THE CHALLENGE OF ORGANIZATION DESIGN
Matrix in the Research Environment

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ABSTRACT

This thesis is about the challenge of organization design in a research environment. The case study, conducted in a high technology company's research organization, looks into the complex matrix organization from the program manager's point of view. The purpose of this study is to describe and clarify the organizational setting in the case organization and to suggest some improvements and possible changes that would enhance the positive and diminish the negative issues in the organization. The main goal is to help the decision-makers to find ways to improve the organization further, so that the programs could deliver the best-of-class research results, despite the complexity of the organization and turbulence and continuous change in the environment, in which the people need to operate.

This case study follows action research strategy and the methods used in data collection are interview and qualitative survey. Content analysis is used for analyzing the data. Following the spirit of the action research strategy, the status analysis of the matrix and its functionality in the case organization are followed by further analysis with an approach where the collected data is used to analyze the degree to which organization supports the program management.

The study permits the conclusion that the matrix organization and its functionality in the case organization does not differ much from the similar kind of organizations studied before. The key findings can be stated as follows. No matter what the organization structure is, there is need for certain things to be in place in order to conquer the challenges: 1) clear roles and responsibilities 2) clear processes, 3) management tools that serve the needs of the users, 4) a person in senior management whose role is to make sure that the organization works as it should work, 5) training for the people to make sure that they have an understanding of the organization and how they are positioned there and how they are expected to work in the particular setting. In terms of taking advantage of the strengths in the research organization too, it needs to be understood that the people are the key to making things happen. Keeping the people motivated and performing well, requires ensuring a) that the individual competence needs are taken care of; b) that the freedom and flexibility in the working environment are ensured; c) that the co-operative culture is maintained by emphasizing the personal networks and encouraging people to interact across organizational boundaries; d) that the continuous renewal happens despite the organizational structure. It does indeed seem that it is always about the people, not only the structures or processes, in achieving success. In any effort at organization design and change this must be kept in mind if the success and high performance are pursued in the continuously changing circumstances.

ACKNOWLEDGEMENTS

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1 INTRODUCTION

The subject in this study is a research organization that is a part of a global high-technology company. Companies, especially those within high-technology, face a lot of challenges in the turbulent and rapidly changing business environment where they operate. In order to survive, the companies need to adjust to the changing environment. For that reason, it has become more and more important to organize work in ways that enable the companies to be more efficient, but still perform excellently. This is why organization design and finding the best organization structure and ways of working have also become an area of interest in companies and these things are found important in the organizations. The differences in organization structures and theories, and what organization design is about, are reviewed in Galbraith (1977), Morgan (1997) and Jones (2001). To understand the special features found in the research and development environments, I have used the studies by Peltz and Andrews (1976) and Thamhain (2004).

When this study was initiated in spring 2005, the case organization had recently gone through organizational and operational mode changes, including renewed processes and new tools for resource and project/program management. The organization structure that was introduced and being implemented was a matrix structure, which in the literature is mentioned as the most suitable organization form for organizations that work in project mode, and which need to have high competence and efficient delivery of results combined in the same package. To understand the history and the present status of the matrix organization designs and structures I have used the studies by Galbraith (1971), Knight (1976), Ford & Randolph (1992) and Sy & D'Annunzio (2005) to describe the subject.

In the case organization the horizontal dimension of the matrix is formed of the program organization and in my thesis I aim at drawing a picture of the functionality of the matrix organization structure from the program manager's point of view. The purpose is to describe and clarify the organizational setting in the case organization, and also to propose some improvements and possible changes that would enhance the positive and diminish the negative issues in the organization. The assumption is that there are plenty of challenges arising from the multi-dimensional matrix organization, but that there are also some positive aspects in the current way of working. The main goal in all this is to help the decision-makers to find ways to improve the organization, so that the programs could deliver best-of-class research results, being fast, innovative, as well as efficient, despite the

complexity of the organization and the turbulence and continuously changing environment, in which the people need to operate.

Case study is chosen, because the target group is fairly small and the aim is not to make any generalization, but to describe and evaluate the current state in this specific organization. This case study follows action research strategy and the methods that are used in data collection are interview and qualitative survey. Some people from the organization, dealing with program management from different perspectives are first interviewed to obtain an understanding about the environment and requirements where the program managers are operating. Based on these pre-interviews, a program manager survey is designed and conducted. Content analysis is used for analyzing the data.

I have divided the analysis of the study in two separate parts. Part One (Chapter 5.2) consists of the analysis of the current state in the organization that is described in the responses collected from the program managers. Following the spirit of action research strategy, I continue with some evolved thinking and in Part Two (Chapter 5.3) I extend the analysis by taking an approach in which the results of the survey, and the pre-interview material are used to analyze the organization's supportiveness for program management. In this analysis I use Morrison, Brown and Smit's (2006) framework of the proposed dimensions of project management supportive organizational culture. In this part I aim to ascertain the state of the organizational culture and its supportiveness to the program management in the case organization at the time when the survey was conducted. In Chapter 5.4 I conclude the analysis and present some ideas and proposals on how to go forward with the knowledge gained from the matrix experience in the case organization. In the final chapter (Chapter 6) I conclude by reflecting the learnings of this case study with the continuous change in today's organizations.

2 ORGANIZATION DESIGN AND RESEARCH ENVIRONMENT

2.1 What is an Organization and Why Do Organizations Exist?

"We live in an organizational world" (Pfeffer 1997, 3). And it is said that by Galbraith (1977, 2): "The term organization and organization structure are terms everyone understands until he or she is asked to define them."

Organization as a term is familiar to most people. We all belong to different organizations at least at some point of our lives. We work in some organization, we belong to some hobby groups, like a sports club, or we might take part in volunteer activities in some organization. In life we do not necessarily need to pay much attention to organization theory or forming an organization, but the concept of an organization and organizing activities is built into our daily lives. Indeed, sometimes it is necessary to take a deeper look at what it means when we talk about these matters.

An organization is basically a construction of two or more units. Units may be people or groups. This construction is an organization (structure of units and bureaucracy) and the construction has an organization (a social system that works, consisting of roles, hierarchies and communication). Galbraith (1977, 3) defines organization as follows. Organizations are (1) composed of people and groups of people (2) in order to achieve some shared purpose (3) through a division of labor (4) integrated by information-based decision processes (5) continuously through time. Jones (2001, 2) describes organization as a tool used by people to coordinate their actions to obtain something they desire or value, meaning that organization is needed to achieve set goals. Galbraith quotes Porter, Lawler and Hackman (Behaviour in Organizations, 1975) who claim that organizations are first and foremost social entities in which people take part and to which they react. Fundamental for organizations is also the purposeful, goal-oriented characteristics focusing attention on the instrumental nature of organizations. Organizations are social instruments set up to do something. (Galbraith, 1977, 3-4)

An organization is usually described by drawing an organization chart with formal reporting lines and by placing the people in boxes, showing their places in the organization. As important as the formal organization is the informal organization that

takes shape behind the official structures and how it affects the way the "formal" hierarchy works should be understood. Because an organization is a network of informal social relations, as well as a hierarchy of formal task and authority relations the power of the informal organization needs to be kept in mind in order to achieve organizational goals. The informal organization can actually enhance organizational performance and much of what is done in an organization is done through the informal organization. It is about the interactions between the formal and informal hierarchies and how these relationships are used in order to motivate and coordinate employees. The formal hierarchical organization structure is the main mechanism of control, but it should not be forgotten that the informal structure along with the formal one allows people to work out solutions to their problems. (Jones 2001, 82-83)

When making s distinction between organizations and other collectives, like small groups, families and mobs, organizations are clearly set to serve specified goals and to accomplish set objectives. Quoting his earlier research with Salamcik, Pfeffer states that the goal oriented or instrumental view of organizations implies that organizations are a collection of individual efforts that are coordinated to achieve things that could not be achieved through individual action alone (Pfeffer, 1997, 7). Jones (2001) aptly explains the reasons why the organization is needed and what the key points are in achieving efficiency by organized activities and people. The chart by Jones (Figure 1) summarizes why the organization exists.

