this thesis is built and to establish the terminology used in this research. The second section of this part discusses the approaches that have been proposed in the literature for achieving success with problem solving in general. These approaches are generally referred to as soft, hard, critical and creative and the combination of them. The criteria that were applied to select a framework for solving ill-defined and complex problems in small companies are stated and the approaches are analyzed in details.

Part III discusses the use of soft methodologies in a small firm (Sørensen et al., 2004) and how the different methodologies have been combined and applied in the problem solving process in this case. Also some cases described by different authors have been analyzed and all the cases are used as a basis for the development of the general framework of a multi-methodology.

This leads into Part IV in which the research questions are answered, the theoretical model for practical use is developed and a framework is drawn.

Part V summarizes the work and concludes the thesis.

In the diagram below (Fig.2) the structure of the thesis is illustrated and a more general overview of the project is provided.

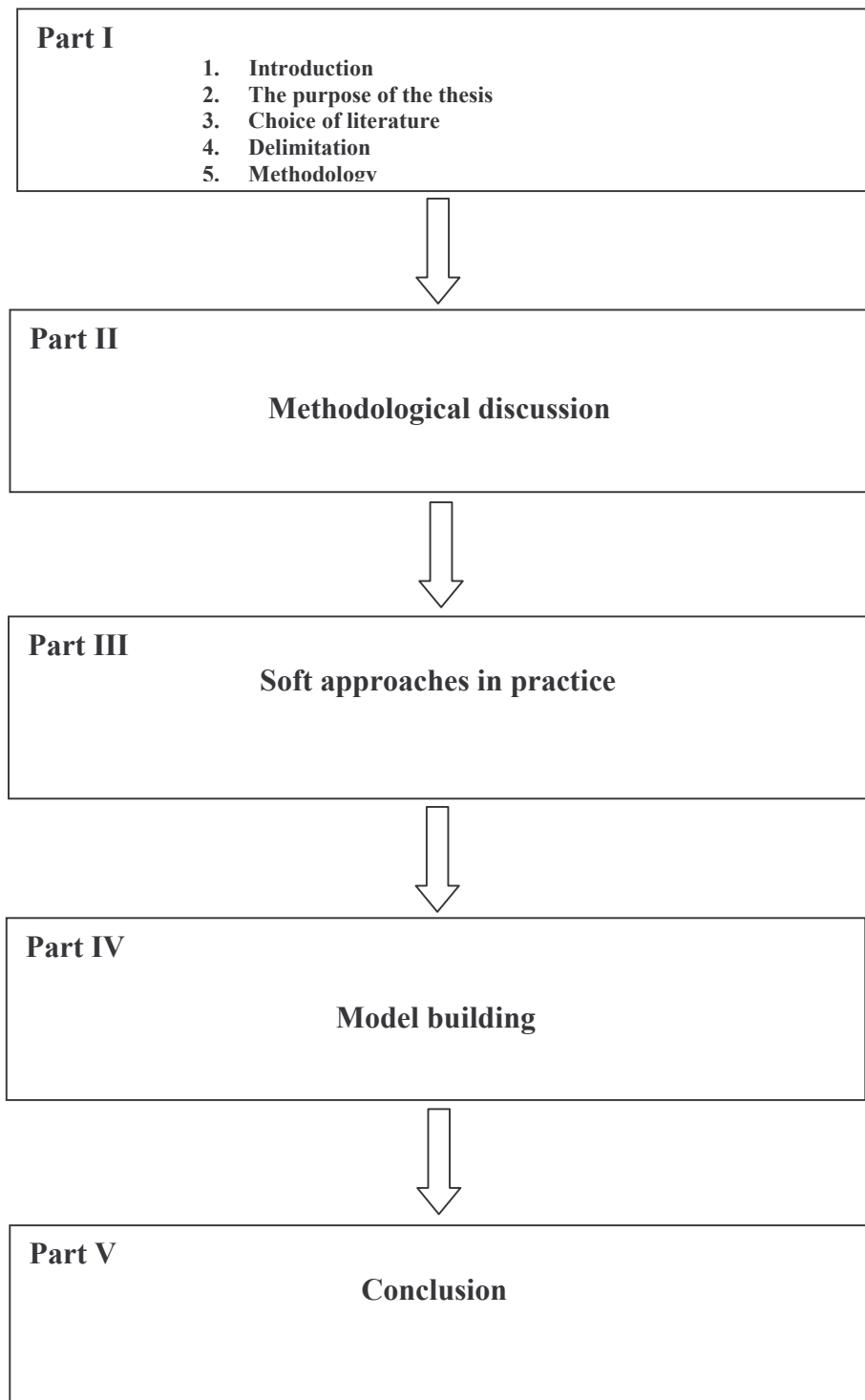


Fig.2 Flowchart of the thesis structure

Part II

Problem solving and multi-methodology

In this chapter I outline the nature of the problem solving process and what kind of problems small companies address. The second part provides a brief history of the pluralism, since the idea of multi-methodology is about to utilize a plurality of methodologies or techniques from different paradigms, in the course of particular intervention (Mingers, 1997). The section gives details about the different types of approaches and which methods support the types of problems that the small firms face. The part also discusses the reasons for using multi-methodology to solve complex and ill-defined problems instead of a single approach.

7. Problem solving process

Every day there are situations in which we have to decide what to do and to choose between several courses of action. We want to cope with these problems as efficiently and effectively as possible, but do not always know how to do so.

7.1 What is a problem

Here I present a number of possible definitions of what a problem is by some experts in this field:

“We usually refer to ourselves as having a problem of things are not as we would like them to be, and we are not quite sure what to do about it.”

Colin Eden, Sue Jones and David Sims (1983, p.12)

“A problem is a condition characterized by a sense of mismatch, which eludes precise definition, between what is perceived to be actuality and what is perceived might become actuality”.

Peter Checkland (1981, p.20)

“A problem is a situation in which a decision-making individual or group has alternative courses of action available, the choice made can have a significant effect, and the decision-maker has some doubt as to which alternative should be selected.”

Russell Ackoff (1981, p.20)

There are many approaches to problem solving, depending on the nature of the problem and the people involved in it. The more traditional, rational approach is typically used and involves: clarifying description of the problem, identifying alternatives, choosing one, implementing it, and evaluating whether the problem is solved or not.

7.2 Types of problems

It is important that when dealing with problem situations we should recognize first the problem and then how to work on it. The problem situation usually consists of several individual problems. Problems could be characterized in many ways, such as complex and simple, well-defined or ill-defined. The scope of the thesis is to find a model, which can cope with complex and ill-defined problems. Small enterprises usually have difficulties to handle such types of problems and therefore I will focus on and discuss only the aforementioned ones.

A well-defined problem is a problem that has a clear and precise definition. Individuals have information about the initial state of the problem, i.e. what is the current situation, what they would it to be, and what kind of methods can be used.

Well-defined problems can be represented mathematically and a mathematical solution may be found. Well-defined problems are related to the hard methods (Vidal, 2004).

An ill-defined problem is one that addresses complex issues and thus cannot easily be described in a concise, complete manner. Ill-defined problems are part of other problems, they are difficult to define and there is uncertainty in them. Ill-defined problems have more than one acceptable solution, and no guaranteed method for finding the solutions. Usually these types of problems can be called complex, wicked, dealing with uncertainty (Sørensen, 2004). Soft, creative and critical methodologies deal with these types of problems (Vidal, 2004).

Small organizations operate under high levels of uncertainty and complexity, where the decisions should be made in no time and management is full of dilemmas and paradoxes. Often managers and employees in small enterprises do not have clear views and ideas about the internal and external environment and the current situation of the company, such as in the case of Kirby (Sørensen et al., 2004).

It depends on the knowledge of the individuals and their experience how well they are able to define a problem. Often it is difficult and even impossible for a decision-maker of a small organization to recognize and define the problem. The main reasons are: lack of knowledge in the whole organization, lack of resources, such as human and financial, lack of time. Usually managers in small firms are heavily involved in the daily and routine operations and they have to focus on many different areas (management, marketing, sales, finance). All the decision-makers in the small companies must be aware that no decision should be made today without an idea of how it will affect the decision that might have to be made tomorrow.

8. The idea of multi-methodology

8.1 The history of pluralism

In the beginning of the twentieth century the positivism (belief in facts which are directly accessible to observation, the logical truth of a proposition in the end must be viewed in its accordance with the (physical) material world) was the philosophy that had been seen as the most suitable way of generating knowledge in the natural and social science.

During the 1970s and the early 1980s the legitimacy of positivism was blown by philosophers such as Kuhn (1970) and Popper (1972), who showed serious mistakes in the inductive theory and theory- and observer-independent observations (Mingers, 1997). This had effect mostly on the social science and OR with the development of soft OR and soft system methodology (SSM). There appeared the four different paradigms and the development of theory and research in isolation. As the researchers and practitioners found that no single paradigm could capture the richness of the real-world situation the debate turned from positivism to pluralism, in both methodology and philosophy.

Before 1980s OR had focused mainly on mathematical models and algorithms and the use of hard approaches. The situation changed after the appearance of the soft methodologies. Soon the critical approaches arrived at the scene and the problem became which methodology the practitioners should use and when. The critical system thinking (CST) became established during the 1980s to manage the diversity of methodologies.

8.2 Desirability of combining approaches

In recent years, the number of methods, techniques and methodologies in the field of Operational research (OR) has grown. There are a variety of approaches, coming

from different paradigms based on differing philosophical assumptions. A significant contribution in this field has been made by Flood and Jackson (1991) with the total systems intervention (TSI), where the main emphasis is that different methodologies could be combined and integrated in a process for problem solving and it is necessary to make a choice which methodologies are appropriate in a particular intervention.

Mingers (1997) argue that TSI and Critical System Approach represents only one possible example of multi-methodology. He also discusses the desirability of multi-paradigm.

Problem situations surround us every day, for instance a simple situation commonly faced is when a person gets ill. Then this person goes to the doctor, gets medicine, which should be taken for several days and then relaxes for some days. This simple situation goes through three activities, which have to be combined and executed in the particular order to get a desired result, namely to get better again. Dealing with the real world with all the associated complexity, it is reasonable to use different approaches, which can cope with the different parts of the problem. Therefore it would be reasonable sometimes to combine several methodologies in a problem to cover all parts and phases of the problem solving process. The way of combining methods will depend on the interventions in the process of problem solving.

Any problem situation is a complex mix of personal, social and material elements (Fig.3). Material or physical characteristics could be modeled using traditional hard OR but social agreements, politics or personal believes and values require quite different, qualitative approaches. The real-world problem situations are highly complex and multidimensional. Different approaches focus on different aspects of a problematic situation. A real project goes through several phases - understanding and appreciating the situation, analyzing information, estimating different options, and acting to bring about change. The various methodologies can be more or less useful at these different stages. These are the strong arguments to combine together different methodologies for problem solving.

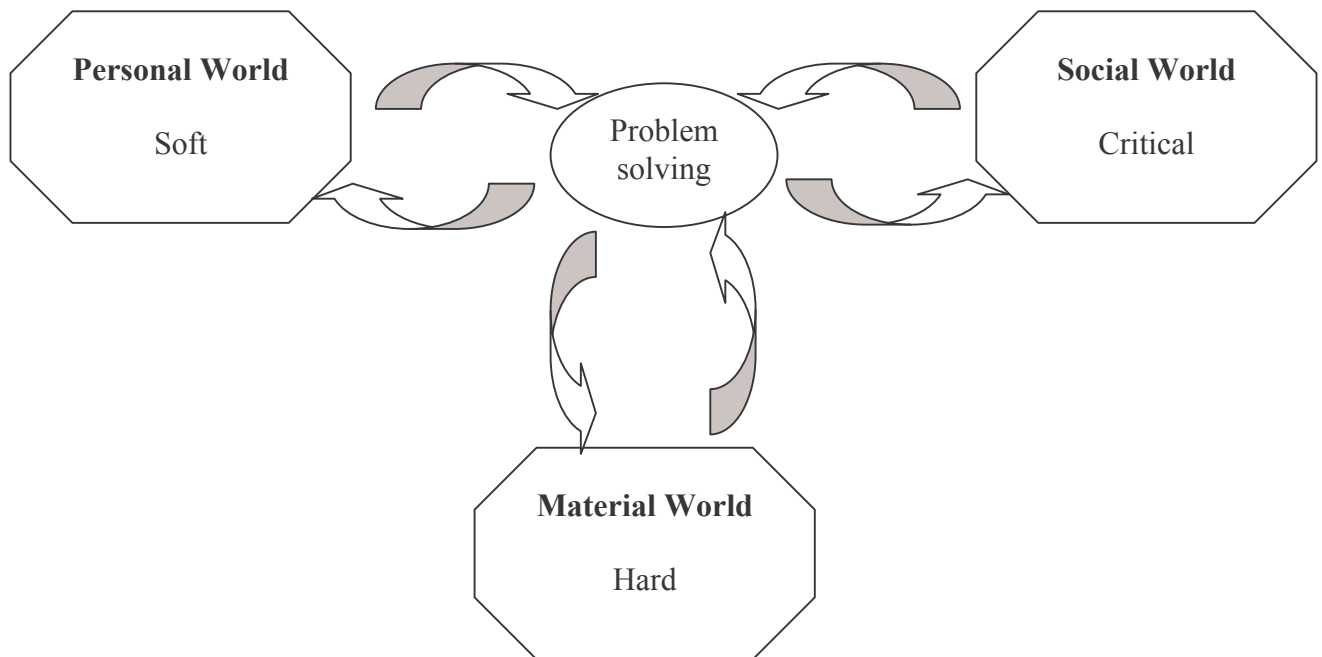


Fig.3 The three dimensions of the problem situation (adopted from Habermas (1984; 1987))

Mingers (1997) argues also: “most if not all problem situations would be dealt more effectively” by combining methods from different paradigms (strong pluralism). I can not agree with this statement, since the practice showed (see Ormerod (1997a, 1997b, 2001); Checkland (2001); Eden and Ackermann (1998, 2001); Friend and Hickling (2005) that combining methodologies from one paradigm, or using a single method could be successful for finding a solution for a particular problem.

Based on the arguments of desirability of multi-methodology, the above-mentioned argument against the strong pluralism, the case of Kirby (Sørensen et al., 2004), the cases in Friend and Hickling (2005), Hickling (2001) and the practical cases described by Ormerod (1997a, 1997b, 2001) I can develop a soft multi-methodological model that can help small companies in the problem solving process.

8.3 Technique, methodology, paradigm

8.3.1 Definitions

The difference between technique and methodology is that the former is an activity that has a clear and well-defined purpose within the context of methodology, for examples rich pictures in SSM or cognitive maps in SODA; whereas the latter involves a set of techniques and tools in a larger process involving judgment and social interaction among the participants in the process (Mingers and Gill, 1997).

A paradigm is a set of philosophical assumptions that define the nature of possible research and intervention (Mingers and Brocklesby, 1997). A paradigm is a philosophical or theoretical framework of any kind. There are five main paradigms in the field of OR: hard (empirical-analytical), soft (interpretive), critical (participative), creative (innovative) and multi-methodology: a combination of them (Vidal, 2002).

The idea of multi-methodology is to use more than one approach, or part thereof, possibly from one or different paradigms within single or multiple interventions.

8.3.2 Rational, critical and creative approaches

Rational approaches utilize hard or soft methods or a combination of them and use the principles of rational thinking: logical coherence, decomposition and optimization. Vidal (2004) determines creative approaches by breaking the boundaries of the system in question and critical approaches, used in conflict situations.

The main concern of the project is which methodologies can be used to determine a framework for problem solving and decision-making regarding strategy and planning in small organizations. The problems I am addressing are complex with a high level of uncertainty. They are usually connected with many sub-problems and it

is difficult to distinguish what kind of problem is exactly strategic or planning or a combination of them.

8.3.3 Soft methodologies

The soft OR methodologies normally cannot be applied without an involvement and a participation of the problem owners, which is why the individuals in the organization play a large role. Therefore the participation of the users and their knowledge and experience are an important element of a problem solving process. Soft methodologies can be problem structuring and are useful in a complex and uncertain situation where it is difficult to find or define a problem. Also they are used in problematic situations where there are many alternative ways to find the solution. The soft methodologies only come as a contrast to the hard methodologies.

Soft methodologies, based on Rosenhead and Mingers (2001), are:

- Problem structuring;
- Easy to use. Some of the soft methodologies are constructed in a way so that everybody can use it after an introduction is made;
- Can be mixed or combined to follow a problem solving process;
- Can be used by groups with different backgrounds;
- Learning is part of the process,
- They are based on very little mathematics (if any);
- Based on cyclic and dynamic process from a group discussion;
- Transparent - all users will understand what is going on.

8.3.4 Hard methods

Hard methods use mathematical models to find a solution and there is usually no need of employees' involvement, because there is a single decision-maker (expert) with a clear objective (Munro and Mingers, 2002). This can lead to a situation where some individuals might not accept the results, because they do not feel involved in

the process. Hard methods see the problems as independent of individuals' beliefs and views. Usually the solution drives the method, meaning that decision-makers know what the solution should be but they do not know the way to solve the problem. These methodologies require an expert, who usually has very good analytical and mathematical skills. The problem should be clear defined and structured and the advantage of the quantitative methods is that an optimal solution would be found.

8.3.5 Creative approaches

Creative approaches are used to deal with messy and complex situations. A skilled facilitator, an expert is needed to support the decision process. This person in practice needs an important skill: intuition. According to me intuition will come after a long experience with dealing with messy problems and actually it will help to overcome the barriers for creative thinking. The creative problem solving (CPS) process might take a long time, depending on the size and complexity of the problem (Vidal, 2004).

Vidal (2004) presents a general version of CPS model as a six steps process:

- Mess finding: Identify the issues and make a list of ideas about possible problem situations. Select one of them.
- Fact-finding: Gather data about the problem and observe as objectively as possible.
- Problem finding: Examine the various parts of the problem to isolate the major part, state the problem in an open-ended way.
- Idea finding: Generate as many ideas as possible regarding the problem, brainstorming
- Solution finding: Choose the solution that would be most appropriate, develop and select criteria to evaluate the alternative solutions.
- Acceptance finding: Create a plan of action

8.3.6 Critical approaches

Critical approaches are usually both rational and creative. Any hard, soft or creative methods can be used within a critical approach. Both the users and facilitator are interested to participate to create changes and these approaches are related to the social interventions. A skilled expert, a facilitator is a must since he/she should have knowledge about the methodologies coming from different paradigms and he/she has to be experienced in combining and using techniques, methods and methodologies. Some of the methods require a large group of participants for the problem solving process.

8.4 Small organization and problem solving approaches

Small organizations deal with messy, unstructured problems, which are a mix of personal, social and material elements. It means that these types of problems cannot be fully represented mathematically with the traditional hard methods. Therefore other qualitative approaches should be used.

I do not say that hard methodologies cannot be used in the problem solving process in the small organization. They can be used in some part of the process but not for solving the whole problem. Hard methods require specific mathematical knowledge and competences. Some hard approaches can be applied amongst a group of people supporting the negotiating and learning process. Hard methodologies in the context of problem solving focus on structuring mathematical models to be optimized. Therefore an expert - facilitator is needed. If the small company has the necessary resources and finances an external facilitator can be hired and the hard methods could also be used in some parts of the problem solving process.

Small organizations do not have traditions of hiring a facilitator (consultant), since they have limited finances. Another characteristic of small firms is the lack of people. Some of the employees should take care of the daily operations in the company, so it can be difficult to gather enough people for a session or an interview.

Lack of knowledge will be an obstacle for the small firms to use critical approaches in the problem solving process, since these types of methods require lots of experience and knowledge about the different approaches and paradigms and how to facilitate such a process.

Soft methodologies can provide some guidelines for the small companies in an effort to introduce certainty as a reduction of complexity. Soft OR methodologies support interventions in 'messy', 'wicked' and contested issues and can help small enterprises in a problematic situation, related to planning, strategy or technology development.

Soft approaches can help small organizations when dealing with environmental problems-company situation and external and internal factors affecting the organization. It is very important that small companies before dealing with particular problems are aware of their own situation. From the case of Kirby (Sørensen et al., 2004) one can see that the company did not have an idea of its situation. You cannot go anywhere if you do not know where you are now.

The soft approaches aim the creative, intuitive and motivating component of planning by supporting the negotiation and the learning processes. Only in this way will the problem be understood and identified. The essence of the soft OR is consensus, which is accepted by all the participants in the problem solving process. The solution that will be found is based on consensus and negotiation (Sørensen, 2004). For the small organization it is important that all the employees identify and understand the problem that arises, because the whole organization should put emphasis on solving the problematic situation together.

Soft methodologies are based on similar principles such as realizing that an intervention is a social act, which involves many stakeholders with different viewpoints, and therefore there is no reason to think that soft approaches will not mix well in practice (Ormerod, 1997a, 1997b, 2001) has described several cases from his experience to mix different soft methodologies in practice and the success

of using them in different problematic situations addressing strategy, planning and developing a technology.

From the other side creative approaches could also deal with complex situations, but the process might take long time. Timing is an important factor for competitive advantage for every company, especially for the small firms, which should overcome the barriers that they are facing: high competition, pressure of the incumbents in the industries, many rivals. A skilled facilitator, an expert is needed to support the decision process when the creative approaches are applied, expenses that most of the small companies cannot afford.

8.5 Importance of creativity for small organizations

Many of the soft approaches are very creative and because creativity could provide the means for coping with the uncertainty and complexity. I believe that it will be reasonable to use some creative techniques to support the soft methodologies in the problem solving process.

My reasons to apply some creative techniques with soft methodologies in a problem solving process are:

- In the case of Kirby (Sørensen et al., 2004) a creative technique such as brainstorming have been used to support the methodologies. It was applied before a SWOT analysis to create a good atmosphere, opened up the dialog between the participants, giving possibilities for participants to get to know each other as well as to generate some thoughts about the problem situations.
- During my study at DTU I participated in a course “Tele-information: Creativity and Strategy” (Sørensen and Vidal, 2004), where in many exercises brainstorming and mind mapping were used before the problem solving process. This helped me to learn more about and from the other participants in my group (there were 5 people with different backgrounds), to generate many useful ideas about the different problems which we discussed and brought a good atmosphere in the group.

Small companies face many problems because of the increasing dynamic industry environment, the competition among them and with the incumbents in the industry. Small companies operate in a rapidly changing world, where the pace of change seems to be forever increasing. Creativity could be a way to survive in this turbulent world as well as to help the company be more competitive. Small companies face problematic situations that have no precedents or traditional models, and frameworks do not work. Therefore creativity should also be part of the problem solving process in the small company. Vidal (2004) outlines four central creative abilities: fluency, flexibility, originality, and elaboration.

Fluency is the ability of making ideas, alternatives and finding solutions. A useful creative tool for producing such ideas is Brainstorming.

Flexibility is the ability to generate ideas or objects in many ways given the same stimulus (Vidal, 2004). The stimulus comes from forcing yourself to answer questions, which you would not normally pose. A good technique can be SCAMPER (an acronym for Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, Reverse). More about the technique is written by Eberle (1971).

Originality is breaking the routine thinking and it is a power of independent thought or constructive imagination. Picture simulation is a known tool to produce original ideas.

Elaboration is to find models and structures after the ideas have been produced. A good tool for elaboration is Mind Mapping.

All these tools can be combined with the soft methodologies and be a part of the problem solving process in the small enterprises. They will engage the participants in a learning process as well.

8.6 Barriers for using soft operational methodologies

As one can see from the case study of Kirby (Sørensen et al., 2004) and the survey from Munro and Mingers (2002) there are several barriers to the applications of the soft OR in small companies.

One of the biggest barriers is lack of people in the small organizations. All the employees are normally too busy to participate in such a session of interviews or brainstorming. The lack of time is a common feature of small organizations. With 10 employees like in the case of Kirby (Sørensen et al., 2004) there are never enough people for a discussion or application of some of the soft OR.

Another barrier is that many employees will neglect the methodologies and avoid participation in the session of the problem solving process. The reason is that they have not heard about the methodologies or they have little knowledge about them. As in the case of Kirby (Sørensen et al., 2004) the company manager does not have experience in using soft OR for solving their strategic and planning problems. In this case the facilitator of the solving process should have a pedagogical and social insight how the different methodologies could be presented and applied for such a group, to change their reactive position about soft OR into a proactive attitude.

Change is also a barrier not only for small companies employees but also for large enterprises. In Kirby one can easily see that employees were not ready for change and even the manager expected that the company would still run as usual.

Another obstacle for the small companies is the time. Often time is pressing small companies' managers to make fast decisions. Soft methodologies usually take some time for interviewing, sessions and workshops. In some cases it can take several months (Sørensen et al., 2004; Ormerod, 1997a, 2001; Eden and Ackermann, 1998) had experienced in several cases where the problem solving process took seven months. Time is important for small companies, which are very flexible and sometimes taking faster the decisions and solving the problems could gain

competitive advantage. It depends on the size of the problem and its complexity as well as the experience and knowledge of the facilitator and the group how fast they could solve the problem.

Last barrier is cost (in time and money). If the company must hire an external facilitator to support the process, it becomes more expensive. Small companies will find difficulties to deal with it. In the case of Kirby (Sørensen et al., 2004) the manager agreed to participate and applied soft approaches, because it was free of charge.

8.7 Summary

After a close look into the different types of methodologies and the case of Kirby (Sørensen et al., 2004) I can make the conclusion that soft OR would be more suitable for the small organizations' ill- defined and complex problems related to strategy, planning and technology.

All the employees should participate in the problem solving process, all the opinions will be heard and everybody can feel his/her own contribution and importance for the future of the company. By participating in the sessions and sharing knowledge between the individuals, the small firms could overcome the lack of knowledge. As soft methodologies are based on consensus, everybody will accept the results, as they will feel ownership.

Some of the methodologies are easy to understand as SWOT and very creative. Hard methods require a specialist facilitator with technical, mathematical knowledge, while soft methodologies are more creative and the facilitator could be external but also the manager/owner of the small company. However creative thinking is important no matter which approach is the main one used.

Working as a team in the process of using methodologies to solve the particular problems in the organization will give the employee not only a friendly and stable working environment but also knowledge about how to learn, to negotiate and make consensus.

And not at the least soft methodologies can cope with uncertainty, which is a threat for the small organizations.

9. Learning process

Learning is an important concept with regard to the problem solving process. Any learning that occurs as a result of individual action becomes organizational learning. Learning is a very important issue for the small organization, which has limited resources and this is the way it could transform into a knowledge-based organization. Learning is the way small firms could overcome some of the barriers they face.

Argyris and Schön (1978) have summarized:

“Organizational learning occurs when individuals within an organization experience a problematic situation and inquire into it on the organization’s behalf.”

Different soft methodologies used in the process of problem solving in the small companies will generate a creative and stimulating environment for learning. Soft approaches can engage the participants in the learning process. Soft methodologies will engage the individuals into a knowledge sharing process through dialog and communication.

The creative tools and techniques will stimulate the participants to interact with each other, exchange ideas and knowledge, strengthen the communication and be good inputs for using the soft methodologies.

9.1 Brainstorming

Problem solving and decision-making are closely related, and each requires creativity in identifying and developing options, for which the brainstorming technique is particularly useful. This tool guides a group in an interactive exchange of ideas, deferring judgment until the end of the session. It is a good way to quickly

generate many diverse ideas. This technique is particularly effective when participants feel "free" to offer their ideas without fear of criticism. By sharing ideas, knowledge, thoughts individuals will be engaged in a learning process. Therefore the technique could be used in all kinds of groups. A disadvantage is that the tool is not appropriate for problems regarding high-tech expertise and know-how, because some of the ideas, which are produced, might be of low quality (Vidal, 2004). If a small company is from the high-tech industry there will be some kind of expertise and people with more technical background, which can insure the quality of a brainstorm session. Otherwise an external expert will be a must. Brainstorming is a useful technique for strengthening fluency and communication skills (Vidal, 2004). The technique is good at the beginning of the problem solving process. The participants will get an opportunity to get to know each other and feel more free to discuss thoughts and ideas with the others in the group. It could be a good input for SWOT, PEST analysis or even Porter's five forces, which I will discuss briefly further down.

9.2 Mind mapping

Mind mapping is a creative tool to structure and visualize complex problem situations. The principles of this technique are very easy to understand. The main problem or subject is placed in the center of a paper (Fig. 4) and all the ideas and thoughts concerning this problem (subject) are connected through main branches and sub-branches. It is possible to use capital letters, colors and symbols to emphasis ideas (Vidal, 2004).