People who work together in organizations may become more productive and efficient at what they do than people who work alone. By organizing people and tasks, it is possible to produce goods or provide services more efficiently. For example, cost savings are possible when an organization is able to use underutilized resources more effectively because they can be shared across several different products or tasks. Pressure from the environment in which organizations operate also makes organizations a favorable mode for organizing productive results. Managing complex environments is a task beyond the abilities of most individuals, but an organization has the resources to develop specialists to anticipate or attempt to influence the many demands from the environment. Over time, the stability created by an organization provides a setting in which the organization and its members can increase their skills and capabilities, and the ability of the organization to create value can be increased significantly. (Jones 2001, 5-7)
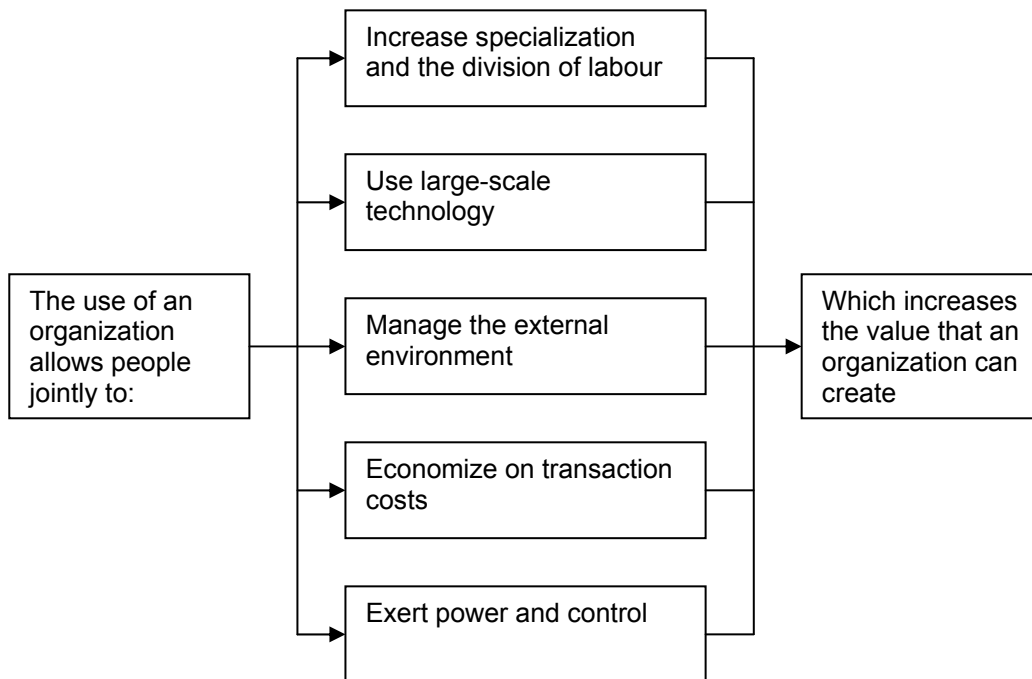
Figure 1: Why Organizations Exist (Jones 2001, 6)

2.2 The Need for Organization Design

Organization design is not a new thing and in point of fact, every organization has been designed. What makes the difference between the organizations is the way the organization is planned in the long run. The history of organization design and theory dates back to the turn of the 19th and 20th centuries, when large organizations other than the church and military began to appear. The story of organization design starts from the Classical School of Management (e.g. Adam Smith, Fredrick Taylor, Max Weber) and goes through the 1930's era of the Human Relations school (e.g. Hawthorne studies) and step by step towards the modern times and understanding that there is no specific theory that alone resolves the challenge of creating the best possible organization. It needs to be understood that a successful organization is a design that takes the best parts of the existing knowledge and implements a suitable mix of theories that fit into the organization in question. (Galbraith 1977, 11-16, 32, Jones 2001, 76-77)

An organization's effectiveness depends a lot on developing a cohesive set of relations between structural design, the age, size, and technology of the firm, and the conditions of the industry in which it is operating (Morgan 1997, 51). In many cases the changing world and today's turbulent business environment dictate the need for continuous change. There is no way just to let the organization develop itself. Organization design is a tool to make organizations work in a way that takes the changing environment into account, using the theories and organization models as a ground to build an effective and functional organization of today. Jones describes the relations between organization theory, structure, design and culture quite well (Figure 2) and shows the role of organization design as a tool to combine the different elements. Anyway, there is never a single optimal or "perfect" organizational design to fit an organization's needs and managers must constantly evaluate how well their organization's structure and culture work, and they should re-design them on an ongoing basis to improve them (Jones 2001, 12). Moreover, there is no one organization theory that fits all. It is not possible to use one theory that solves the problems in every organization. It is assumed that a consciously designed structure based on the current theories of organization can improve the effectiveness of organizations because the best structure is not likely to evolve spontaneously over the time (Galbraith 1977, 5-9).

Increased competition and complexity of the environment where the organizations are operating today are driving managers to search for new and better ways to coordinate and motivate their employees in order to increase the value their organizations can create. More and more organizations are discovering that organizational design is a way to achieve competitive advantage. Competitive advantage is the ability of one company to outperform another because that company's managers are able to create more value from the resources at their disposal. Organizational design has important implications for a company's ability to e.g. deal with contingencies (events that might occur and must be planned for, such as changing environment or a competitor that decide to use a new technology in an innovative way), effectively manage diversity, and most of all, increase its efficiency and ability to innovate new goods and services. The design of the organization determines how effectively an organization responds to various factors in its environment and obtains scarce resources. This is one reason why organization design activities are very important to companies and other organizations that must continuously keep pace with the changing world and its complexity. (Jones 2001, 10-11)

Organizational Structure	Organizational Design	Organizational Culture

Organizational Theory
The study of how organizations function and how they affect and are affected by the environment in which they operate

Organizational Structure
- The formal system of task and authority relationships that controls how people are to co-operate and use resources to achieve the organization's goals.
- Controls coordination and motivation; shapes behavior of people and the organization.
- Is a response to contingencies involving environment, technology, and human resources.
- Evolves as organization grows and differentiates.
- Can be managed and changed through the process of organizational design.

Organizational Design
- The process by which managers select and manage various dimensions and components of organizational structure and culture so that an organization can control the activities necessary to achieve its goals.
- Balances the need of the organization to manage external and internal pressures so that it can survive in the long run.

Organizational Culture
- The set of shared values and norms that controls organizational members' interaction with each other and with people outside the organization.
- Controls coordination and motivation; shapes behavior of people and the organization.
- Is shaped by people, ethics, and organizational structure.
- Evolves as organization grows and differentiates.
- Can be managed and changed through the process of organizational design.

Figure 2: The relationship among Organizational Theory and Organizational Structure, and Design (Jones 2001, 9)

Organization design is very much a decision process for achieving coherence between the goals or purposes for which the organization exists and the main task of organization design is "to do it well". Organization design is the continuous monitoring and assessing of the fit between goals, structures, and rewards, the creation and choice of alternative actions when there is no fit, and the implementation of these. There are different strategic choices to make – about organizing modes, processes, integrating individuals into the organization etc. The main question in decision-making is whether goals, organizations, individuals, or some combination of them, should be changed in order to adapt to changes in the environment. Organization design is concerned with maintaining the coherence of these choices over time. Organization design is also needed to find the right solution for the organization in question. The organization design efforts must combine the theoretical

knowledge about organizations and the factors that are unique to a particular organization. However, an organization cannot be designed without the people who are to operate within it. The participation of members is needed not only for acceptance of the new design but also to generate the new design which must take account of the many unique features of any specific organization. (Galbraith 1977, 5-9)

The way an organization designs its structure is an important determinant of how much value the organization creates, because organizational design is the means of implementing an organization's strategy. Many sources of competitive advantage, such as skills in research and development resulting in novel product features or state-of-the art technology, quickly disappear because they are relatively easy for competitors to imitate. It is much more difficult to imitate organization structure and culture, because the structure and culture are embedded in the way the people in an organization interact and coordinate their actions to get the job done. Successful structures and cultures take a long time to establish and develop and therefore companies which possess them can have a long-term competitive advantage. (Jones 2001, 11-12)

Organizations of today are in many cases very diverse and it is important to manage this diversity in a way that motivates the people working together in an organization. An organization's structure and culture determine how effectively managers are able to coordinate and motivate workers. Differences in the race, gender, and national origin of organizational members have important implications for the values of an organization's culture and for organizational effectiveness. An organization needs a structure that is designed to make optimal use of the talents of a diverse workforce and to develop cultural values that encourage people to work together. Organizational design involves a constant search for new or better ways of coordinating and motivating employees and plays an important role in innovation. Historically, the capacity of organizations to create value and to be innovative has increased enormously with the introduction of better ways of producing and distributing goods and services, which is one reason why the design and use of new and more efficient organizational structures is important. For example, the way an organization's structure links people in different specializations and tasks determines how fast the organization can introduce new products. Similarly, an organization's culture can affect people's desire to be innovative. (Jones 2001, 11-12)

2.3 Choosing the Organization Structure

Organizations can be roughly divided into two categories. Different theorists call the categories slightly differently, but the basic understanding of the two main categories is the same: one is static, consistent and predictable in nature (formal, mechanistic, functional, bureaucratic organizations) and the other is flexible, dynamic and more adaptable to changes (organic, synthetic, multidivisional organizations) (Galbraith 1977, Morgan, 1997, Jones 2001). The two main types have various subcategories and variants and organization design is about finding the most suitable structure or combination of structures for a given organization to organize the work, the people and the tasks that they do and make it all work in the best way possible. Organization structure needs to be carefully designed to match the specific needs and requirements of the organization and for the challenges that it faces internally and from its environment. The concept of organization is a product of the mechanical age and as we are currently living in an electronic age, new organizing principles - the more flexible solutions for organization design - are necessary for surviving and meeting the challenges of the reality of today (Morgan 1997, 375-378).

In the studies done in late 50's and early 60's it was found that 1) there is no single best way to organize, and 2) not all the ways of organizing are equally effective. The theory suggests that we can observe a wide range of differences in effective organizations but these differences are not random. The form of organization makes one difference. One of the first studies was conducted by Burns and Stalker. In observing 20 English and Scottish firms, they identified two types of organizations – mechanistic and organic. More importantly they suggested that each type was effective. The mechanistic form, the type suggested by the classical theorists, was effective in stable markets while the organic, the type suggested by human-relations theorists, was effective in the presence of rapidly changing markets and technologies. (Galbraith 1977, 28)

Jones (2001) shares this view of mechanistic and organic forms and corroborates Galbraith's earlier views. The decision about whether to design an organic or mechanistic structure depends on the situation an organization faces: the environment it confronts, its technology and the nature of the tasks it performs, and the type of people it employs. In general, the contingencies or sources of uncertainty facing an organization shape the organization's design. The contingency approach to organizational design tailors

organizational structure to the sources of uncertainty facing an organization. The structure is designed to respond to various contingencies – things that might happen and, therefore must be planned for. Most organizations are a mixture of the two types (Figure 3). According to an increasingly influential view on organizational design, the most successful organizations are those that have a balance between the two, so that they are simultaneously mechanistic and organic.