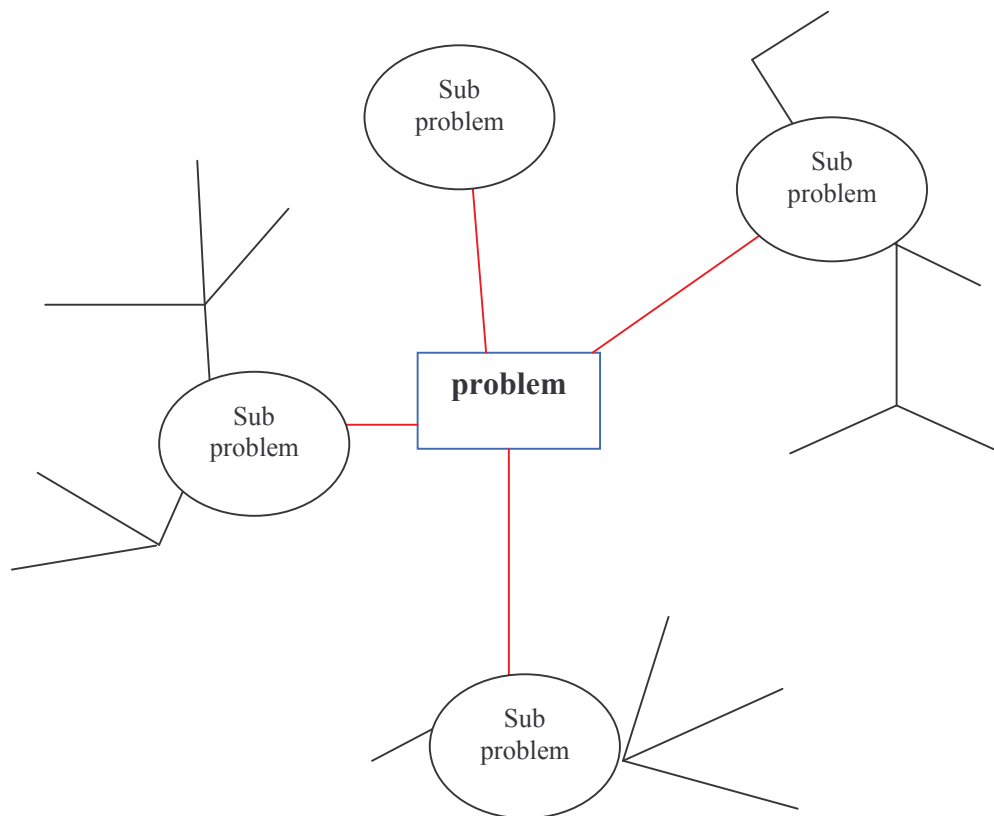


Fig. 4 Mind mapping

9.3 SWOT

The SWOT analysis (Sørensen and Vidal, 1999) is a very simple but effective tool for carrying out an analysis for a company/product and can clarify both a company situation and a problematic situation. It is used to identify organizations' strengths (resource or capability the organization can use to achieve its goals) and weaknesses (limitation or defect in the organization that will keep it from reaching its objectives). SWOT stands also for opportunities (potential favorable situation for the organization) and threats (any unfavorable conditions for the firm's environment that can damage its strategy). The analysis can be performed on a product, on a service, on a company or even on an individual. The role of SWOT analysis is to take the information from the environmental analysis and separate it into internal issues (strengths and weaknesses) and external issues (opportunities and threats).

When this is completed, SWOT analysis determines if the information indicates something that will help the firm in achieving its goals (a strength or opportunity), or if it shows an obstacle that must be overcome or minimized to reach desired results (weakness or threat). The information from environmental trends and internal capabilities are set in the SWOT matrix (Table 1).

		Internal environment	
		Strengths	Weaknesses
External environment	Opportunities	Maximizing the strengths and opportunities of the company to create a Maxi-Maxi strategies	Maximizing the opportunities and minimizing the weaknesses in Maxi-Mini strategy
	Threats	Minimizing threats and maximizing strengths into Mini-Maxi strategy	Minimizing both the threats and weaknesses in Mini-Mini strategy

Table 1. SWOT matrix

SWOT is one of the best-known methodological tools (Munro and Mingers, 2002). It is easy to understand and use. SWOT is suitable in the beginning of a problem solving process, because it can easily identify the problem areas and help to focus on the key issues.

9.4 PEST

PEST analysis. This is analysis of the external macro-environment that affects all firms. PEST is an acronym for the Political, Economic, Social and Technological factors (Johnson and Scholes, 1999). PEST factors usually are beyond the control of the enterprises and must normally be considered as either threats or opportunities. PEST is useful when you start operating in a new country or region. The SWOT and

PEST analysis can be used together to get an overview of a problematic situation.

9.5 Porter's five forces

The Five forces analysis looks at five key areas, namely the threat of an entry, the power of buyers, the power of suppliers, the threat of substitutes and competitive rivalry (Fig. 5). Porter (1991) has identified five competitive forces that shape every industry and every market. These forces determine the intensity of competition and hence the profitability and attractiveness of an industry. The objective of corporate strategy should be to modify these competitive forces in a way that improves the

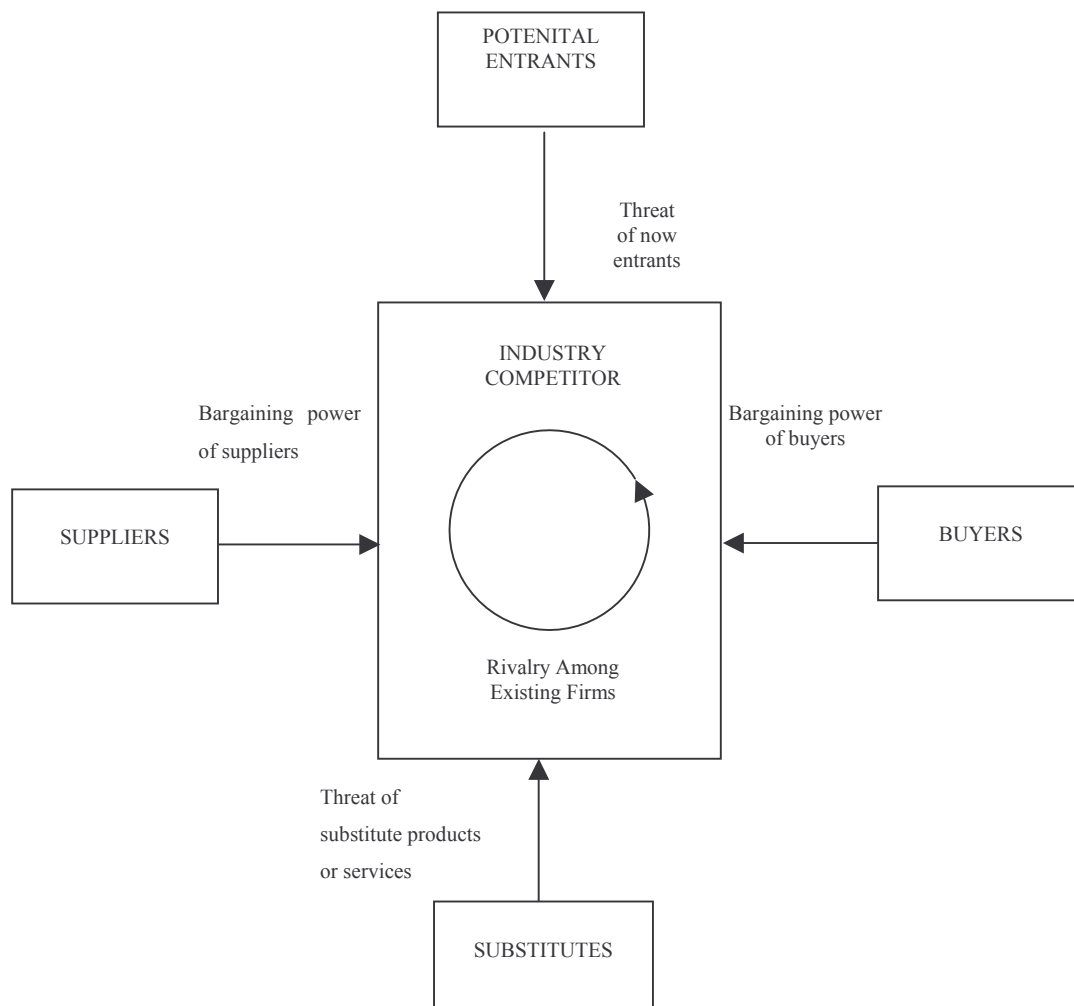


Fig 5 Porters five forces industry Analysis Framework, source: Porter, 1991.

position of the organization. Porter's five forces are helpful to make a picture of the external environment and could be applied as a complimentary approach to SWOT to identify all the key factors influencing or affecting the firm.

9.6 Cognitive mapping

The SODA methodology (Eden and Ackermann, 2001) is a framework for designing problem solving interventions by using cognitive mapping and it assists the strategic decision-making. Cognitive mapping is a technique where the problem is presented by interconnected maps. Individuals draw cognitive maps of how they view a particular problematic situation, after that the maps are combined to form a single map, which should be worked out until everyone finds it acceptable and an action plan is presented.

Typically, the map created when working with one member of a problem solving team contains 40 to 120 concepts. When the facilitator aggregates all the maps from the other members the size could be around several hundred. The disadvantages of the whole process of using SODA are that an experienced facilitator is a must, the process is a little bit heavy and it is time consuming.

Small companies could overcome these disadvantages of the method if they first agree on the problematic issues by using other methodologies and creative tools such as SWOT, Porter's five forces, PEST, brainstorming, mind mapping. In this way the problematic situation will be easily unidentified and agreed on. Then the cognitive mapping can be used to link the different sub-problems to the main one and the size of the map will be much smaller.

As the team members have already used some tools and methods they will now feel free to communicate and interact with each other and they will express their thoughts about the situation. As most of the decisions need to be made fast, to save the time consuming process the facilitator could make an interview with all the

participants at once, like in a workshop. The idea of cognitive mapping will be still used as in the theory but instead of merging many maps, the facilitator will work on one map only. The idea and the concept of the technique will still be used but just modified to the need of the small companies.

9.7 Strategic Choice Approach (SCA)

Strategic Choice Approach (Friens and Hickling, 2005) deals with complexity and managing uncertainty in a strategic way, which is a big threat for any organization, especially for the small firms. It structures possible decision options, it can be used for strategy and planning and it deals with the interconnectedness of decision problems.

The CSA engages the participants in a learning process of how to make judgments, how to negotiate, how to find a balance between current commitment and future flexibility. The flexibility is one of the biggest advantages of the small firms and all the decisions must take this into consideration.

The main features of the SCA are the incremental analysis and management of the complexities involved in problem structuring, the demonstration of the interdependence of possible chains of decisions and the analysis of three kinds of uncertainties. These make it one of the most suitable approaches for small firms to deal with their problematic situation regarding ill-defined, complex problems related to strategy and planning.

A key theme underlying SCA is the identification of uncertainty areas (Fig. 6): Uncertainty about the working Environment (UE), Uncertainty about guiding Values (UV) and Uncertainty about Related decision fields (UR).

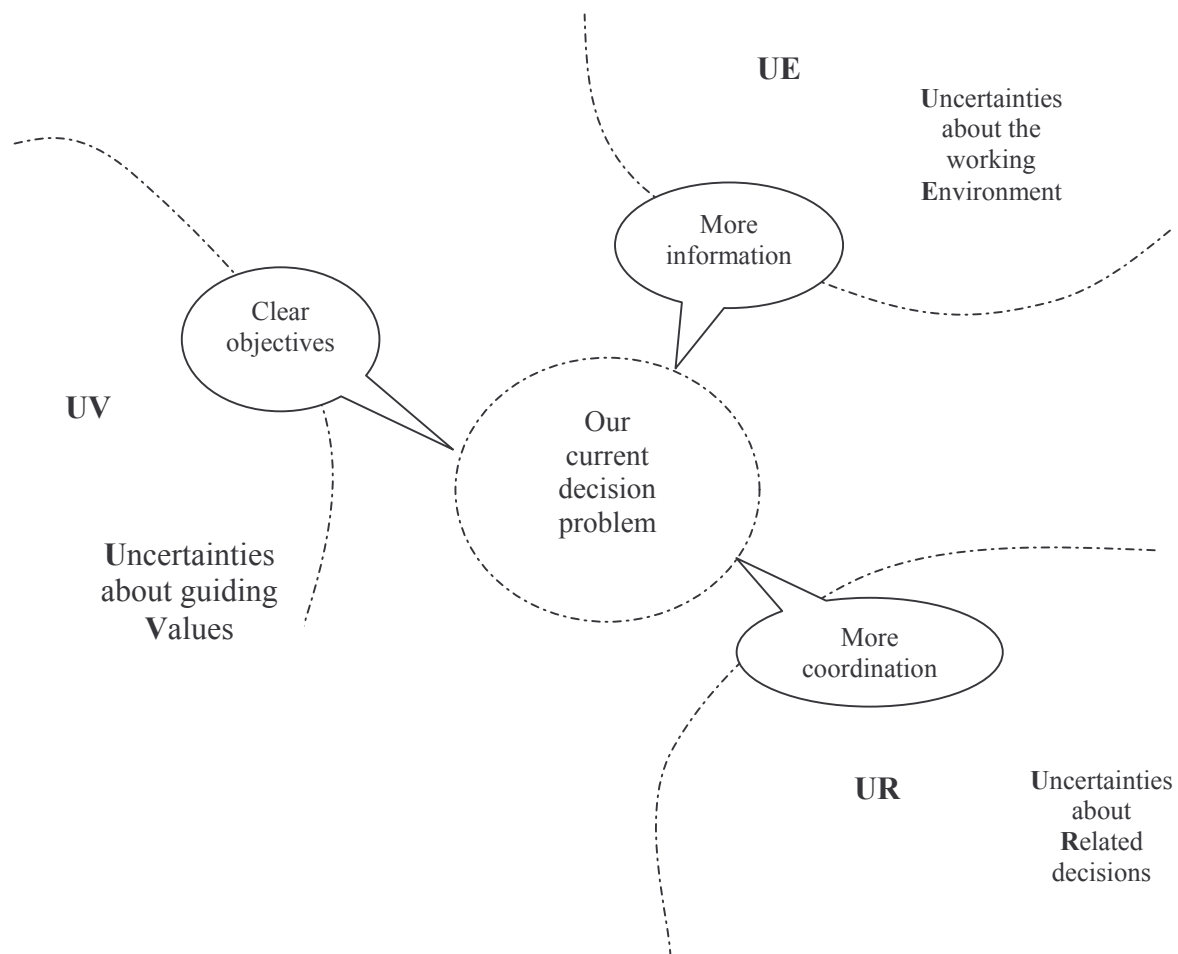


Fig. 6 Three types of uncertainty in decision-making, source: Friend and Hickling, 2005

UE can be managed through technical response: by surveys, research, forecast. UV can be reduced through political response, e.g. clarifying objectives, consulting the interest groups, asking higher authorities for their opinions. UR can be managed by an exploration of structural relationships: by adopting a broader perspective, by negotiating/collaborating with other decision-makers.

Friend and Hickling, 2005 wrote:

“The choice of how best to manage uncertainty through time is one that implicitly faces all decision-makers faced with complex problems. It is such choices that the

strategic choice approach aims to articulate in a more explicit- and indeed strategic way.”

The uncertainty areas are identified through out the framework of four modes: shaping, designing, comparing, and choosing solutions in order to manage a continual input of multiple problems and to achieve a continuing output of multiple decisions (see Figure 7). It includes the option to switch freely from one mode to another; this offers the opportunity to share insights and perceptions, making a valuable contribution to sustaining the sense of momentum in the decision process (Friend and Hickling, 2005).

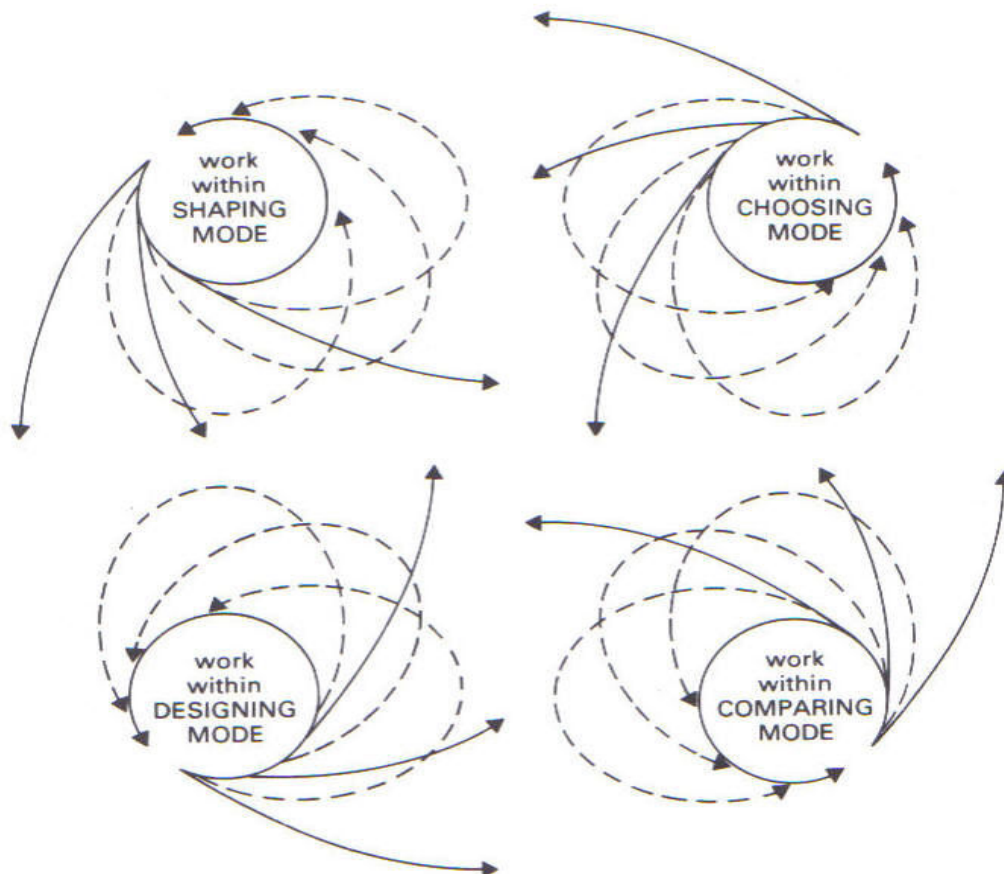


Fig. 7 Four modes of the SCA and the opportunities for movement between them, source: Friend and Hickling, 2005

Shaping mode

The set of decision areas, which represent the choices within the problem field are identified and sorted by the level of importance and urgency and the UR is taken in consideration. It is always possible to go back and reformulate the decision areas. After that the links between the decision areas must be built. It is also possible to rearrange the decision graph.

The method gives a lot of freedom, there are opportunities at every moment to go back and reformulate or redesign your problem areas. This helps the small companies' participants to rethink and come back with more ideas. As the small enterprises have little knowledge and experience of using methodologies they could rethink their ideas and suggestions in every mode.

The challenge in this mode is not to identify the decision areas and the links between them but rather to apply them in such a way as to represent the complex problems and to capture as much as possible of the understanding of these problems. The other significant aspect here is to find ways to move forwards an agreed collective view (Friend and Hickling, 2005).

Designing mode

For every decision area the options have to be listed and the judgment about feasibility between different pairs should be made, meaning that participants have to explore the compatibility of options between different decision areas within the problem focus. The feasibility constraints between the options in the decision areas can be identified through a matrix.

The aim of this mode is to show the links between infeasible pairs of options, which are called option bars. The reason for choosing connecting lines between incompatible pairs of options rather than compatible is that in practice it is almost always simpler to draw and interpret a graph with infeasible option pairs (Friend and

Hickling, 2005). The final task in the designing mode is to develop an option tree, where the decision graph with its options is presented and the feasibilities and incompatibilities between the options can be broadly viewed in one table.

Comparing mode

First the comparison areas are identified to compare each of the feasible decision schemes. In the comparing mode the decisions must be made in a context where multiple aspects must be considered, and not all are usually quantitative, which makes the choice more difficult. The set of issues to be compared may range from a small set of options in a single decision area to a wider set of feasible schemas in several linked decision areas. In order to make a choice a balance between multiple criteria should be found.

Choosing mode

In the choosing mode a commitment package is decided upon and the uncertainty is managed. The areas of uncertainty are listed as they arise, classified by UE/UV/UR, and are addressed in the context of proposed decisions. It is possible to reformulate the composite uncertainty areas in terms of their more significant elements and this could lead to opportunities for managing uncertainty.

The step after the uncertainty areas have been evaluated and the focus turns to more important uncertainty areas is to decide what can be done about them. Also the mode helps the participants to make decisions about actions, which have to be taken now and in the future.

9.8 Multi-Criteria Analysis (MCA)

Multi-Criteria Analysis (often called Multi-Criteria Decision Aids - MCDA) is a formal approach helping decision makers to handle effectively complex decision

situations in which the level of conflict between criteria is such that intuitive solutions cannot be satisfactory (Borges, Sørensen, Vidal, 1997).

In general, in a multi-criteria problem, there is no solution optimizing all the criteria at the same time and therefore compromise solutions have to be found. However, one should note that when different conflicting evaluation criteria are taken into consideration, a multi-criteria problem is mathematically ill defined.

Multi criteria analysis directly involved all the stakeholders facing a decision problem in order to detect their own preferences and values regarding the decision criteria. It is also an interactive learning process that motivates the participants to think about the conflicts addressed by taking into account other points of view and opposing arguments. In this way the stakeholders will better understand the problem and usually arrive at commonly accepted solution.

The aim of multi-criteria decision analysis is to recommend an action, while several alternatives have to be evaluated in terms of many criteria. It supports the decision makers, it does not decide instead of them (Borges, Sørensen, Vidal, 1997). The two main families in Multi-Criteria Decision Aid (MCDA) are the Multi-Attribute Utility Theory (MAUT) and Outranking methods.

The first family consists of aggregating the different criteria into a function, which has to be maximized. Thereby the mathematical conditions of aggregation are examined. The most common function corresponds to the additive model that is a weighted sum of the values of all criteria (Borges, Sørensen, Vidal, 1997). The analytical hierarchy process (AHP) is a popular MAUT technique. Here, the decision problem is represented in a hierarchy graph.

In the Outranking methods the decision-makers have to compare different alternatives and decide which one is better than another through the help of outranking relations. They have to find also arguments to support their choices. The

best-known outranking methods are the ELECTRE and PROMETHEE.

9.8.1 PrOACT

PrOACT is a multi-criteria decision approach. It is a straightforward process and takes one step at a time. As it can be seen from the name of the approach, it is a proactive one. You should not wait until a decision is forced on you. Hammond, Keeney and Raifa (1999) break complex problem statements into eight components:

- **Problem** – Find the key issues, think creatively and state your decision problem carefully, because the way it states will outline all the decisions later. When the problem is broken down into key issues, it will be easier to ensure that you focus on the right problem.
- **Objectives** – What are your goals? Where do you want to go? Make a priority list of the objectives
- **Alternatives** – List all the alternatives because they will give you a course of action.
- **Consequences** – Lay out the result of each alternative. This will help to identify the best alternatives that meet the objectives.
- **Tradeoffs** – Usually the decisions to be made are not simple and the alternatives we should choose from are not so perfect, therefore we need to find a balance. Also it is sometimes difficult to fulfill all the objectives and therefore we must set priorities and find a balance in that.
- **Uncertainty** – Identify the key uncertainties, the possible outcomes of them and the consequences of each outcome. Some complex decisions will require more visual analysis and making a decision tree can be very useful. The decision tree can clarify the relations among the alternatives, uncertainties and consequences.
- **Risk Tolerance** – When the decisions include uncertainty the result is often not the one you have thought. There is always some risk when you make a decision. Try to find out the chances of each alternative occurring and the consequences if it happens. Visualize them in a tree. Try to accept the risk.

- Linked Decisions – No decision should be made today without an idea of how it will affect the decision that might have to be made tomorrow.
- Separate short-term and long-term issues and while resolving the short-term ones gather information needed to resolve the problems that can arise later.

The fundamental nature of PrOACT is to divide and conquer. Complex problems are broken into their elements and you think systematically about each one. Then you rebuild the analysis you have made into a smart choice (Hammond, Keeney and Raiffa, 1999). The first five elements are the core elements of the approach and are applicable to any decision. The last three ones-uncertainty, risk tolerance and linked decision - help to clarify a decision in an unstable or developing environment.

PrOACT helps to evaluate which uncertainty most critically affects the decision and what decisions are most robust to these uncertainties. It can deal with multiple values and objectives. PrOACT is suitable for use at the end of a project to evaluate the alternatives and help the individuals to make a decision. It addresses complex situations with high level of uncertainty.

9.9 Scenario methodology

Scenario (Vidal, 1996) is a description of a possible future through analyzing. Scenario has been used for several years for problems addressing planning in uncertain and dynamic environments in public and private organizations. The method has been in strategic planning to evaluate the strategic decision, development of strategy, testing short and medium term planning (Vidal, 1996).

The other application of the Scenario approach is environmental monitoring. It is the link between strategies, future perspectives (scenarios) and the action towards this future. Godet (1987) has made a list of 30 different applications of the scenario methodology.

Vidal (1996) outlines different types of scenarios depending on their purpose:

- Background scenario is a non-structured set of facts and future tendencies of the relevant variables and parameters.
- Threats/conflicts scenarios have been used in analysis of highly competitive industries and also in the military planning
- Alternative scenarios are presented where many ideas are analyzed
- References or normative scenario is when the organization scenario work has led up to a consensus path of development in society and/or within the organization.
- Surprise scenario includes some radical changes that might occur.

Scenario makes it possible to understand complex issues by dividing them into series of actions and reactions. It is multi-dimensional; meaning that it allows as many variables as desired.

9.10 Summary

In this chapter I have presented different approaches to problem solving, discussed and explored some problem situations where predominantly one approach may be more appropriate than another. The different methodologies are suitable to the different stages of a problem solving process – some are good in the beginning to shape the problem areas, others in the end to evaluate and make decisions.

The idea of the soft OR is that they should be used to help individuals and groups to think through the consequences of their beliefs and preferences. Some of the soft approaches are rather structuring than decision orientated and others have opposite characteristics. Therefore the methods should be used in a way most suitable for a given task, meaning a given phase of the problem solving process.

Part III

Soft approaches in practice

In the following chapter (Chapter 10) I provide a general overview of a small company that has been part of a big supply chain. The company has faced a decision problem regarding a technology implementation. A combination of soft approaches has been used in this problem situation to help the manager find a solution and make a decision. My reasons for analyzing the case are to understand exactly how the soft methodologies have been applied in a real life case, why they have been chosen in the different phases of solving the problem and how they have been combined. This section is mostly focused on the decision-making process and how it was supported by the methodologies.

10. Soft methodologies in practice-the case of Kirby (Sørensen et al., 2004)

10.1 Introduction

As the number of soft OR methods has grown and a lot of people have become familiar with more than one approach, the question of which methodologies to choose and how they should be combined has become of practical interest. In some cases soft approaches have been used alone, in others combined with hard methods and/or critical and creative methods. However the purpose for doing that was not experimental but to apply the most appropriate approaches for the given stage of the problem solving process and the different types of problems the methods are addressing. The aim of this project is to make a framework of multi-methodology, which can be used in practice for solving complex and ill-defined problems, concerning strategy and planning in small enterprises.

10.2 The methodological approach

My starting point is the article “Using soft OR in a small company - The case of Kirby” (see Sørensen et al., 2004). This paper discusses how soft OR methodologies have been applied in a small Swedish retail company to solve a practical problem, regarding an implementation of a new technology. Their bigger partner has been using EDI⁵ for years and they now wanted to integrate all business processes electronically. Technology has been the main factor affecting the firm. The question was which IT system the company should adopt and implement. The organization wanted to find a solution for keeping the good position as a distributor to major re-sellers in Scandinavia, and to be able to expand their business to a new niche - selling bikes.

The competition in the retail business was extremely high and there was a risk that the company can be excluded from the supply chain if it were not able to support their biggest partner. On the other hand there were risks of integrating a very expensive electronic network, where the expense could not be returnable in a short time and of locking the company to the partners with one specific EDI system, since the specially designed systems would not be compatible with other systems (Sørensen et al., 2004).

Kirby has not run their business by using electronic communications (except e-mail, a homepage and an old ERP⁶ system not compliant with others). The taken analysis aimed at finding out which technology would support the electronic communications with their present re-sellers and would also support the company in pursuing the new business.

The methodologies, used in this case are summarized in a flow chart (see Fig. 8).

⁵EDI is acronym for Electronic Data Interchange. Electronic exchange of information over private lines

⁶ERP is acronym for Enterprise Resource Planning. Administrative software application

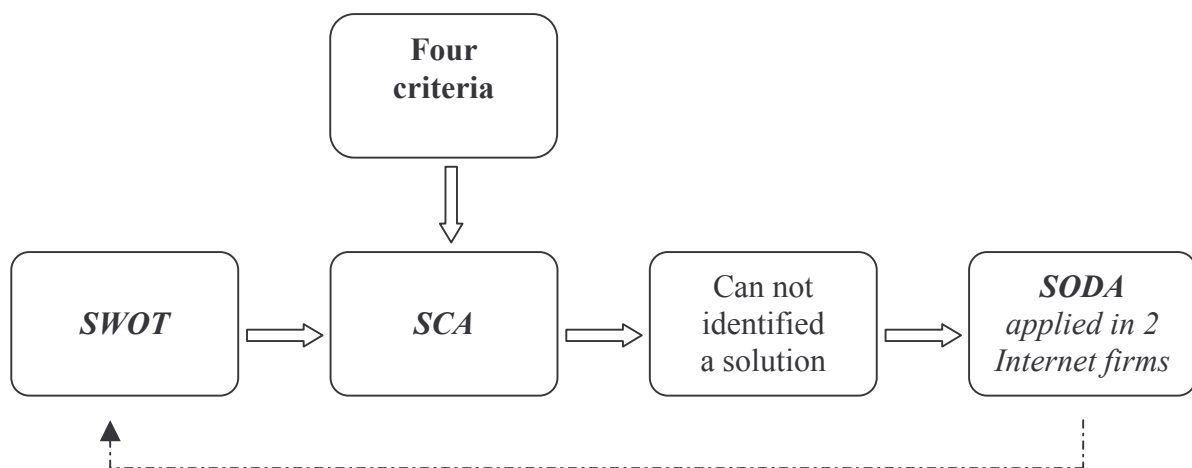


Fig. 8 Framework of the methodological model used in Kirby (own source)

The problem that appeared before choosing the methods is that only the manager would participate in the session, because he thought that it was too time consuming. This of course gives some limitations on the approaches available to choose from, since the essences of soft methodologies are participation and interaction and therefore require group work in the sessions.