Mechanistic structure result when an organization makes these choices:	**Organic structures result when an organization makes these choices:**
Individual Specialization: Employees work separately and specialize in one clearly defined task.	**Joint Specialization:** Employees work together and coordinate their actions to find the best way of performing a task.
Simple Integrating Mechanisms: Hierarchy of authority is clearly defined and is the major integrating mechanism.	**Complex Integrating Mechanisms:** Task forces and teams are the major integrating mechanisms.
Centralization: Authority to control tasks is kept at the top of the organization. Most communication is vertical.	**Decentralization:** Authority to control tasks is delegated to people at all levels in the organization. Most communication is lateral.
Standardization: Extensive use is made of rules and processes to coordinate tasks, and work process is predictable.	**Mutual Adjustment:** Extensive use is made of face-to-face contact to coordinate tasks, and work process is relatively unpredictable.
Status-Conscious Informal Organization: Employees protect their area of authority and responsibility from others.	**Expertise-Concious Informal Organization:** Employees share their skills with others, and authority and responsibility change over time.

The structure that is simultaneously mechanistic and organic is achieved when the organization balances these choices in a way that matches the contingencies it faces.
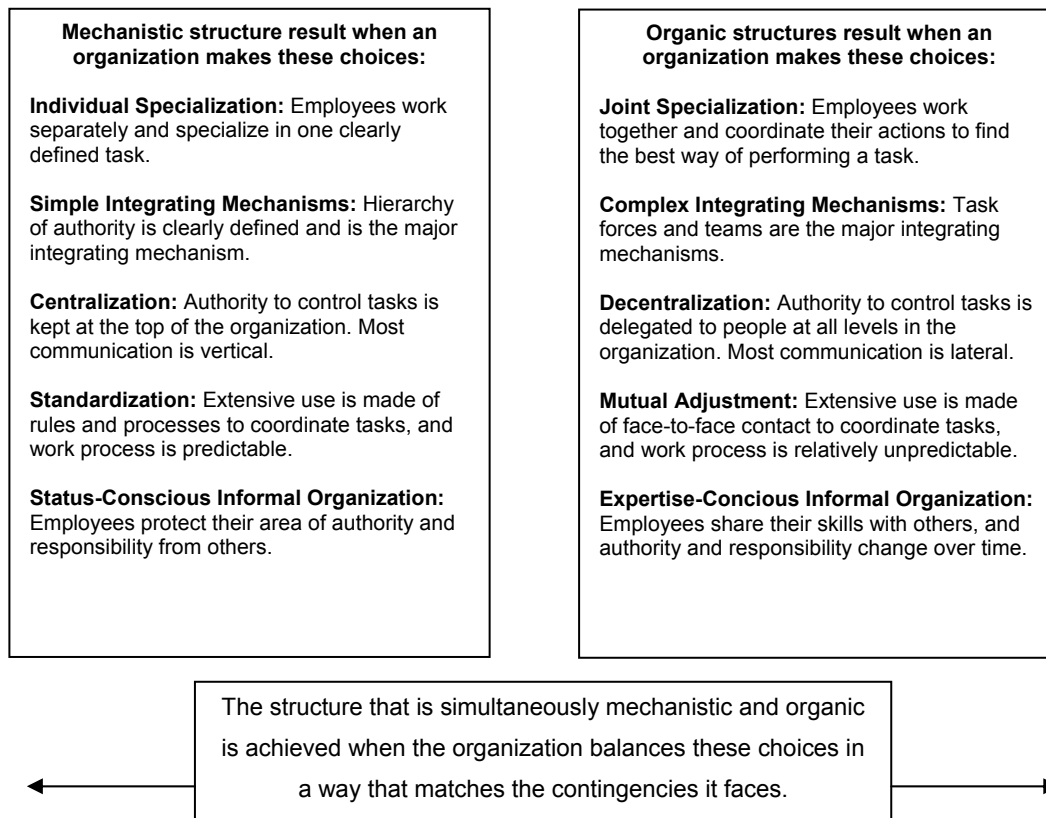
Figure 3: Mechanistic and organic organization structures (Jones 2001, 54)

In understanding organization as a rational, technical process, mechanical imagery tends to forget the human aspects of organization and to overlook the fact that the tasks facing organizations are often much more complex, uncertain, and difficult than those that can be performed by most machines. A mechanistic approach to organization works well only in conditions where machines work well: a) when there is straightforward task to perform; b) when the environment is stable enough to ensure that the products produced will be appropriate ones; c) when one wishes to produce exactly the same product time and again; d) when precision is at a premium; and e) when the human "machine" parts are compliant and behave as they have been designed to behave. Mechanistically structured organizations have great difficulty adapting to changing circumstances because they are

designed to achieve predetermined goals; they are not designed for innovation. From a historic perspective, the mechanistic approach to organization belongs to the mechanical age. Now when we have entered an age with a completely new technological base drawing on microelectronics, new organizational principles promoting organic organization structures are likely to become increasingly important. (Morgan 1997, 27-31) For today's organizations, it could be strongly suggested to make a choice for organic organization structures that promote flexibility, so that people could better initiate change and adapt quickly to changing conditions (Jones 2001, 55-56). Morgan (1997, 51) refers to the work of the McGill researchers that confirms that the machine bureaucracy and the divisionalized form of organization tend to be ineffective except in conditions where tasks and environment are simple and stable.

Organic organizations are called by many different names like adhocracies, "virtual teams", and "virtual organizations" and innovative firms e.g. in the electronics and other high-tech and rapidly changing industries are embracing these forms of organization that are assumed to be effective. They are the norm in all kinds of project-oriented companies and this form of organization also sometimes emerges as a differentiated unit of a larger organization: for example, an ad hoc task group or project team performing a limited assignment or contributing to the strategic planning and development of the organization as a whole. It is also frequently used in research and development (R&D) work. As organizational environments have become more complex, differentiated, and turbulent, more and more "species" of organizations seem to have emerged. Morgan (1997, 52) One of the best known organic organizations is the matrix organization that is to be described in more detail in Chapter 3.

2.4 What Is Special in Research Environment?

In research and development (R&D) the key words are creativity and innovation. Innovation means exploring and experimenting with fresh ways. Innovation is a non-linear activity, where new issues often spring out of the blue, one new event leading to a cascade of evermore novel and unexpected events. (Harris 2003, 130) In R&D, many times the greatest inventions originate from some innovative side experiment or some small unofficial study run in parallel with an official research project. Great things happen when somebody just starts to look into a tiny matter or a strange idea that may look really stupid

or impossible to take further. Small things can turn into huge inventions, if there are enough courage and open-minded spirit to take action.

2.4.1 People in Research and Development

People working in R&D are often engineers, researchers and scientists. Their task is to invent new technologies, products and services that are something extraordinary in the markets, or develop some new features or improvements for existing technologies, products and services. These people are usually categorized as knowledge workers, often academically educated and highly talented, intellectual individuals, who are motivated by the challenges that the work provides (Odiorne 1987, 212). Theory X and theory Y, the commonly known theories of human motivation created and developed by Douglas McGregor at the MIT Sloan School of Management in the 1960's, describe two very different attitudes toward workforce motivation, X and Y being opposite to each others. The people working in R&D definitely belong to the theory Y people. Checking the information e.g. in the Wikipedia dictionary in the Internet (http://www.en.wikipedia.org), the assumption of theory Y people is described as follows: "these people are assumed to be ambitious, self-motivated, anxious to accept greater responsibility, and exercise self-control, self-direction, autonomy and empowerment". It is also said that theory Y employees enjoy their mental and physical work tasks and if given the chance, employees have the desire to be creative and forward thinking in the workplace. If the employees are given the freedom to perform to the best of their abilities without being bogged down by rules, they draw a chance for greater productivity.

It seems that the people working in R&D in the 1970's and now in the 21st century do not differ much, only the pace of life has doubled or even tripled during the decades. In R&D the contents of the work, freedom and flexibility in the work environment, as well as the ways of working were and are highly valued. In R&D the interaction with the co-workers and discussion within and especially across different disciplines enhances innovativeness and creativity. Challenging arguments for and against some research topics and findings are refreshing and critical comments from peers challenge people to think more and dig deeper. Coffee table discussions are one of the best ways to test one's ideas and whether these could be studied more profoundly. The world outside one's research lab is also very important in R&D. It was, and today even more so, is a must to know what is going on in

other companies and what is being done in universities and other research institutions. Discussion with research communities as well as consumers is very important. It is necessary to keep up with the speed of future trends and what kind of equipment and services the people in the real world would like to see and use now and in the future. (Morrison et al. 2006, Peltz & Andrews 1976, Thamhain 2004)

2.4.2 Projects and Programs

Nowadays it is very common to work in project mode and that is also the case in R&D. A project, and on a larger scale also a program, is an efficient way to organize work and it has become more and more popular to work in project mode. (Turner 2003) Waddell (2005) suggests that instead of talking about program management as a different species and separate from project management, it should be seen as an extension of project management and a complementary tool for achieving organizational outcomes. Managing a project is more like managing operational objectives. Managing a program goes more under a category of strategic work and longer term objective setting. A program is usually a multiyear objective, and the project can be defined as a smaller portion which contributes part of the whole program. The program is likely to remain constant throughout its lifetime, although it may be cancelled before completion. The program is usually clear and simple to state, but also very difficult to execute. The project, on the other hand, might be broken down into dozens or even hundreds of subprojects. Projects are mostly short-term in nature (likely to be accomplished in a single year), and with a high probability of success. (Odiorne 1987, 214; Waddell 2005)

However, if we talk about pure research projects, they differ in many ways from manufacturing projects, for example. Research projects can last for many years, sometimes resulting in dramatically profitable discoveries, but also the opposite; they may consume vast amounts of time and money and eventually yield no practical results. All research projects share one common characteristic – the projection of ideas and activities into new endeavors. There is an ever-present element of risk and uncertainty that means that the events and tasks leading to completion can never be foretold with absolute accuracy. Research projects carry the highest risk because they attempt to extend the boundaries of current knowledge and the project objectives are usually difficult or even impossible to define. (Lock 2003, 3-6) In order to succeed in running a research project, or a program,

there is a need to have a competent leader and management system to make things happen, not to mention a supportive working environment and functional organization structure and culture.

In the fast paced business environment it is necessary to deliver results in time and with high efficiency, and project mode is a way to organize the work accordingly. The projects are usually done by a team and led by a project manager, or if the work is organized in program mode, a program manager. There is a need to decide how to organize the people into teams, what kind of organization model to choose in order to achieve the goals set for a project. Is it better to have functional teams where people in each function are doing their share of work and then combining the results or giving the project to the other function to continue when the specific task by one team has been accomplished? Or should there be a project organization where the people from different disciplines are organized to work on a problem together, each of the projects having a project team which exists until the project specific results are accomplished? Or should it be something in between – a matrix organization?

2.4.3 Organizing the Work

Especially more extensive research programs, there is often a need to have a cross-disciplinary workforce to conduct the work. Matrix organization is suggested as a solution when there are many different projects to be done simultaneously or problems to be solved in parallel and with limited timeframes. In a matrix, where the people are organized in functions, each function representing some special area of expertise and the work is organized as projects, it is possible to put together a project team consisting of people from different functions. The project runs as long as the work is completed, but the members of the project team can change over time. The matrix is not the simplest construction, but in many cases it is said to be the best way to beat the challenging schedules and utilize the special resources efficiently. (e.g. Galbraith 1971, 39-40; Jones 2001, 117-118; Odiorne 1987, 214-215; Lock 2003, 36-41) Although the matrix is widely recommended as a solution to organize teams and project work, there are also opinions against the matrix. For instance, Harris is not so convinced that a complex matrix structure is necessary for organizing innovative and efficient team work. Harris states that the complexity of a matrix is just a way to sandbag innovation, because it requires too many interconnections

within the organization and causes unnecessary political repercussions. Ideally the work should be organized to be done in teams containing no more than 12 people. Seventeen people seems to be the absolute limit for high performance innovative teams, otherwise there is too much hierarchy and the structure is too layered, causing different kinds of problems like difficulties in communication. (Harris 2003, 119-120)

Today it is also quite common to have people from different parts of the world working on the same project. In large globally operating companies it is often possible to create virtual teams and many times that gives an opportunity to use resources more efficiently. With modern technology, it is possible to have virtual teams that work together using various kinds of online and networking tools for communicating and sharing information. It is not necessary to have all team members sitting in a same place and it is not necessary to hire a new specialist to do a required task in a project if there is someone available at some other location who can do the job. Sometimes a virtual team can be an advantage in organizing the work, but does it work in R&D? (Gibson & Cohen 2003)

The work is done in projects and project teams are the units conducting the work. What is an important thing in R&D projects is the management of the projects and leadership in the teams, not to mention the environment and conditions in which the people work. To get projects done on schedule, within the given budget and using the available resources efficiently, it is necessary to have the right kind of management and leadership in place. (Lock 2003, Morrison et al. 2006, Thamhain 2004, Turner 2003, Waddell 2005) It is also important that the organization design is suitable and provides good conditions and an atmosphere where people enjoy working. The challenges in today's research environment are mostly related to the business world. The pace is fast and new products, technologies and services are needed. Market firsts are every company's objectives and efficient research and development are in the key role in taking the lead in the markets. The best projects are needed, and must be carried out on limited resources and within tight schedules. In order to accomplish this there should be the best people, the best leaders and the best management practices and support available, not to mention good working conditions that make people motivated and enthusiastic towards the work they should do. (Morrison et al. 2006, Thamhain 2004, Turner 2003, Waddell 2005)

3 MATRIX UNCOVERED

3.1 The Past

Matrix as a form of organization has existed since the 1960s (Galbraith 1971, 1977; Knight 1976; Davies & Lawrence 1978). Since that time matrix designs have been used a lot, especially in organizations that are involved with project work and are dealing with a fast paced and complex business environment. Originated in the American aerospace industry, matrix is currently found in all kinds of organizations. Matrix structures have spread most rapidly in organizations where people work on projects, such as research and development units, advertising agencies and management and consultancy, but they have also begun to appear in non-project settings like governmental units and hospital environments. (Knight 1976; Davis & Lawrence 1978; Ford & Randolph 1992; Morrison, Brown & Smit 2006) Coming to the present days, it seems that matrix is an evermore popular way to design organizations, although it is quite complex to manage. Interest in matrix organizational peaked during the 1970s and 1980s, but since that time the research and literature on matrix have dropped noticeably. At the same time, organizations continue to adopt matrix as a viable alternative to deal with their increasingly complex business as evidenced by its growing presence in a variety of industries. (Ford & Randolph 1992; Sy & D'Annunzio 2005)

Matrix organizations do not just happen, they are introduced for a reason. According to Knight (1976), the reasons given for their adoption seem to be of three kinds: 1) the historical background in the development of matrix structures in the American aerospace industry, 2) a set of analytic approaches to the new tasks and requirements facing complex organizations, and 3) associated with the latter, the more general desire to develop new organizational forms which satisfy the motivational and ideological criteria of those who criticize bureaucratic hierarchies. Knight (1976, 115) refers to D. R. Kingdon's Matrix Organization (1973) and describes how the development of matrix structures in the 1960's resulted from a fairly specific state of affairs. The fact that the American government made it a condition of consideration for research and development contracts that the contracting firms should have a "project management system" ensured that representatives of government agencies could work with a specific person, the project manager, with full

responsibility for meeting costs and deadlines over the project as a whole, rather than having to negotiate with a number of functional heads, each with only partial responsibility. In practice the condition could be met in one of two ways – by abandoning functional groupings and organizing entirely on a project basis, or by superimposing project management on the existing functional structure, thus creating a matrix.

3.2 The Present

Each form of organizational design has its own advantages and disadvantages. If, for example, the functional structure is adopted, projects fall behind; if project organization is chosen, technologies are less well-adopted. The matrix design attempts to gain the benefits of both forms. (Galbraith 1971, 29) By its simplest definition, the matrix is a grid-like organizational structure that allows a company to address multiple business dimensions using multiple command structures. One of the most common characteristics associated with the use of the terms matrix and project is the "mixed" or "overlay" organizational form in which traditional, vertical hierarchy is "overlayed by some form of lateral authority, influence, or communication". The vertical hierarchy is traditionally functional line organization and the horizontal "overlay" typically consists of projects, products, or business areas. Along these two dimensions, the matrix structure shows a second common characteristic; dual lines of authority, responsibility, and accountability that is against the traditional "one-boss" principle of management. (Galbraith 1971; Knight 1976; Ford & Randolph 1992; Sy & D'Annunzio 2005)

Davis & Lawrence (1978) summarize the essential characteristics of the matrix (Figure 4). The summary gives a good overview of the essence of the matrix structure. A theoretical analysis of the matrix organizational structure can be found in the literature and e.g. Ford & Randolph (1992, 275; 278) are putting together the advantages and disadvantages of the matrix structure. In their article on cross-functional organization forms, Ford & Randolph review and summarize the literature published since 1976 up to the early 90s. In the review, the listed key advantages of the matrix are the following: 1) Creates lateral communication channels that increase frequency of communication in the organization, 2) Increases amount of information the organization can handle, 3) Flexibility in the use of human and capital resources, 4) Increased individual motivation, job satisfaction, commitment and personal development, 5) Technical excellence is achieved

The identifying feature of a matrix is that some managers report to two bosses rather than to the traditional single boss: there is a dual rather than a single chain of command.

Companies tend to turn to matrix forms:

1. when it is absolutely essential that they be highly responsive to two sectors simultaneously, such as markets and technology;
2. when they face uncertainties that generate very high information processing requirements; and
3. when they must deal with strong constraints on financial and/or human resources

Matrix structures can help provide both flexibility and balanced decision making, but at the price of complexity.