Isolating the employees from the methodological sessions is a mistake, since they are excluded from the learning process during the different analysis of what are actually the problems in Kirby, how to get out of this messy situation, which are the internal and external factors affecting or influencing the company, what kind of strategies can be developed and implemented, how the company itself could use these methodologies for other problems in the future.

The employees should be encouraged to speak out their opinion about problematic situations in the company and to give suggestions for finding a reasonable solution. I think that people that are more engaged in solving problems in the company would be more motivated. The participants in the sessions can exchange thoughts and knowledge, since the essence of soft methodologies is orientated towards interactive participation.

It has been decided to start the study by applying SWOT analysis, because it is easy to use and can provide an explanation about the problematic situation in the company. It can also be applied in a case with only two participants: facilitator and manager.

10.2.1 SWOT

The employees in the firm had an unclear view over the company's situation and had no idea how to get out of the mess. SWOT has been chosen, because it is easy to understand, simple to use, transparent, provides some ideas about the present situation in the firm, identifies easily the problem areas and helps focusing on the key issues. SWOT is appropriate for use in the beginning of the discussion of a problematic situation, as it will give an overview of the current situation of the company and the external environment, which influences or affects the firm. Such information is usually lacking in small organizations.

Munro and Mingers (2002) have made a survey in the UK about the use of multi-methodology in practice. One of the results was that SWOT is a well known and broadly used by practitioners. Another result from the survey was that SWOT is usually combined with SSM (Checkland, 2001). SSM is difficult to understand, because of the shift between the real world and the system thinking and requires a number of skilled participants and an experienced facilitator. It is usually applicable in large organizations and a facilitator is a must.

In this particular case the manager has a little knowledge about relevant technological options for the firm, therefore the facilitator formulated different strategies. Then the sales manager transformed these strategies, so that they fit the Kirby's objectives. Here can be seen the important role of the external facilitator for formulating strategies, because of the insufficient knowledge of the manager about relevant technological options for the firm. In some small firms in dynamic industries where technological understanding is a must, it is possible for the facilitator to be internal, someone from the company. In Kirby an external facilitator

was a necessity.

After the SWOT analysis were made, the problem was understood and different strategies were formulated, it became clear that it was difficult to identify which of these strategies would best fulfill the objectives of the firm. Then another problem appeared: it was not possible to choose a technology. Because of the large uncertainties due to market changes, technology, etc. it was hard to identify the strategies that served best the purposes of Kirby. The other problem with SWOT was that the results could not be completely quantified and visualized.

Better and faster results from SWOT analysis could have been achieved if all the employees had participated in the sessions, because even people with limited technological understanding (this was also a reason why the other employees were not involved) could be very creative, and they can generate many useful ideas and suggestions. They can see different aspects of the problem and thereby help understand and solve it.

Cognitive mapping could be a good input for the shaping mode in SCA, actually it can go quite further than SWOT analysis, but the approach requires more participants and therefore in this case with only one participant it cannot be applied.

Soft System Methodology might be considered as an option too to shape the decision areas but not in this particular case. SSM is a difficult for understanding approach and requires several participants, with certain knowledge about system thinking and an experienced facilitator. Small organizations have less experience of using soft methodologies and usually little knowledge about system thinking. They do not have traditions for hiring a facilitator and therefore SSM will not be considered as a suitable approach for them. As the thesis only considers small companies, SSM will not be included in the analysis for developing general multi-methodological model for solving problems in small enterprises.

To evaluate the different options and find the related possibilities for the organization the facilitator has decided to apply Strategic Choice Approach.

10.2.2 SCA

SCA deals with complexity and uncertainty, and it structures and narrows down the many available decision options and evaluates possible strategies. This is a soft methodology with hard elements and nevertheless a very creative tool. It intends to be freely accessible to participants who have different backgrounds.

SCA has been selected, because SWOT analysis has found a number of different decision areas and options but it has not been obvious which one to include in a strategy (Sørensen et al., 2004). SCA is a decision-focused approach to manage complexity and can deal with multiple factors that are affecting the decision. The decision, which Kirby should make, has to be faster and a number of criteria ought to be fulfilled too. SCA has been applied to show the alternatives that the company could use for the development of their strategy process. The other reason for choosing this methodology was that it is able to handle multiple decision areas and it is useful in complex and uncertain situations considering technology and business development. This approach is suitable for the end of a project to shape and support the decision process (Ormerod, 1997).

SWOT actually has been a good input for the first shaping mode, where the decision areas should be identified. After the participants got a better overview of the company situation and were able to identify different problematic areas it was easy to formulate the decision areas and to make the link between them.

After the decision areas have been shaped with the help of SWOT, a number of options for each of them have been identified. To find out if incompatibilities exist (when selecting two infeasible options at the same time), comparisons have been carried out for each combination.

SCA is not a straightforward process but rather one that goes back and forth and this allows the participants to get a better understanding of the problem. After an option tree has been developed a problem appeared. There were many options and strategies to choose from. In the choosing mode of the approach the authors saw that there were too many alternatives to choose from and there was a need of more logical consequences of (usually quantitative) assumptions, which can reduce the alternatives.

By introducing four comparison areas the number of alternatives was decreased. Therefore four basic criteria were introduced and compared to the alternatives into the option tree. These comparison areas actually are the basic criteria Kirby has for their business. The main concerns for Kirby were not to be locked up in a system that could limit the possibilities to work with different customers/partners and also the cost and investment in any technology. Flexibility is of great importance for Kirby. It has been one of their strengths to be able to satisfy different partners and customers fast and efficiently. The other concern was the cost. The manager was clear that the company would not invest in a very costly system if there were not short-term returns.

After the uncertainty areas have been compared, two main alternatives have become clear: the long-term expansion potential that lies in Extranet⁷ and XML⁸ has been the technology needed in order to capture new markets, and EDI is a very good short-term option. However, there were still too many uncertainties about the technology that should be implemented and thus no specific solution has been identified and no decision was made.

Crucial points in moving the decision processes forward are managing the incremental decision taking under uncertainty. The insight that uncertainties can be

⁷ Extranet: Giving access to customers and partner to the Internet

⁸ XML: Extendible Markup language. The next generation after XTML

handled explicitly without necessarily being resolved opens the possibilities for progress.

10.2.3 SODA

As it was difficult to handle the uncertainties, the facilitator decided to gain inspiration from the experience of two companies in such problematic situation. The companies were analyzed through interviews by applying SODA/cognitive mapping, because it can get much further in the analysis but it also requires more people to be involved in the sessions (something which can not be done in Kirby with only one participant). The purpose was to help the decision-makers in Kirby to manage the uncertainties better and to build a final strategic plan for the future of the company.

SODA was not providing a solution for Kirby but rather relating their own situation to the other companies' perceptions. It will give a better understanding of the problem situation the organization has faced, and by learning from other similar problems Kirby will be able to make a final decision of strategy. This leads to re-creating the SWOT analysis with the new identified areas and going through the SCA to identify and evaluate the options, uncertainties and make a final decision. As the results of SODA were not applied in Kirby, a conclusion about how SODA works in this particular case could not be made. One thing was quite sure that SODA could engage the participants in a learning process for better understanding the problem situation and managing the uncertainties. However the case of Kirby did not go further. No specific solutions were identified.

10.3 How to make better decisions

How to make a good decision has been one of the biggest problems in Kirby. Even after SODA analysis it is not quite certain that Kirby's manager will be able to solve the problem and take a final decision. A useful tool for making smart choices is the ProACT approach (Hammond, Keeney and Raiffa, 1999). It does not show you what to decide but it does show you how. The approach is very flexible; it can be

used for business decision as well as personal and family decision.

First the problems and the objectives of the company have to be identified and then all the alternatives must be listed. This will give an idea about the kind of action the organization should take. Before a decision is made the firm should be aware of the consequences of the choices it made and the firm has to find some balance when taking in consideration the many issues, consequences and objectives.

Small companies usually face more uncertainty than large enterprises and the decisions involving uncertainty hide bigger risk. Therefore all eight elements of the PrOACT approach must be considered, when a decision has to be made in a small organization.

A solution for the problem in the case of Kirby (Sørensen et al., 2004) can be found by applying the PrOACT approach in the comparing and choosing modes in CSA where the choice between several alternatives has to be made. Going through all the eight steps of the method will ensure that the uncertainty, risk and consequences are considered too, because they were the biggest concern for the Kirby manager, before the decision is made.

PrOACT can be considered as a good tool in the last two modes of the SCA when we deal with complex decisions and the users need more quantitative output before the final decision to be made. I could say that it is a hard approach with soft elements. In the figure (Fig.9) below I make a framework, where I show the way I see how the problem could be solved.

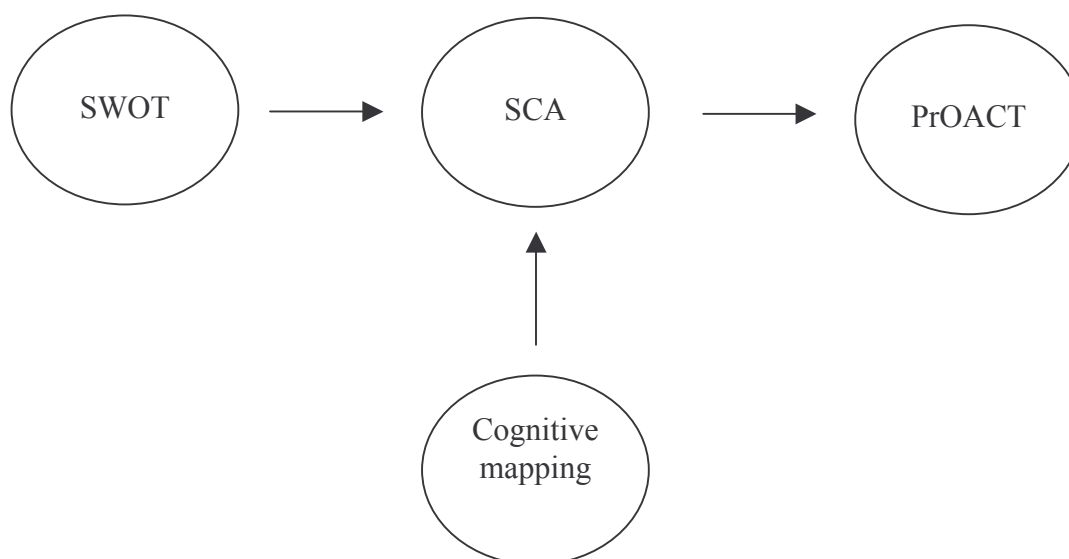


Fig.9 Multi-methodology model for solving the problem in Kirby (own source)

10.4 Summary

The facilitator chose to start with SWOT because it is easy to use and can provide information about the problematic situation and the strategic issues in the company. Unfortunately due to the many uncertainties associated with the market changes and the technology SWOT has not been able to identify which of the formulated strategies best fulfill the objectives of the firm. The other problem with SWOT was that the approach could not support the decision making process in the firm. Therefore the need of a new method appeared and the facilitator decided to apply SCA. SWOT has been a very good input for the SCA.

SCA is a problem structuring and decision-making approach that can deal with complex problems with a high level of uncertainty but in this particular case it was not able to find a solution to the problem due to the many uncertainties related to market changes and technology. Therefore the facilitator turns to another method - SODA.

The facilitator has got an idea that uncertainties about implementation of Internet technology identified by the company could be related to the experience in solving

such kind of problematic situations of other Internet companies. SODA requires more than one participant and it was not possible to apply it into Kirby.

Soft methodologies did not provide a final solution but they have been a part of the learning process in the company. The manager that has participated in the session got more understanding about the problem situation and the different strategies associated with the firm's goals and objectives.

11. Mixing methods in practice

In this chapter I present other real life cases from Ormerod (1997a, 1997b), Herron and Finlayson (2005) and Hickling (2001), where soft methodologies have been applied. The authors discuss their experience and knowledge about using soft methods in practice. The main discussions are about how the soft OR has supported the problem solving and decision-making processes. In the first two cases cognitive mapping, SSM and SCA have been combined to solve complex problems regarding development of strategy. In the other cases CSA has been applied to different situations concerning some decision problems. The results of these analyses and the results of the case of Kirby (Sørensen et al., 2004) will be used later on in the next part for developing a framework for a complex problem solving in small companies with regard to strategy and planning.

11.1 Introduction

Richard Ormerod (1997, 1997a, 1997b) has described his experience in mixing soft approaches in practice. In one of the cases (1997a) he had to help a large company conduct an information system strategy development exercise. At this time the company was considered by many in the field as a leader in the application of IT in their sector (Ormerod, 1997a). The task of the consultant in this case was to design a process of problem solving, to facilitate the process and to deliver results. To design a process of solving problems is a difficult task, which includes choosing methods to use, coaching the participants in the use of the methods and facilitating the whole process. To find out which methods to use Ormerod (1997a) drew up some criteria that had to be checked:

- If the method support an organizational learning process
- If the method motivate participation of management to entrust to the strategy
- If the method motivate the accommodation of diverging interests between groups

- If the method recognize that organizations are complex, open and adaptive systems
- If the method allow management to set and develop their understanding of the environment and the company situation

11.2 ISS Development at Sainsbury's Supermarkets (Ormerod, 1997a)

Ormerod (1997a) has chosen cognitive mapping, SSM and SCA to support the problem solving process. Each of these methods has been used to support a different part of the process. The methodologies have been chosen because they can engage the participants in learning and participatory process and they can stimulate the participants to think creatively.

The other reason for choosing the soft approaches has been that they are based on similar principles, such as recognizing that the intervention is a social act involving stakeholders with different backgrounds and different viewpoints. Therefore Ormerod (1997a) concluded that there is no reason to think that soft methodologies will not mix well in practice. And the results of the problem solving in this case confirm his conclusion.

The reason for using three approaches instead of one is that each of the methods fits best at different stages of the process of problem solving.