A matrix organization is more than a matrix structure. It must be reinforced by matrix systems such as dual control and evaluation systems, by leaders who operate comfortably with lateral decision making, and by a culture that can negotiate open conflict and a balance of power.

In most matrix organizations there are dual command responsibilities assigned to functional departments (marketing, production, engineering, and so forth) and to product or market departments. The former are oriented to specialized in-house resources while the latter focus on outputs. Other matrices are split between area-based departments and either products or functions.

Every matrix contains three unique and critical roles: The top manager who heads up and balances the dual chains of command, the matrix bosses (functional, product, or area) who share subordinates, and the managers who report to two different matrix bosses. Each of these roles has its special requirements.

Aerospace companies were the first to adopt the matrix form, but now companies in many industries (chemical, banking, insurance, packaged goods, electronics, computer, and so forth) and different fields (hospitals, government, agencies, and professional organizations) are adapting different forms of the matrix.

Figure 4: What is a matrix? Davis & Lawrence (1978, 134)

more easily. The main disadvantages found were: 1) Violates single line of authority and authority equal to responsibility principles of organization, 2) Creates ambiguity over resources, technical issues, pay, and personnel assignments, 3) Creates organizational conflict between functional and project managers, 4) Creates conflict among individuals who must work together but have very different backgrounds and perspectives on work, time horizons, and goals, 5) Creates insecurity for functional managers and erodes their autonomy, 6) More costly for organizations in terms of overheads and staff, more meetings, delayed decisions, and information processing, 7) More costly for individuals in terms of role ambiguity, conflict and stress, 8) Slow response time to multinational issues. A similar account is found in a more recent article by Sy & D'Annunzio (2005) and presented in the Figure 5. As in these examples, there have been no significant changes in the matrix setting during the decades. One of the matrix's most basic advantages over the familiar functional or product structure is that it facilitates a rapid management response to changing market and technical requirements. However, in order to get the advantage, it is necessary to make the complex organization work – complexity is one of the biggest challenges to overcome.

STRENGTHS - MATRIX - WEAKNESSES	
•Leverages functional economies of scale while remaining small and task-focused •Focuses employees on multiple business goals •Facilitates innovative solutions to complex, technical problems •Improves employees' companywide focus through increased responsibility and decision making. •Allows for quick and easy transfer of resources. •Increases information flow through the creation of lateral communication channels •Enhances personal communication skills.	•Violates principle that authority should equal responsibility •Violates the principle that every subordinate should be assigned to a single boss. •Can create ambiguity and conflict. •Increases costs resulting from the need for additional management and administration. •Increases likelihood of resistance to change as employees may attribute the matrix with loss of status. Authority, and control over traditional domains.

Figure 5: Matrix strengths and weaknesses (Sy & D'Annunzio (2005, 40)

Galbraith describes the pure matrix organization with two distinguished features which differentiates it from the other cross-functional organization forms (Figure 6). First, the pure matrix has a dual authority relationship somewhere in the organization. Second, there is a power balance between the product management and functional sides. According to Galbraith (1971, 37) "equal power is an unachievable razor's edge". But a reasonable balance that is needed for solving the problems can be obtained through enforced collaboration on budgets, salaries, dual information and reporting systems, and dual authority relations.

To meet the demands of an increasingly complex global marketplace, companies must adopt equally complex organizational structures. In this kind of environment for most organizations, the matrix organization structure is a viable option, because it provides a blueprint to handle complexity. In other words, companies use complexity to battle complexity. (Sy & D'Annunzio 2005) Managers must be aware of the different kinds of matrix designs and develop some bases for choosing among them. If the business requires a rapid response to market changes and it is necessary to run several activities and develop different products or services in parallel for surviving in the competition, then there is a

need to go more towards the product oriented organization (Figure 6). If expertise is critical for a company to achieve competitive effectiveness, the functional form of organization is preferable. The greater the need for expertise, the greater is the force to move to the left towards functional organization. Galbraith (1971, 38-40) In Figure 7, Sy & D'Annunzio sum up the different forms of matrix - functional, balanced and project matrix. These forms summarize the different matrix alternatives described by Galbraith (Figure 6).
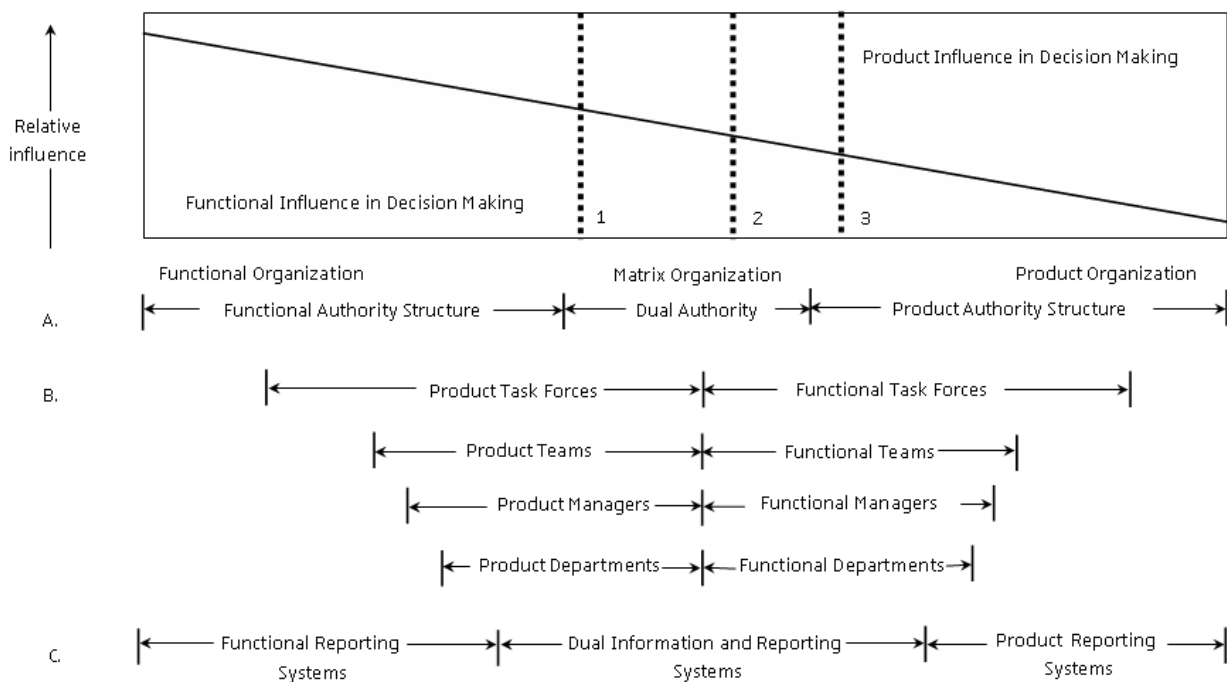

Figure 6: The Range of Alternatives, Galbraith (1971, 37)

The matrix seems to have many qualities that are necessary in managing global organizations. The matrix allows companies to leverage vast resources while staying small and task oriented. The matrix encourages innovation and fast action, and speeds information to those who know how to use it. Conversely, the matrix may be complex and unpredictable. It violates the traditional principles of authority, tending to breed ambiguity and conflict. The matrix also may require more managerial and administrative support at the time when companies appear to be cutting back. Matrix organizations are adopted for four primary reasons, as the matrix: 1) Allows companies to focus on multiple business goals. 2) Facilitates the management of information. 3) Enables companies to establish

economies of scale. 4) Speeds up response to environmental demands. (Sy & D'Annunzio 2005)
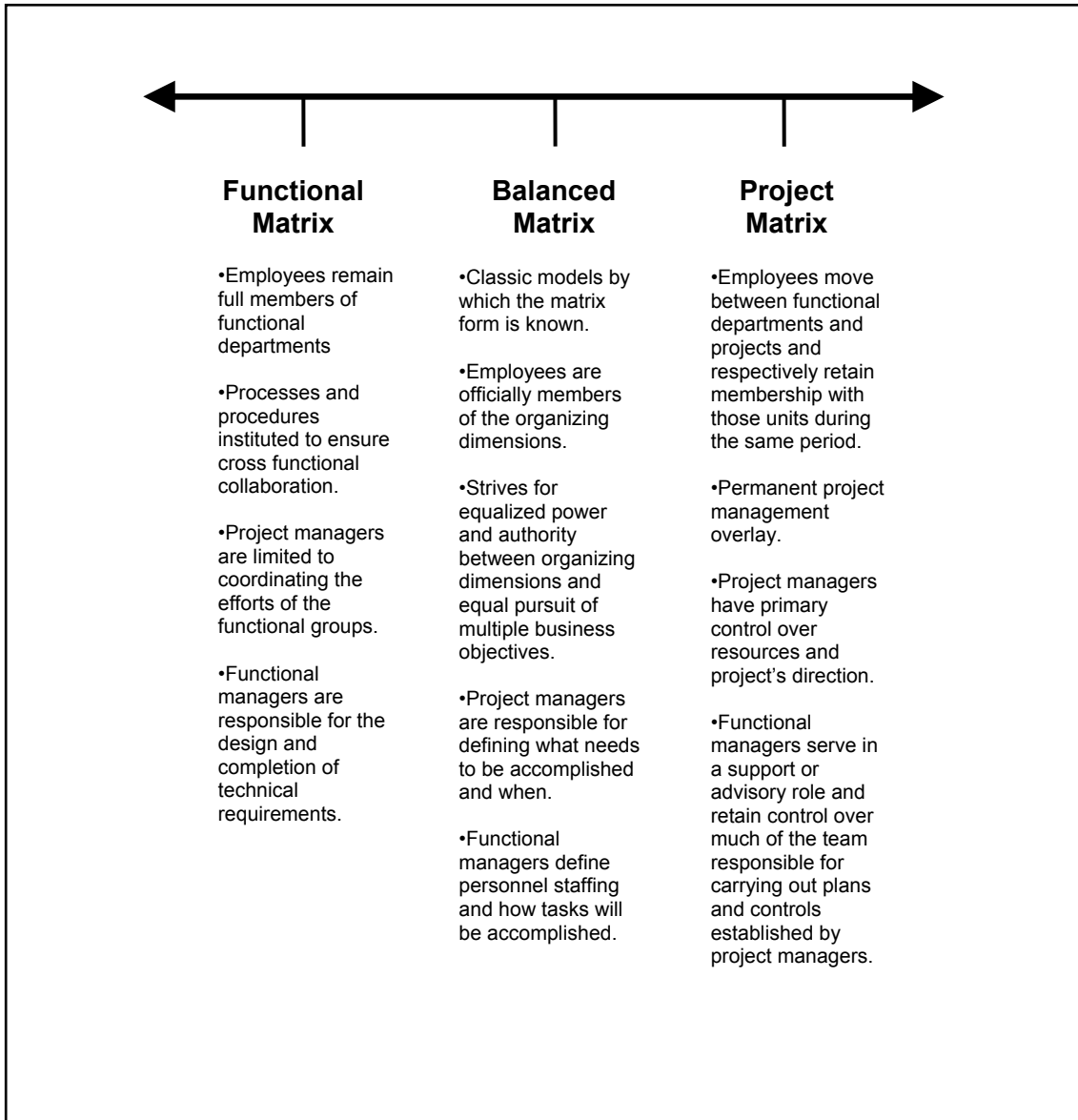

Figure 7 : Matrix Forms, Sy & D'Annunzio (2005, 40)

Despite of the popularity of matrix organization forms, there is still not too much empirical research available. To take some examples, in the late 70's Davis & Lawrence (1978) identified nine problems that they found especially in matrix organizations, "nine pathologies" as they call these factors:

1. Tendencies toward anarchy: A formless state of confusion where people do not recognize a "boss" to whom they feel responsible

2. Power struggles: Managers jockey for power in many organizations but a matrix design almost encourages them to do so.

3. Severe groupitis: The mistake that matrix management is the same as group decision making

4. Collapse during economic crunch: When business declines, the matrix becomes the scapegoat for poor management and is discarded

5. Excessive overhead: The fear of high costs associated with a matrix

6. Sinking to lower levels: The matrix has some difficulty in staying alive at high levels of corporation, and a corresponding tendency to sink to group and division levels where it thrives

7. Uncontrolled layering: Matrices which lie within matrices which lie in matrices result frequently from the dynamics of power rather than the logic of design

8. Navel gazing: Managers in a matrix can succumb to excessive internal preoccupation and lose touch with the marketplace

9. Decision strangulation: Too much democracy, not enough action?

A more recent study by Sy & D'Annunzio (2005) used surveys, interviews, and workshops with 294 top-level and mid-level managers from seven major multinational corporations in six industries. They have identified the top five challenges of the matrix organizational form. This study identifies the same kind of problems as Davis & Lawrence earlier. It seems that over the years, there has not been much progress in making the matrix organization work better.

In Sy & D'Annunzio's study, the first challenge listed is *misaligned goals.* Overall, the participants of the study identified the following difficulties in goal alignment: competing or conflicting objectives between matrix dimensions, inadequate process to align goals and detect possible misalignments, lack of synchronization, coordination, and poor timing of work plans and objectives, insufficient communication and consultation between matrix dimensions. The second challenge found was *unclear roles and responsibilities.* Generally, the following issues were found concerning unclear roles and responsibilities: unclear job descriptions and guidelines for roles and responsibilities, ambiguous roles and responsibilities creating tension among employees, confusion over who is the boss, not

knowing whom to contact for information. The third challenge identified was *ambiguous authority*. Overall, participants report the following concerning ambiguous authority: confusion over who has the final authority, lack of clarity on areas of accountability, leaders unaccustomed to sharing decision rights, delay in the decision making process. The fourth challenge found was *a lack of a matrix guardian*. Although few studies discuss the importance of monitoring matrix performance, it was indicated that the matrix guardian is critical for matrix performance. The matrix guardian should be in a position of influence and well-respected within the organization. This person works as an overseer, identifying best practices and disseminating those throughout the company. The key issues associated with the matrix guardian are: lack of consequences and rewards for matrix performance that fails to motivate employees to make the matrix work, establishing a monitoring process to detect and identify matrix performance problems (because employees are reluctant to divulge problems associated with their units), ensuring that the matrix guardian has senior level support and authority to take action, preserving the objectivity of the matrix guardian and preventing undue political pressure. The fifth challenge named by Sy & D'Annunzio is *silo-focused employees*. Employee behavior is perhaps the most critical challenge that matrix organizations face. – Managers agree that silo-focused employees impede matrix performance. Overall participants report the following issues relating to this challenge: personal conflicts between leaders impede collaboration between units, withholding resources from others, lack of trust between employees in different business units, insufficient communication between different business units.

3.3 … and the Future?

Davis & Lawrence (1978) believed that in the future, matrix organization would become almost commonplace and that managers would speak less of the difficulties and problems of the matrix than of its advantages and benefits. Despite the fact that today matrix organization is a widespread and commonly used organization form, the problems seem to persist. In the late 70's Davis & Lawrence thought that matrix is becoming less and less experimental and more and more a mature formulation in organization design. They anticipated that as more organizations go through the learning curve, the curve itself becomes easier. Similarly they thought that as more managers gain experience of operating in matrix organizations, they spread this experience as some of them move, as they inevitably will, into other organizations. According to Sy & D'Annunzio (2005), it seems

that in the 21st century, people have still not conquered matrix and its major challenges. They conclude their article by saying that according to their findings, people need training targeted at specific matrix challenges relevant to their organization level. They state that their study reveals a potentially damaging gap in employee training, because a large proportion of employees seem to lack the required knowledge and skills to operate in a matrix structure. Could it be that after decades of matrix organizations, we have not learned the essential fact – training is needed to be able to operate in the complex environment? Or is each matrix organization so special that no previous best practices and lessons learned can be used? Or is the environment, where we need to work and manage different things, changing so fast that whatever organization design is chosen for people to operate in, it becomes outdated before the organization is mature enough to deliver the results that it was designed to deliver in the first place?

Most of the research and literature concentrates on describing the positive and negative aspects, advantages and challenges and especially identifying the challenges. Most of the articles consulted pay much attention to finding the potential problems in the matrix. This is not necessarily a bad thing, except no real cure has been found over the decades. What if instead of diagnosing and treating problems, the concentration were on promoting positive matters and keeping the organization on track? Would it be possible to take action before the worst symptoms have appeared, taking preventive actions in advance and making sure that the organization is working successfully, despite some inevitable challenges? There is admittedly a lot of research and literature on the challenges and pitfalls of the matrix organization, but when all the organizations are different from each other, a product in a specific context, it is quite difficult to benefit from previous experiences and studies and try to avoid challenges and setbacks. Of course, the knowledge of the challenges and disadvantages of the matrix could be used to pre-empt the worst case scenarios. One way to conquer the challenges could be to find ways of enhancing the strengths, and especially, to pay attention to the people, environment and culture in which the people are to operate, if it is they and not necessarily the structure that make the difference and determines whether the organization is successful or less successful.

4 THE CASE

4.1 What is the Study About?

The subject in my study is an R&D organization that is a part of a global high-technology company. When the study was initiated in spring 2005, this organization had recently gone through organizational and operational mode changes, including renewed processes and new tools for resource and project management. The biggest organizational change was the matrix design of the organization (Figure 8). In this setting, the functional line-organization is organized in five departments called laboratories. The laboratories take care of the resource management, competence building and longer term technology exploration. The other dimension of the matrix is called strategic focus areas (later SFAs). There are three SFAs each running several strategic programs, using the cross-laboratory resources to complete the strategic research work in the short and medium term timeframe. The programs are run by program managers who have a line-manager in the laboratory dimension, but they are reporting the program work related matters in the SFA dimension. The matrix organization is complex and challenging to manage and in this case the more complexity is added with the global network, with personnel working in different countries. Each laboratory has site offices in many countries and SFA programs also utilize expertise from around the world. The country specific management issues and cultural differences add further challenges in managing the matrix. The organization charts are drawn in matrix form on a higher level, but on program level the arrangement is more like a network of virtual teams working to accomplish the program goals.