Ormerod (1997a) used cognitive mapping in the first stage of a problem solving process, because it can open up a debate, provide an overview of the current company situation and identify key areas for further examinations. The approach is suitable in the early stages of an intervention when the requirement is to capture the dimensions of an issue. In these particular cases we have a large organization and therefore the facilitator did not have problems with gathering participants for the sessions, which was a problem in the case of Kirby (Sørensen et al., 2004), where only the manager was involved.

The facilitator used SSM in the next stage of the problem solving process to provide a framework for understanding and analyzing the business to receive system ideas. SSM is very structured but also very abstract, which makes it flexible. Individuals involved build conceptual models of their world-view. After that they compare their ideal system design - the conceptual model with what actually occurs in the real world. The comparison generates a debate about what changes are systemically desirable and what changes are culturally feasible and later the agreed changes are implemented. This methodology presents very creative solutions, helps to solve problems where hard techniques fail, sets clear requirements for the system, takes into consideration social, political, and power distribution issues, an experienced facilitator is needed to keep track and order of the process and milestones of it. This methodology is considered to be state of the art in soft approaches (Sørensen, 2004) and it is useful in the middle of a project to define the system that is being examined for discussion and debate. The difficulties that Ormerod (1997a) has experienced with this method were that the participants found it hard to get used to the approach and some of the finer points were lost on the way. However the SSM provided the necessary information needed to be evaluated in the next step in the process.

Not only Ormerod has discussed about the difficulties that appear when using SSM. Sørensen et al. (2004) has also argued that SSM cannot be easily applied in small companies, because the shift between the modeling and the real world takes a lot of experience in system thinking. Therefore SSM has not been applied in Kirby, even though that the results of a survey in the UK of the use of multi-methodology in Munro and Mingers (2002) show that one of the best known and most used approach is SSM.

In the last stage of the problem solving process Ormerod has used SCA to structure and evaluate the system suggestions resulting from the SSM investigation. SCA is suitable for the end of a project to shape and support the decision process. It is a decision-making method, which can deal with the uncertainty affecting the decisions. After an SCA methodology was applied it became clear that an evaluation

of the costs, benefits and risks was also required and this evaluation was more quantitative (harder) than the one visualized in the SCA. Also in the case of Kirby (Sørensen et al., 2004) the facilitator saw the need of using some more quantitative criteria (cost, risk) to help the evaluation.

The problems that appeared after the use of SCA in the cases described by Ormerod (1997a) and the case of Kirby (Sørensen et al., 2004) are similar. There were too many alternatives, too many uncertainties regarding strategy and technology implementation and the clients wanted more quantitative results to make the final decision.

11.3 Customer service Strategy at Severn Trent Water (Ormerod, 1997b)

The second case where Ormerod (1997b) has mixed soft methodologies was about a development of customer service strategy. The biggest challenge for him was to facilitate the problem solving process and to deliver results in only five days. The success of applying the soft methodologies in even less than five days shows that soft methodologies are not always very time consuming. I would say that it rather depends on the skills of the facilitator, the competencies of the participants and the size of the problem.

In this case cognitive mapping, SSM and SCA have been used again in the same order as in the previous case but here the author as a facilitator has minimal involvement. The soft methodologies have been used without any design of the intervention. They have been the most appropriate to address the particular issue.

The analysis has been completed with the critical path analysis to draw the future decision process.

These cases show the way that soft methodologies can precede a hard method. It seems reasonable to start an intervention with the soft approaches, which are good to structure problems and to give participants understanding about the problem

situation. Once the problems are defined and understood it may be appropriate to follow with some more quantitative criteria which are good at working out the logical consequence of assumptions (Ormerod, 1997b).

11.4 Cases, where SCA has been applied

Friend and Hickling (2005) gather cases from different practitioners, who have applied the SCA in different problem situations. SCA has been used alone or mixed with other soft methodologies such as SSM, cognitive mapping and scenarios. The problems addressed here are in general concerning the planning and strategy development process. The focus has been mainly on reflection of the decision-making about process management in practice.

Herron and Finlayson (2005) have been joint facilitators in a development project that engaged managers from small and medium sized firms in the agricultural sector in a workshop of learning, reflection and consultancy to strengthen their capacities to adopt changes. They used SCA as a main tool for this project.

The facilitators have introduced SCA as a decision-focused approach to managing complexity. Participants have been set in groups of three and exploring examples of decision problems on each participant's present agenda through a mutual consulting design. Each group started to work with a short session and every participant has been asked to write down an example of a difficult current decision problem in strategic choice terms. Later on came a longer session where the participants had to go through the three roles of problem owner, consultant and recorder. The role of such an exercise is to give managers of small organizations the necessary knowledge of using SCA as a facilitator, meaning that they must understand how the different stakeholders are related in a problem solving session and how they could facilitate such a process.

The role of the consultant was to take the problem owner through a set of eight questions based on a simplified version of the four modes of SCA. The role of the

recorder was to take notes to outline the problem that later would be presented to all the groups.

The exercise had great success. It was used to identify business problems, engaged the participants in a learning process very quickly (the exercise took 3 days) and the participants shared knowledge, skills, experience. The participants were satisfied because they were able to discuss on their favorite topics.

One of the difficulties of discussing present business problems and choices between potential competitors is the trust issue. How much can you allow the information and experience from your own company to be shared with managers of competing firms? To overcome such a barrier the facilitators have arranged overnight stay in a local hotel to give the participants time to know each other better and to soften the atmosphere. To overcome such stiffness in the sessions when using a soft approach it could be suitable to warm up with some creative tools such as brainstorming and mind mapping or engage the participants in some exercises in terms of a game.

After a week all the participants met again to present on a wall all the problems defined in the previous session. Then each of them should vote for a problem but not their own in which he/she is most interested. At the end the problem with the most votes was chosen for further analysis. A commitment package was introduced. The process of problem solving has gone through the four modes of the SCA and the commitment package has been agreed.

The results of the session show once again that SCA is very flexible both in its usage and in the nature of discussions. The other conclusion from the sessions was that SCA could be used as a supplementary tool for more quantitative methods.

Vila and Benaiges (2005) has described a case where SCA has been used in a management project of solid waste thus reducing environmental damage in Venezuela. Key decision areas have been identified even though the participants found difficulties to shape the decision areas in such a multi-dimensional problem.

To overcome this obstacle the decision areas have been classified as technical, political, etc. Then the five important decision areas have been introduced. To evaluate the decision schemas four comparison areas have been presented and eight uncertainty areas have been identified. Commitment packages have been agreed on.

The conclusion after the session shows that the low-cost application of SCA can contribute not only to the solution of such multi-dimensional and complex problems but also to the building and sharing a knowledge between the participants with differing backgrounds - managers, university students and their lectors (Vila and Benaiges, 2005).

Hickling (2001) describes a case where SCA has been used for making a government policy in the Netherlands. The problem has been characterized as a difficult decision problem, where uncertainty, complexity and conflict were present. The participants in the session were from four different Ministries and it was difficult to satisfy all the interest in this problem. However the group was able to produce a commitment package and make the policy passed through its formal process of acceptance.

An important role in the process of using SCA was the cyclic method of the process that allows progress to be made as the shared understanding grows. The decisions have been made and re-made until a consistent set was found. Uncertainty was seen as something to be worked with and managed creatively. The complexity was handled by presenting the links between the decision areas. The flexibility of the approach has allowed the participants to go back and forth, looping into the four modes at any time of the process. The big part of the problem was the management of uncertainty. To handle this there were used quick loops between choosing and comparing modes.

11.5 Summary

As opposed to the traditional or hard methods, soft OR employs predominantly qualitative, rational, interpretative and structured techniques to interpret, define, and explore various perspectives of the problems. Soft OR includes methods such as Soft Systems Methodology, Cognitive Mapping, Scenario Planning, SWOT, and SCA. These methods generate debate, learning, and understanding, and use this understanding to progress through complex problems.

SCA has been seen as very effective in supporting small business, public organizations and large enterprises. The nature of the problems varied from a choice of carnival route to developing environmental policies and managing conflicts through strategic action planning. In one of the cases SCA was used in a more unstructured way through questions instead of through the four modes, which shows the flexibility of using this method. Ormerod found that SCA is more appropriate for the end of the project to evaluate the alternatives and help to make decisions under the pressure of uncertainty and risk.

Different practitioners of SCA (see Friend and Hickling, 2005) have found that the method is very flexible, very powerful in a complex situation with high degree of uncertainty and useful in a situation where the decision should be made with regard to many criteria. They argue that the method could also be used in a large group of participants with the same success as in a small. The other conclusion from the cases is that the individuals use the method after a short introduction and gain results in a short period of time. Hickling (2001) shows a case where SCA has been used in a conflict, complex, uncertain situation where the decision of making a government policy should be made fast. The main conclusions were that the important element of SCA was the cyclic process, which allows the shared understanding and learning to grow and that the individuals should not try to reduce the uncertainty but to manage it creatively.

Cognitive mapping and SSM have both been used in the beginning or in the middle stage of the problem solving process to shape the problem and identify the key issues. However the two approaches have been seen as suitable for defining the problem areas, capturing the key issues and providing a framework for understanding and analyzing the business.

The methods used in these particular studies are affected by the nature of the problem, the context, the skills and knowledge of the facilitator. As the problems became increasingly complex and the standard formulations of OR methodologies were limited in their application to these unstructured problems, the facilitators saw the need of using soft approaches.

Soft OR clearly has a lot to offer in addressing some of the increasingly complex issues the companies face today. The choice of methods used in these particular cases is a product of the knowledge, experience and skills of the facilitator and the nature of the problem itself. The future for soft approaches will probably be to complement hard methods even though there are relatively few combinations of hard and soft methods.

As a final thought about combining approaches comes the question: is there no limit to the mixing of methods?

“Yes, the limitations of mixing methods lie in the competence of the facilitator and the participants rather than in the methods themselves.”

Ormerod (1997,p.52)

Part IV

Building a model

In this part I built a model for solving ill-defined, complex problems, regarding strategy and planning in small companies. The conclusions from the previous two parts (Part II and Part III) are used as a basic step for developing the model. The idea is that soft methodologies are more appropriate for the ill-defined, complex and uncertain problems that are addressed in this project.

SCA is used as a central approach and some other methods are implemented in the four modes of SCA. In this way a multi-methodological framework is developed. As it was mentioned earlier in Part III every approach is best appropriate for a given stage of a problem solving process. Even though the soft approaches are based on the same fundamental purpose of supporting problem solving, they are quite different in terms of focus point, the role of the OR-worker, involvement of the individuals in the organization, organizational view, technologies used, etc. (Sørensen and Vidal, 2002). The nature of the problems is so complex that only one approach could not be always suitable for a particular problematic situation. The combination of different approaches could give more highlights of a singular aspect of a problem. As many practitioners have successfully used combinations of soft methodologies for solving complex and not well-structured problems regarding strategy and planning mostly in the large enterprises, I will explore these theme by developing a framework of a soft multi-methodology for problem solving in small companies.

12. General model for solving complex problems in small organizations

12.1 Introduction

Ormerod (1997a, 1997b, 2001), Hickling (1997), Herron and Finlayson (2005), Eden and Ackermann (1998, 2001) and Vila and Benaiges (2005) illustrate practical examples and their theoretical inferences. In the article “Using soft OR in a small company - The case of Kirby” (Sørensen et al., 2004) one can also see how soft methodologies are combined to solve strategic problems in a small company.

The aim of this project is to develop a general model of combining different approaches that address interconnected decision problems concerning strategy and planning and to manage uncertainty in a strategic way in small enterprises. There is not enough information and literature about using soft methodologies in small companies, because soft OR is a new field, which is still developing, and there is a lot of research still to be made.

12.2 Choosing a central approach

My main criteria for choosing a central approach are:

- It can structure the problem. As the purpose of the thesis is to find a way to deal with ill-defined and complex problems, the approach should be able to structure the problem. Therefore it is reasonable to turn to the problem structuring methods.
- On the other hand it should also be decision-focused, as the small companies face difficulties to make decisions, because of the many uncertainties affecting the choice. Therefore the methodology should be able to support the decision-makers in finding a solution.

I also have to choose which methods to combine in a way so that they can be applied to solve complex and possibly ill-defined problems, regarding strategy and planning in small companies and at the same time to support the central approach. Of course, there could be cases where the multi-methodology will not be able to find a concrete solution but nonetheless it will engage the participants in a learning process about issues, which no one claims to be able to fully understand and will give a clearer view over the problematic situation, which can provide knowledge for discovering alternative ways to find a solution.

The central approach has to be able to respond to the needs of the small enterprises, which tend to be limited by their resources and the problems that they address: not well-defined and complex problems. This methodology has to be also able to make choices, because usually messy and complex problematic situations end up with many possible choices and alternatives and therefore the approach should be able to compare and evaluate the decisions.

My decision to choose a central approach is influenced by the two previous parts (Part II and Part III). The former gives a theoretical understanding about the concept and the anatomy of the soft methodologies, whereas the latter adds knowledge about how the soft approaches are applied in practice and shows the reasons for choosing them.

SCA has been successfully applied in practical cases to solve strategic and planning problems mainly in large companies (see Part III, Chapter 11). Even though there were many uncertainties, complexity and conflict affecting the decision the solution of the problem was found by going through the modes of SCA. The conclusion of the practitioners was that SCA is a powerful tool not only for solving complex problems with a high level of uncertainty but also for building a shared knowledge between the participants about problems, methods, experience.

After a careful look at all the practical cases and the supporting theory, I decided to use SCA as a central methodology in the framework for solving complex and ill-defined problems associated with uncertainty in small companies.

12.2.1 SCA

Like every other tool SCA has its strengths and weaknesses. My main idea is to use SCA as a central methodology and to overcome or reduce the weaknesses of this approach by using other tools, methods or techniques into the four modes of this method. The reason for doing this is that the different soft methodologies can support different parts of the process of problem solving and thus different parts of the process of SCA. In this way the weaknesses of the SCA could be reduced or completely overcome.

The reasons for choosing SCA as a central method in the framework are:

- It is both a problem structuring method and a decision-focused approach to manage uncertainty in a strategic way.
- It can deal with complex and ill-defined problems and multiple factors that affect the decision. It structures and narrows down the many available decision options, and evaluates the possible strategies.
- It can deal with conflict situations, meaning that there are different interests, which should be satisfied.
- It is not a straightforward process but rather one that goes back and forth. This allows the participants to get a better understanding of the problem, in other words they are engaged in a learning process.
- It is flexible, both in the nature of the decisions and the delivery formats and environments used. The approach consists of four modes: shaping, designing, comparing and choosing and it allows looping and switching between the modes.
- It is a cyclic process, which allows the understanding and learning to grow before the final decision is made.

- It is an interactive process, meaning that it is accessible for participants with different backgrounds.
- It has been used successfully in many practical complex problems, associated with uncertainty in many different areas such as planning, strategy, policy making, implementation of technology (Vila and Benaiges, 2005; Herron and Finlayson, 2005; Ormerod, 1997a, 1997b; and Hickling, 2001).