In my thesis I seek to describe the functionality of the matrix organization structure from the program manager's point of view. Program managers are the key contributors in the matrix organization and they were asked how things were and what should be changed to improve the functionality of the organization and get better results from the programs. The assumption is that there are plenty of challenges arising from the multi-dimensional organization, but that there are also some positive aspects to be found in the current way of working. The purpose of the study is to benefit the organization by describing and explaining the current situation and also giving some ideas and suggestions for future planning and change in the organization. In other words, the aim is to describe, and clarify the organizational setting in the case organization and to suggest some improvements and potential changes that would enhance the positive and diminish the negative issues in the

organization. The main goal is to help the decision makers to find ways to improve the organization, so that the programs could deliver best-of-class research results, being fast, innovative, as well as efficient, despite the turbulence and continuous change in the environment in which the people need to operate.
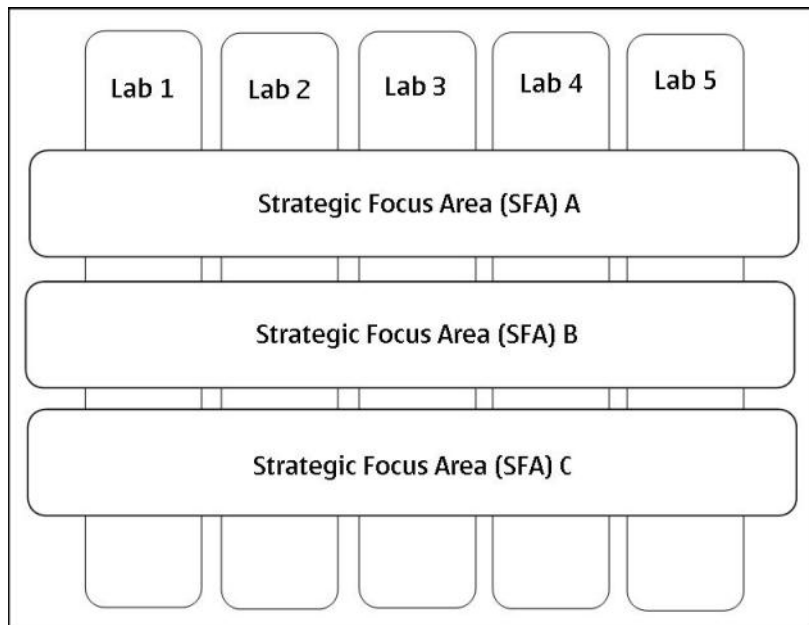

Figure 8. The matrix in the case organization. Laboratories on the vertical dimension representing the functional/line organization, Strategic Focus Areas in horizontal dimension representing the program organization.

One important question asked in the study is: What are the advantages and disadvantages of a matrix type of organization in research environment? This must be resolved otherwise it will be difficult to direct the improvement efforts to the right and necessary targets. Moreover by asking this question, it is possible to compare the answers with the knowledge gained from earlier studies and what is stated in the literature. It is useful to see whether the opinions in this specific organization match the knowledge generated over the decades. Other questions that are related to the main questions and which are important to take into account when evaluating the current organization are the following. "What are the role and the position of a program manager in the matrix organization?" The core of SFA dimension performance and efficiency is the management of the programs. Program

managers have an important role in planning, running and delivering the results of the strategic programs and in order to succeed, they need to have certain qualities and skills and support available for managerial and administrative tasks. It is advisable to understand what the program managers themselves think about their role in the organization and about the support they get. Another interesting question is whether the matrix design is the right one for organizing research activities and managing research programs. This can be discussed by reflecting the study results against the literature and research done earlier in the area.

4.2 The Choices for Conducting the Study

My choice here is to conduct a case study. The target group can be called a bounded system, a selected group of program managers in the research organization of a high technology company. 'Bounded system' is "a particular instance or entity that can be defined by identifiable boundaries" (O'Leary, 2004). This kind of 'bounded system study' is often called a case study. Case study is chosen because the target group is fairly small (30 possible respondents) and the aim is not to make any generalization, but to describe and evaluate the current state in this specific organization.

This case study follows action research strategy as described in Burns (2000, 443): "Action research is the application of fact-finding to practical problem solving in a social situation with a view to improving the quality of action within it, involving the collaboration and cooperation of researched, practitioners and laymen. Action research is "A research strategy that pursues action and knowledge in an integrated fashion through a cyclical and participatory process. In action research, process, outcome, and application are inextricably linked" (O'Leary 2004, 139).

According to Burns, action research "aims to improve practical judgment in concrete situations" and "is a total process in which a 'problem situation' is diagnosed, remedial action planned and implemented, and its effects monitored, if improvements are to get underway." The theories generated by action research are validated through practice, not by using scientific test of truth. The usefulness of theories generated by action research is that these theories help people to function more intelligently and skillfully in the specific context in which the action research is conducted. The focus in action research is on a

specific problem in a defined context, and not on obtaining generalized scientific knowledge. Action research is an "on-the-spot procedure designed to deal with a concrete problem". (Burns 2000, 443-444)

I find action research as described above very useful as a research strategy in this particular case study. In the case organization of this study, it is evident that there are some problems and challenges that need to be uncovered and documented in order to point out the issues that need to be taken into account while making the new changes in the organization or in the ways of working. And conversely – it is useful to ascertain what is considered as strengths and good things in the organization and ways of working. For an organization operating in the field of high technology and future research, continuous change is a necessity, not an option, and the only thing that can be taken for granted is change. The best way to identify the key issues to be improved in this specific organization is to ask the questions of the key persons who are working in that organization and facing the challenges.

O'Leary (2004) and also Burns (2000) describe some basic characteristics that define the process and procedures of action research. Action research is situational, collaborative, participatory and self-evaluative and addresses practical problems, generates knowledge and enacts change. The term "action research" was coined by the social psychologist Kurt Lewin in the 1940's. Action research is a cyclical process and in Lewin's model there are two major steps defined by Burns (2000, 444) as: 1) Diagnostic – problems are analyzed and hypotheses developed. 2) Therapeutic – hypotheses are tested by consciously directed change experiment in a real social situation. O'Leary describes the action research cycle with simple four steps: observe – reflect – plan – act. After each cycle the process continues from the beginning, using the knowledge of the previous cycle as a starting point. Action research can be seen as an experimental learning approach to change. The goal is to continuously refine methods, data, and interpretation in the light of the understanding developed in previous cycles. The cycles themselves can be defined in numerous ways and, in fact, are often defined through collaborative decision-making. However, decisions generally involve some variation on observation, reflection, planning, and action. (O'Leary 2004, 140)

Burns (2000, 445-449), after mentioning the two major steps of cyclical process, divides the research cycle into seven more detailed substages that can be seen an extended version of O'Leary's cycles:

1. Identification, evaluation and formulation of the problem or general idea perceived as critical in everyday situation.
2. Time for fact finding, so that a full description of the situation can be given.
3. Possible review of the research literature to find out what can be learned from comparable studies, their objectives, procedures and problems encountered.
4. Having, through 'brainstorming' around the problem, generated some hypotheses, one can then proceed to gather information which is relevant to testing them.
5. Deciding on the selection of research procedures such as choice of materials, resources, teaching method, allocation of tasks.
6. Implementation of the action plan.
7. The final stage involves the interpretation of the data and the overall evaluation of the project, often by writing a case study.

In my study, I can find the research cycle of observing, reflecting, planning and acting in each of the steps described above. Of the seven steps mentioned, my study includes steps 1 to 4, leaving steps 5 and 6 to the future decision making. After step 4, in this case, is a place for putting together an interim report of the survey results after which it remains for the organization, if it is taking the actions forward, to complete steps 5 and 6. The final report is this thesis, including some reflections on the actions taken in the organization after the interim report was completed. Two years elapsed between the data collection and summary report and completion of the thesis and during that time there have indeed been changes in the case organization.

At first I have identified the general idea that is the subject of my study: the organization design for the research organization and, more specifically, program management in a matrix organization. I opted for this subject after considering various topics related to management in the research organization. The choice was made after reading some material related to the issue, observing the environment and actions in the organization in question and assessing what would be valuable information to be revealed and what could be used in benefiting the organization itself in the continuous change process. As a second

step, in spring 2005, I collected information to determine the current status of the case organization by interviewing some people who are involved with research work within the organization. The interviews enabled the generation of some categories for classifying the various matters related to the subject. The third step was to read relevant literature on project/program management, organization design and matrix organization. Comparing and adding up the interview results and the material found in the literature gave some perspectives for pre-hypotheses, general statements attempting to explain some of the facts of the problem and giving the basis for step four, which in my case is to conduct a small survey among the program managers involved in management tasks in the organization. The survey was conducted in summer 2005.

While planning the study involving the program managers, I considered two methods: interview and survey. I chose the survey, because it would yield responses from all target group people with no need to select specific respondents. Responding to the survey was voluntary and a self-administered survey offers respondents anonymity and confidentiality and a choice of response time. The potential respondents are located in different locations in Finland and also in other countries, so the self-administered survey gives flexibility for answering the questions and also saves the researcher's time. The response rate may be low, but the qualitative survey is useful in this case. The open-ended questions ask respondents to construct answers using their own words and they can offer any information or express any opinion they wish, thereby generating rich and candid data (O'Leary 2004, 159). The space provided for answers may limit the responses compared with interview, but the need for space should be anticipated. When the questionnaire is in the web-pages, it is easy to leave ample answering space. Qualitative survey data is more difficult to code and analyze than quantitative responses, but the same holds true of interview data. I realized small number of responses, but relied on the good quality of the answers.