There are three key elements of the analysis, which are used in structuring problems and working towards decisions: the decision area, the comparison area and the uncertainty area. The last one is divided into three broad categories:

- Uncertainties to do with the working environment
- Uncertainties to do with guiding values
- Uncertainties to do with related choices

SCA can address many types of uncertainty. When small companies face a complex problem the decision-makers have to make a choice of how best to manage the uncertainty through time. The aim of SCA is to articulate such choices in a more explicit and indeed strategic way.

Another reason for choosing SCA is its orientations – technology, organization, process and product. None of them can be viewed in isolation from the other three. In terms of technology it can be described as an open technology intending to be freely accessible to participants who have different backgrounds, which often is the case in small enterprises. It is orientated towards interactive participation or in other words interaction between the participants to work jointly on complex problems. Sometimes it is difficult to decide what should be done and the action must be postponed or entered in a partial way. In this way the shared understanding grows (Sørensen et al., 2004, Hickling, 2001; Vila and Benaiges, 2005 and Herron and Finlayson, 2005).

From the case of Kirby (Sørensen et al, 2004) it can be seen clearly that SWOT is a very good input for SCA and actually SWOT analysis present the methodology used to shape the problems in the shaping mode of SCA. In the same way other approaches can be found to serve as an input in the other modes of the central methodology.

12.3 Application of SCA

A Strategic choice approach is the central approach in the model for solving ill-defined and complex problems with regard to strategy and planning in small companies. The objective now is to find which soft methods, techniques or tools can be used in the four modes of SCA in a way helping the participants go through the modes and have a broader view of the problem. Going through the modes engage the participants in a learning process. From the cases (see Sørensen et al., 2004; Hickling , 2001; Vila and Benaiges, 2005 and Herron and Finlayson, 2005) one can see that the problem solving process is not straightforward but rather one that goes back and forth several times. This helped the individuals in the session to realize and learn about the particular problem, the organization and the environment.

The four modes of the methodology: shaping, designing, comparing and choosing play a particular role in the process of solving a problem. I will go through each of them and find out which methodologies can fulfill the objectives of each mode and the objectives of the thesis as a whole, namely solving complex problems in small firms.

12.3.1 Shaping mode

Shaping a complex decision problem is a difficult task especially in the small organizations, where it is common to have an unclear idea about the problematic situation. The importance of the shaping mode arises from all the difficult judgments that can be involved, when practical problems are outlined in terms of decision areas and the links between them, and then agreeing on the problem on which to work

within the resulting decision graph.

In the case from Hickling (2001) the problem is too complex and it is difficult to keep a track of all decision areas and their connectedness at once. Vila and Benaiges (2005) also argued that the participants saw difficulties in the shaping mode, because the problem was multi-dimensional. Each problem focus evolved over time, splitting and reformulating as the level of concern changed. Quick loops into the other modes were taking place regularly. While the results were not used straight away in the shaping mode, the understanding gained did enable the work to be directed better.

From the case of Kirby (see Sørensen et al., 2004) one can see that the participants do not have a clear picture of the company's situation and the environment. There was a different understanding of what is at stake (see Hickling, 2001, Vila and Benaiges, 2005). In the case of Kirby (Sørensen et al., 2004) there was only one participant, which limited the choice of methods that could be used for the problem solving process. The practical cases from Vila and Benaiges (2005), Herron and Finlayson (2005), the case of Kirby (Sørensen et al., 2004) and Hickling (2001) show that the map of decision areas and the links connecting them have been changed several times, as the level of the shared understanding grows. The whole process of problem shaping can be seen as one, in which there is tension between the desire of expanding the boundaries of the problem and the desire of keeping its dimensions manageable which will secure a progress towards action (Friend and Hickling, 2005).

The Strategic choice approach aims to structure "complexity" rather than clarify objectives. Therefore it will be reasonable to choose a tool or an approach, which can clarify the objectives and shape the issues in the shaping mode of the methodology. Friend and Hickling (2005) have experienced that the creativity of the process of shaping problems is best sustained by keeping the level and methods of analysis as simple as possible, especially when working in groups. This is because it keeps the process open and transparent, and provides flexibility for

changes in the formulations as the work proceeds. Other authors such as Vila and Benaiges (2005), Herron and Finlayson (2005), Sørensen et al. (2004), Hickling (2001) have also seen that the key for a successful session in every mode lies in the open, transparent and flexible process.

SWOT has been applied in Kirby and seems to be a very good input for the SCA. The SWOT analysis is easy to understand, simple, transparent, provides some ideas about the present situation of the firm and can identify the key areas (Sørensen et al 2004). Therefore SWOT is very good to use in the beginning of the discussion of a problematic situation, because it first gives an overview of the current situation of the company, which is usually an absence in the small organization. This methodology engages the individuals in a learning process and involves the participants in opening up the possibilities in a creative way (rather than evaluating fixed, given set of options). It is a participative process where every employee can discuss freely and suggest which are the problematic issues in the company, how to get out of the mess, and what kind of strategy should be made. SWOT is also a creative tool. It can be combined with techniques such as brainstorming and mind mapping. It can provide a good atmosphere in the sessions.

SWOT has been used in the case of Kirby (Sørensen et al., 2004) to open up a process of discussion. It has been evaluated as easy to understand for the participants, as well as very dynamic in its process, and a very good input for the SCA. Therefore SWOT is most appropriate in the beginning of the problem solving, namely in the shaping mode to identify the decision areas with the links between them.

By introducing some creative tools such as brainstorming and mind mapping to the participants, I aim to warm up the atmosphere before the sessions are started. Mind mapping can visually structure complex problem situations and its principles are very easy to understand. Brainstorming is a good way to quickly generate many diverse ideas. As the point of these two tools is that no criticism is allowed, the

participants feel free to discuss and exchange ideas, to share knowledge. These creative sessions will help the individuals in the team to learn more about each other. The results of the creative sessions will be a good input for the SWOT and the shaping mode of SCA.

SWOT has many advantages but also some limitations, which can be overcome by using other tools or methodologies. The results of the SWOT workshops cannot be completely standardized. A SWOT analysis often represents a view particular to a specific point in time. Often one factor can be placed in several categories and strengths may not lead to an advantage. Another disadvantage of SWOT is that sometimes the uncertainty can be excluded by the analysis because of the difficulty it may present to the planners. Many small organizations from industries where the competition is high, face more uncertainty than other companies and they put more emphasis on staying in the game. They must be constantly aware of their rivalries and incumbents' situation even in the case of changing competition. In such a case another tool, such as Porter's five forces might need to be built together with the SWOT analysis to make it fit the realities of today.

In the case of Kirby (Sørensen et al., 2004) the company should be also aware of the competitors in the market and therefore Porter's five forces analysis has been applied before SWOT analysis. It also helps the manager of Kirby to clearly see the company situation.

For some small companies, which have started a business in a new country or region and have encountered a problem there, PEST analysis will be a useful complementary tool to SWOT. PEST factors usually are beyond the control of the enterprises and must normally be considered as either threats or opportunities. PEST is useful before SWOT – in general not vice-versa – because PEST definitely helps to identify SWOT factors. There is overlap between PEST and SWOT, in that similar factors would appear in each.

12.3.2 Designing mode

After the participants have used SWOT analysis to shape the decision areas, the next step is the designing mode where the analysis of the problem(s) should go further in details. However, the participants can always go back in the shaping mode and reformulate the decision areas and the level of importance, because SCA allows moving back and forth between the modes.

In this mode individuals must recognize what can be done, to look at possibilities and drawbacks. The participants must list what course of action is feasible in relation to their current problem situation, what are the options and to explore the compatibility of options between different decision areas. A technique that can handle the record of the options and to investigate the feasibility between pairs of options is Cognitive mapping (Eden and Ackermann, 1998, 2001) within SODA methodology.

SODA helps to work with both quantitative and qualitative aspects of the problem. Cognitive maps represent the way in which a person defines an issue. The technique requires a skilled internal or external facilitator, even though the experience of Eden and Ackermann (1998, 2001) shows that the approach could be learned without too much effort. I can suggest that if the small company does not have any experience with Cognitive mapping it is necessary to hire a facilitator for the sessions. For the later use of the approach the manager could be able to learn how to facilitate the process.

My reasons for choosing cognitive mapping are:

I am trying to develop a model, which can be used by the small companies with limited resources. I want to keep the model as simple as possible so it can be easily used and understood by all the participants. SODA is not an easy to apply method but can deal with complex situations, it is very creative and it is a designing and structuring approach. Therefore I use only the main technique, cognitive mapping,

which can give me a broader overview of the problems situation and the related sub-problems. By applying SWOT to identify the issues in the company in the shaping mode I will reduce the numerous number of maps.

As SWOT would already have shaped and defined the main issues in the problematic situation the role of cognitive mapping will be to go a bit further in the analysis and to provide a number of options for each of the decision areas. Then the feasible and unfeasible pairs of options will be easily identified.

By drawing a cognitive map the participants will find and agree on different decision options and the links between them. Since the problem issues would be already shaped and discussed by the SWOT analysis the participants will not find it so difficult to construct a cognitive map of the decision options and to investigate their compatibility.

To visualize the results of the cognitive map, the participants summarize them in a decision graph with the options of each decision area and the links between them. This will be of assistance for the comparing mode, where the comparison areas must be identified.

Cognitive mapping has been used by Ackermann and Eden (2001) for designing an audit for the National Audit Office. The whole process did not take long time even though that at the beginning the participants saw difficulties in using the method, some of them did not believe that it could provide results. But the cognitive mapping shows that we can get information from each participant on their understanding of key issues and the relations between them. Ormerod (1997a,1997b) has also experienced the positive effect of using cognitive mapping in the beginning of a problem solving process to identify the key areas, with the list of the options. The overall map visually shows a picture of the problem situation in terms of decision areas, feasible and unfeasible options pairs and the linkage between them.

12.3.3 Comparing and choosing modes

In the comparing mode the decisions must be made in a context where multiple aspects must be considered, and not all are usually quantitative. The first step is to decide the comparison areas. In other words it should be decided which are the main issues that can affect the final decision. The next step is to identify the uncertainty areas and to compare the decision schemes. The set of issues to be compared may range from a small set of options in a single decision area to a wider set of feasible schemes in several linked decision areas. In order to make a choice a balance between multiple criteria should be found. In the case of Kirby (Sørensen et al., 2004) the four comparison areas identified were actually the basic criteria Kirby have for its business.

In the case of Kirby (Sørensen et al., 2004) it was impossible to handle all the uncertainties and to make a decision. Ormerod (1997a, 1997b) also experience difficulties in the final stage of the problem solving process, when SCA has been applied (see 11.2 ISS Development at Sainsbury's Supermarkets). Therefore he introduced four more quantitative criteria to make the final decision. In the second case described by him (see 11.3 Customer service Strategy at Severn Trent Water) the author saw the need to use a hard method such as a critical path analysis to work out the logical consequence of the assumptions.

Hickling (2001) experienced that SCA was able to handle all uncertainties alone. Conflict and complexity of the problem and the comparison scheme in the comparison mode was product of a group process. And Hickling wrote:

“The source of knowledge used was the current level of understanding and common sense held by the participants, improved by synergy created through the interactive work style”.

As there were many decision schemes the analysis carried out went through several cycles. Vila and Benaiges (2005) and Herron and Finlayson (2005) have handled the comparisons and the uncertainty associated with them only by applying the SCA.

As there are too many criteria in the complex problems that have to be taken into consideration a multi-criteria analysis must be used. PrOACT is a methodology that can cope with many criteria and uncertainties in a complex situation and can support the decision-makers in the comparing and choosing modes of SCA. As I have suggested earlier in Part III, PrOACT can handle the uncertainties and support the manager in the case of Kirby (Sørensen et al., 2004) to make a decision.

In the choosing mode, the group agrees in some areas and sets up explorations and/or consultations in other areas. Uncertainty areas are identified and listed. However, the stakeholders could feel uncertainty at many moments in a decision-making process and all these uncertainty areas are somehow relevant to the decision problem, which has been addressed. For example, the participants in the session could feel uncertain as to where the boundaries of their problem should be drawn or if pairs of options can be considered feasible. These areas of uncertainty can be categorized in uncertainty about the working environment (UE), uncertainty about related decisions (UR) and uncertainty about guiding values (UV).

After the uncertainty areas are listed, the level of relevance (importance) has to be drawn. Hickling (2001) has experienced a situation where there were too many uncertainties. Since it was impossible to make a progress, it was necessary to make a list with only the most important uncertainties, e.g. the ones that can affect the decision most. The question that arose after that was what actually might be done about these uncertainty areas. The options should be examined and the sequences of them have to be weighted up. PrOACT helps to evaluate which uncertainty affects the decision most critically and what decisions are most robust to these uncertainties.

Scenario planning is a strategic tool for medium to long-term planning under uncertain conditions. It helps participants sharpen their strategies, and focus on their goals. Decision-makers need risk reduction and certainty to be able to make decisions about their future facilities. The more complicated a system is, the more irrelevant this type of briefing becomes.

When uncertainty increases, decision-makers need tools to reveal and discover the potential business situation in order to identify possible risks and opportunities, and a plan for many possible outcomes and situations. Some of the possible futures seem more probable than other futures. Other scenarios are preferable and the desired future could often differ from the most probable one. At the same time, decision-makers cannot explore every possible future. Scenario planning is one way for them to reduce complexity. Scenario workshops can challenge existing paradigms and create shared perspectives on the future.

In the case of Kirby (Sørensen et al., 2004) Scenario will be not useful for the choosing mode, because more quantitative analysis about relevant technology option need to be made. It is more suitable in cases concerning planning where more qualitative variables are examined. As discussed in the previous part, the decision about the technology, which has to be implemented in Kirby, can be taken after a PrOACT approach is applied.

12.4 Framework for solving complex and ill-defined problems in small companies

The idea is to use SCA as a main tool for managing complexity and uncertainty in the small firms. It is a planning approach that can structure the problem and it is a decision-focused method. In the shaping mode of the SCA, SWOT analysis is used to give a clear picture of the company situation and the key issues affecting the organization. To warm up the starting session it is reasonable to use creative techniques such as mind mapping or brainstorming. If the company is from a dynamic sector, analysis of the competitors and the market will be a must. Porter's

five forces will provide the necessary information and make analysis of the factors influencing and affecting the business. If the company is started in a new location or country, PEST analysis could be a helpful tool. Since this approach gives opportunities for movement between the modes, it is possible that the participants make different scenarios after the SWOT analysis and move directly in the choosing mode, where they can discuss the commitment packages. Otherwise the analysis moves further in the designing mode.

In the designing mode of SCA cognitive mapping should be used to go a bit further in the analysis. For each decision area a set of options must be identified. To find whether incompatibilities exist (when selecting two infeasible options at the same time), comparisons have to be carried out for each combination. This will leave only the feasible option pairs to be analyzed further in the next modes. There are opportunities for the participants to go back into the shaping mode if they feel a need to discuss again the key issues or if they have found other problematic areas. The last thing to be done is to develop the option tree, with all the decision schemes. Then the analysis moves into the comparing and choosing modes.

In the comparing and choosing mode ProACT can be used. It will identify the comparison areas and since it is a MCDA, it can deal with multiple criteria and uncertainty in a complex problem. ProACT will identify the uncertainty areas and compare the different options and weigh up the consequences associated with them.

Scenario could be used in the choosing mode if the problem is not related to technology as in the case of Kirby (Sørensen et al., 2004). It is more suitable in cases concerning planning where more qualitative variables are examined. The participants can turn back in the shaping, designing or comparing modes if they decide that there are more issues to be discussed and agreed on.

The framework for problem solving in the small companies by using SCA as a central method, can be summarized graphically (Fig.10).

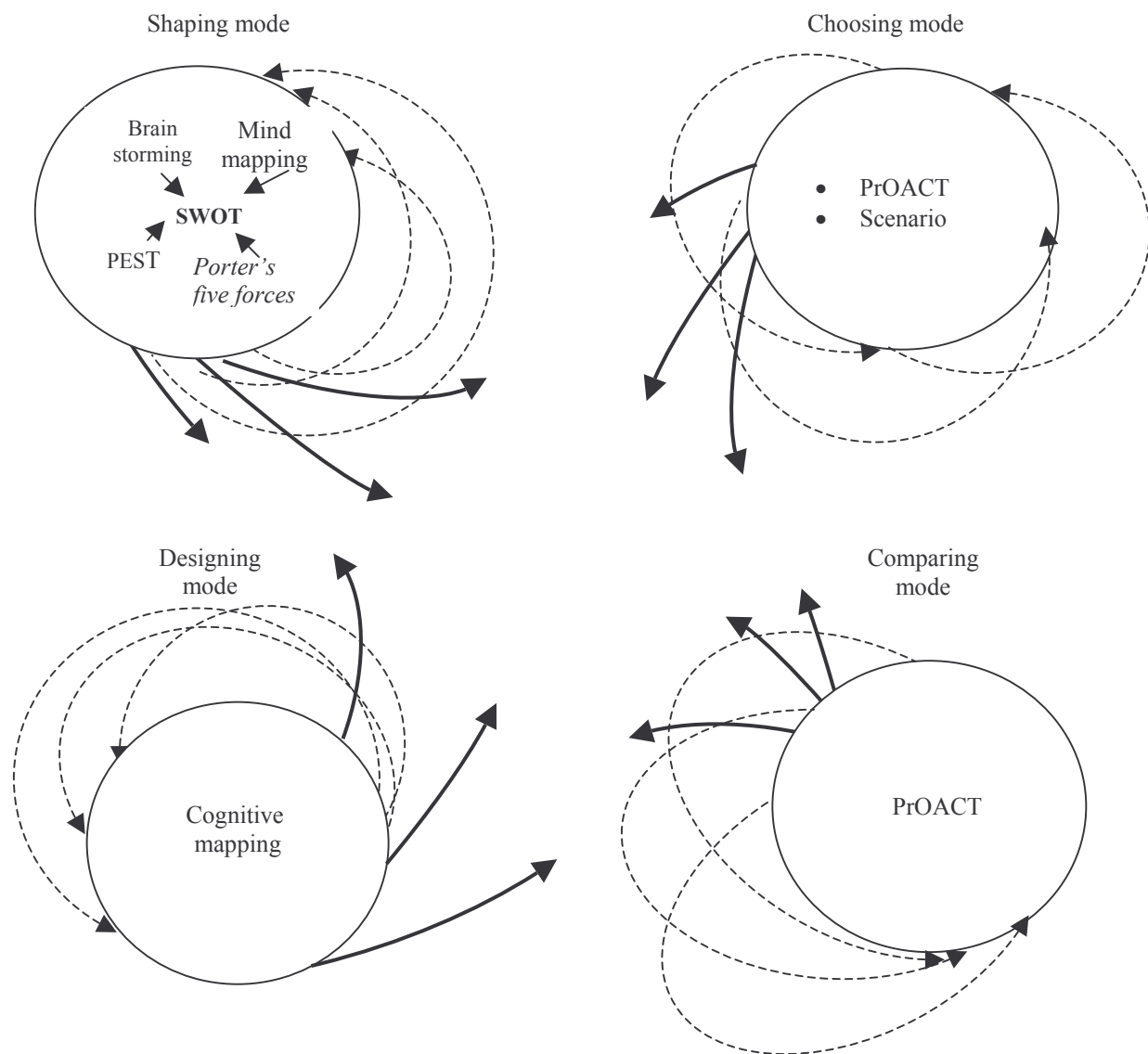


Fig. 10 The framework for solving ill-defined and complex problems, regarding strategy and planning in the small firms

Part V

13. Conclusions

The purpose of this thesis is to develop a soft multi-methodological model for solving ill-defined problems, regarding strategy and planning in small companies. In undertaking this task I used certain well-recognized theories, models and practical cases, where soft methodologies were applied.

In order to understand the concept of multi-methodology and the kind of problems that the different approaches can address I discussed the ideas and theories of Habermas (1984,1987), Mingers (1997), Flood and Jackson (1991), Rosenhead (2001), Vidal (2002, 2004) and Sørensen (2002, 2004). By examining this ideas and theories I established that soft methodologies are more appropriate for ill-defined and complex problems with high level of uncertainty in small firms. These types of problems are related to strategy and planning. I also established that any problem situation is a complex mix of personal, social and material elements and those real-world problematic situations are highly complex and multidimensional.

Different approaches focus on different aspects of the problematic situation. Therefore it would be reasonable to combine soft methodologies in a framework for solving problems. Another reason for choosing soft methods is that the soft approaches aim at the creative, intuitive and motivating component of planning by supporting the negotiation and the learning processes. Only in this way can the problem be understood and identified. The essence of soft methodologies is consensus, which is accepted by all the participants in the problem solving process. The solution that will be found is based on consensus and negotiation. Soft OR offers the participants different ways for a better understanding of the problem.

To investigate how soft methodologies were used in practical cases, I analyzed and discussed cases from Ormerod (1997a, 1997b), Sørensen et al. (2004), Hickling (2001), Vila and Benaiges (2005) and Herron and Finlayson (2005). The practical cases show that soft methods generate debate, learning and understanding, and use this understanding to progress through complex problems. Practical cases were helpful in choosing the central methodology in my framework for solving ill-defined problems in the small companies. SCA was successfully used in varieties of problems in both public and private sectors. Different practitioners of SCA (Vila and Benaiges, 2005; Herron and Finlayson, 2005; Ormerod, 1997a, 1997b; and Hickling, 2001) found that the method is very flexible, powerful in a complex situation with high degree of uncertainty and useful in situations where the decision should be made with regard to many criteria. Hickling (2001) shows a case where SCA was used in a conflict, complex and uncertain situation. The approach allows the shared understanding and learning to grow in a cyclic process.

To support the SCA in the problem solving process several different methodologies have been applied in the four modes of the main method. The theory and practical cases have been explored in debt and for each mode of SCA the most appropriate tools have been chosen. Brainstorming and mind mapping with SWOT analysis are applied in the shaping mode to identify the key issues and to warm up the atmosphere in the beginning. As complementary approaches to SWOT in the shaping mode PEST and Porter's five forces are recommended. They will be a must if the small company is from a dynamic industry or the problem has technical aspects as in the case of Kirby (Sørensen et al., 2004).

Cognitive mapping is the methodology, which I found best suitable for defining the number of options for every decision area and for finding the feasible and unfeasible pairs of options.

In the comparing and choosing modes ProACT should be used to manage the uncertainties, make the comparisons, look at the consequences of each choice and

finally to make a decision. PrOACT can be used for all types of problems. The scenario methodology can also handle the uncertainties and complexity in the problems but it is not suitable in situations regarding technologies or quantitative variables

14. Future research

This model has been analyzed mainly on the background of cases described by different practitioners and the theory provided. It has not been put into work in a small company. To put it into quantitative terms and to test how it works as a model to solve ill-defined and complex problems with regard to strategy and planning in small companies is a future work, which could help the small organizations to deal better with the different problems.

Soft OR clearly has a lot to offer in addressing some of the increasingly complex issues the companies are facing today. The choice of which methods to use in these particular cases is a product of the knowledge, experience and skills of the facilitator and the nature of the problem itself. The future of soft OR will probably be to complement hard methods even though there are relatively few possible combinations of hard and soft OR. What hard OR offers is precisely what soft OR lacks - logical objective ways to make appropriate/best decisions once the problem is clear. Time will show whether hard and soft OR will come together, or whether, they will remain bitter enemies.

Bibliography

- Argyris, C. and Schön, D. (1978). *Organizational learning: A theory of Action Perspective*, Addison Wesley
- Ackoff, R. (1981). *The art and Science of mess Management*, Interfaces, 11(1), February (The Institute of management science)
- Borges, P., Sørensen, L., Vidal, R.V.V. (1997). *Strategy/Planning/ Multicriteria. Why? How? For what?*, technical report, IMM, DTU, Lyngby
- Checkland, P. (1981). *Systems Thinking, Systems practice*, Chichester: John Wiley
- Checkland, P. (2001). *Soft Systems Methodology*, In: Rosenhead and Mingers
- Eberle, R.F., (1971). *SCAMPER: Games for Imagination Development*, NY: D.O.K.
- Eden, C. and Ackermann, F. (1998). *Making Strategy: The Journey of Strategic Management*, Sage, London
- Eden, C. and Ackermann, F. (2001). *SODA – The principles*, In: Rosenhead and Mingers.
- Eden, C., Jones, S. and Sims, D. (1983). *Messing About in Problems: An Informal Structured Approach to their Identification and management*, Oxford: Pergamon Press.
- Flood, R. and Jackson, M. (1991). *Creative problem Solving*, Wiley, London
- Friend, J. and Hickling, A. (2005). *Planning under pressure. The Strategic Choice Approach*, Butterworth-Heinemann, Oxford,
- Gavin C. Reid (1993). *Small business enterprise -an economic analysis*, Routledge, London,
- Godet, M. (1987). *Scenarios and strategic management*, Butterworths, London
- Graham Hall (1995). *Surviving and prospering in the small firm sector*, Routledge, London
- Habermas, J., (1984). *The Theory of Communicative Action Vol.1: Reason and the Rationalization of Society*, Heinemann, London
- Habermas, J., (1987). *The theory of communicative action Vol.2: Life world and System: a Critique of Functionalist reason*, Polity Press, Oxford
- Hammond, John S.; Keeney, Ralph L. and Raiffa Howard (1999). *Smart choices - a practical guide to making better decisions*, Harvard Business School Press, Boston

- Herron, R. and Finlayson, D. (2005). *Fast Forward with Strategic Choice: Mutual consultancy for small enterprise development*. In: Friend and Hickling
- Hicks, M. (2004). *Problem solving and decision making -Hard, Soft and Creative Approaches*, 2 ed. Thomson Learning, London
- Hickling, A. (2001). *Gambling with Frozen Fire*, In: Rosenhead and Mingers
- Johnson and Scholes, (1999) *Exploring Corporate strategy*, 5. ed. Prentice Hall, London
- Kuhn, T. (1970). *The Structure of Scientific revolutions*, Chicago University Press, Chicago.
- Mingers, J. (1997). *Multi-paradigm Multimethodology*, In: Mingers and Gill
- Mingers, J. and Brocklesby, J. (1997). *Multimethodology: Towards a framework for Mixing Methodologies*, Omega, Int. Journal of Management Science, Vol.25, No.5, pp. 489-509
- Mingers, J. and Gill, A. (1997). *Multimethodology- the theory and practice of combining management science methodologies*, John Wiley & Sons, Chichester
- Munro, I. and Mingers, J. (2002). *The use of multimethodology in practice- results of a survey of practitioners*, Journal of the Operational Research Society, 53, 369-378
- Ormerod, R. (1997). *Mixing methods in practice*. In: Mingers and Gill
- Ormerod, R. (1997a). *Case D: Information System Strategy Development at Sainsbury's Supermarket (external consultancy-soft-process design and facilitation)*. In: Mingers and Gill
- Ormerod, R. (1997b). *Case E: Customer Service Strategy at Severn Trent Water (academic consultancy-soft OR-catalytic)*. In: Mingers and Gill
- Ormerod, R (2001). *Mixing methods in practice*. In: Rosenhead and Mingers
- Popper, K. (1972). *Objective Knowledge: An evolutionary Approach*, Oxford University Press, London
- Porter, M. (1991). *How competitive forces shape strategy*, Harvard Business School Press, Boston
- Poul Rind Christensen, Kathrine Høeg and Flemming Poulfelt (2004). *RENT XIII 2004 -Managing complexity and change in SMEs*, LOK Research Center, Copenhagen
- Rosenhead, M. and Mingers, J. (2001). *Rational analysis for a problematic world revisited*, John Wiley & Sons, Chichester

Sørensen, L. (2004) *Tele-information and strategy*, Notes for course 02727/34743 Tele-information: Strategy and Creativity, Center for Tele-information, DTU, Lyngby

Sørensen, L. and Vidal, R.V.V. (1999). *Getting an Overview With SWOT*, CTI working paper, Center for Tele-Information, Technical University of Denmark, Lyngby

Sørensen, L. and Vidal, R.V.V. (2002). *The Anatomy of Soft Approaches*, <http://eawp.economistascoruna.org/archives/vol1n8/index.asp>

Sørensen, L. and Vidal, R.V.V. (2004). *Notes from the course: Tele-information: Strategy and Creativity*, DTU, Lyngby

Sørensen, L, Vidal, R.V.V, Engstrom, E., European (2004). *Using soft OR in a small company - The case of Kirby*, Journal of Operational Research, vol. 152(3), pp. 555-570

Vidal, R. V. V. (2002) *Dealing with Problematic Situations*, IMM working paper, DTU, Lyngby

Vidal, R. V. V. (2004) *Creativity and Problem Solving*. Economic Analysis Working Papers, vol. 3(14), pp. 29.

Vidal, R.V.V. (1994) *Scenario – Methods and applications*, CTI working paper, Center for Tele-Information, Technical University of Denmark, Lyngby

Vila, E. and Benaiges, A.M. (2005). *Capacity Building in Venezuela: using strategic choice methods with policy-makers and students*. In: Friend and Hickling

Internet websites

<http://www.jcu.edu.au/studying/services/studyskills/mindmap/index.html>

<http://eawp.economistascoruna.org/archives/vol1n8/index.asp>