The framework of my survey is built on pre-interviews with six people involved with program work. One of the interviewees is a program manager, but the other five interviewees represent management, program members and line organization. The questions asked concern the role and the job of a program manager and the program management in the case organization in general as well as the current organization model and its suitability for the research work. The aim of the interviews was to elicit different

perspectives on the subject, how the different people see the current state of program management, the program organization and the program managers' role in the case organization. The interviews were recorded in audio format with an mp3 recorder and some notes were also taken during the interview sessions. Each interview took about 30-40 minutes. The interviews were analyzed using Excel table where the answers were transcribed for analysis.

The pre-interviews initially conducted to obtain relevant and reliable background information and also to confirm the understanding of the situation in the organization were first loosely coded into themes, issues and topics arising from the discussions, which were quite free, only some themes being to guide the sessions (Appendix 1). Then the frame and the questions of the survey questionnaire were created based on the interview categorization. The questionnaire is a mixture of closed questions (answers yes/no, selecting a response of some available alternatives and filling in blanks) and open-ended questions (Appendix 2). Closed questions are mainly a means to elicit background information and were also used in other survey questions. Most of the questions were open questions, aiming at the rich content of the answers. The resulting questionnaire includes a set of questions related to program management issues in the case organization and to the organization itself. The questions elicit the program managers' opinions and experiences of their work and role in the organization, about the organization itself, program management issues, communication issues, process related issues and support issues. My intention was to classify the answers under the categories used in the questionnaire and then search for the similarities and differences etc. in the material, and later create hypotheses and explain the matters. The material from the pre-interviews can also be used in triangulation, comparing the answers of the program manager questionnaire with the results of the interviews with non-program managers. The analysis that proceeds from pre-interviews to the status analysis is described in Figure 9.
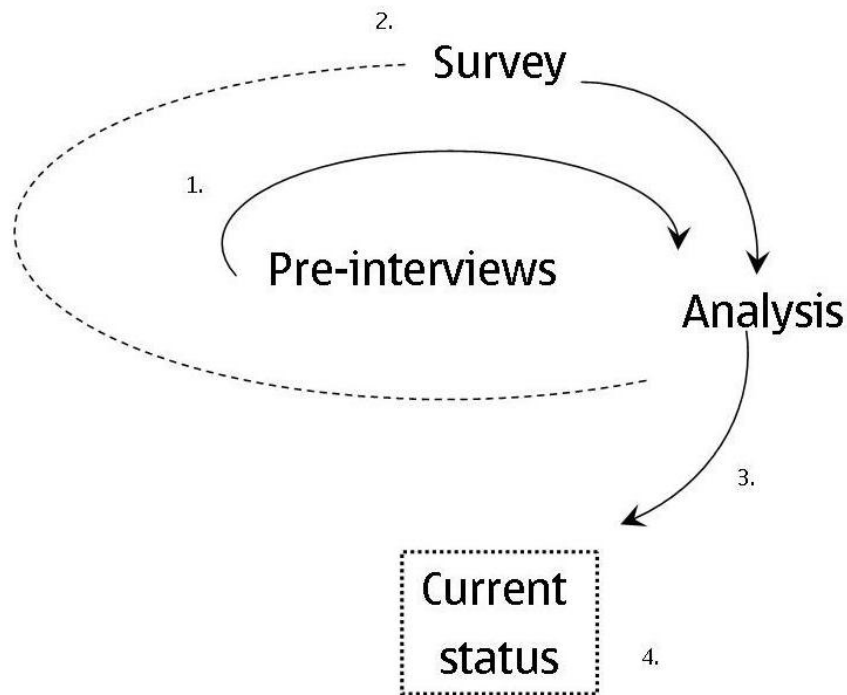
Figure 9: Analysis by cycles.

As noted, the questionnaire is qualitative (open-ended questions, structured questions related to certain themes) and was completed as an electronic questionnaire in the company's intranet. The questionnaire was composed in English and the responses were given in English, which is the official company language in the case organization. The first version of the questionnaire was planned and created based on the interview material. The draft questions were sent to certain individuals for comment and based on the comments the next version was created. The questionnaire was set up in the intranet pages and the answers were collected in a database. The electronic questionnaire was tested by four people before being sent out and some minor changes were made based on the comments. The respondents received the information and the link to the questionnaire by e-mail.

Content analysis was used to evaluate the qualitative data. Content analysis needs a coding system related to the theoretical framework or research question. Content analysis is used for identifying themes, concepts and meaning and is a form of classifying content. The elements can be counted in numerical terms and also be examined for meaning. When looking at the meanings, the problem is the hidden meanings necessitating reading between the lines. In many cases, content analysis is more an art than a science. The

process of category generation involves noting regularities and recurring ideas/themes in the setting, or people chosen for the study. The categories may be generated by the people in the setting as they perceive their environment, or may be constructed by the observer or interviewer. As categories and patterns become evident in the data, the researcher can then start to evaluate the credibility of emerging hypotheses and test them against further data. This includes attempts to challenge the hypotheses by seeking further positive instances and disconfirming instances. The apparent pattern must be challenged. Other convincing explanations always exist, and the researcher must demonstrate how and why their explanation is the most credible of all. (Burns 2000, 432-434)

In my study, qualitative research is chosen because it enables results with more substance. Qualitative research is also more suitable than quantitative research when the target group is fairly small and generalization of the results is not the aim. The aim is to get as spontaneous and genuine answers as possible and in this case, when the number of respondents is fairly small, open questions are more likely to yield more input and more substance to be analyzed. If the questionnaire was a quantitative form with a set of questions that are answered by numerical scales, the questions would be very difficult to formulate. There is a danger that the researcher does not succeed in asking the right questions and the answers do not yield valid and reliable data. If the questions were ready formulated and answered with e.g. a Likert-type of scale of 1 to 5, there is a chance that the questions may not be understood correctly, or the researcher may not have posed the right questions at all. In quantitative research the response rate should also be high to permit the drawing of conclusions, especially when the target group is fairly small. If the quantitative method is used in this specific case the likelihood of lame results is greater than with qualitative methods; in this case interviews and a qualitative questionnaire.

In a case study using qualitative research methods and a small number of people as a test group (sometimes a case itself is just one person), reliability and validity are more difficult to establish than in pure quantitative research. In quantitative research there are certain tests that can be used to measure the reliability, but in qualitative research there are not so many ways to do the testing. One way of checking whether the data is reliable and valid, is triangulation. The research results can be evaluated by comparing data gathered from different sources. However, action research can really only possess internal validity, as it is a one-off intervention in a specific context. The result, findings and recommendations can

only have relevance for that unique setting. Replication of the study is doubtful, as change is an integral part of the process. Internal validity can be claimed if it is demonstrated that changes have occurred based on the problem situation analysis and the action taken to improve the situation. Both the analysis of the problem situation and the evaluation of the steps undertaken for improvement are needed in action research. Case study results can be judged to be externally valid if the insights contained can be generalized beyond the situation(s) studied. External validity can be claimed, if the readers of an action research case study can identify themselves with the situation described, gain fresh insights into their own problems and test the study results by action. If the insights gained from a case study can be translated into an improved quality of action in some other setting, then it may also be possible to demonstrate external validity. (Burns 2000, 450-451)

Internal validity is also the goal in this study. A unique organization and the action within that organization are studied in order to ascertain the current state in terms of functionality and in order to make suggestions about the possibilities for action and to improve the functionality. If the results of the study can also benefit others facing a similar situation, it would be positive and suggest that the situation faced by the case organization can be generalized and that the proposals for improvement could also be used more widely than only in the case organization. Reliability of the data and results will be demonstrated by finding evident categories and patterns in the content analysis, when it can be said that the results do not rely on a few comments, but on the common understanding among respondents. Triangulation is also used to verify the reliability. There are numerous articles and literature on the subject and the material can be used for this purpose, likewise the pre-interviews conducted before the actual survey. Some company confidential material is also available for use in triangulation (e.g. employee satisfaction surveys).

5 PROGRAM MANAGEMENT IN A MATRIX ORGANIZATION

5.1 Foreword

In the summary report of the survey compiled at the end of the year 2005, the emphasis was on describing the current status and summarizing the feelings, comments and opinions responded by the program managers. There was little, if any, analysis of the improvements that could be done or suggestions as to how to proceed with planning the future change. The summary report was essentially more plain input information than a clear plan for further steps. The summary was intended to give more detailed information of the status of SFA program management for the people in charge of the program dimension and other people in charge of organizational development and change initiatives. Going through the summary report, it is easy to see the current state of the program managers and the program management in the SFA dimension at that time, and in that sense the report served its purpose. Going forward in time, the changes in the organization did take place, not because of the program manager survey, but because of the need to have a more agile organization structure to deliver the research results faster and more efficiently.

I have divided the analysis of the study into two separate parts. Part One (Chapter 5.2) consists of the analysis of the current state described in the responses collected from the program managers. In this part, I report of survey results, including basic information about the research and the contents of the summary report delivered at the end of 2005. To follow the spirit of action research strategy, in Part Two (Chapter 5.3) I extend the analysis by taking an approach where the results of the survey and also the pre-interview material, are used to analyze the organization's supportiveness of the program management (Figure 10). In this analysis I use the framework of proposed dimensions of project management supportive organizational culture (Morrison et. al 2006). In this part I ascertain the state of the organizational culture and its supportiveness of program management in the case organization at the time when the survey was done. In Chapter 5.4 I'll present a concluding account of the current organization and present some ideas and proposals on how to go forward with the knowledge gained from the matrix experience in the case organization.
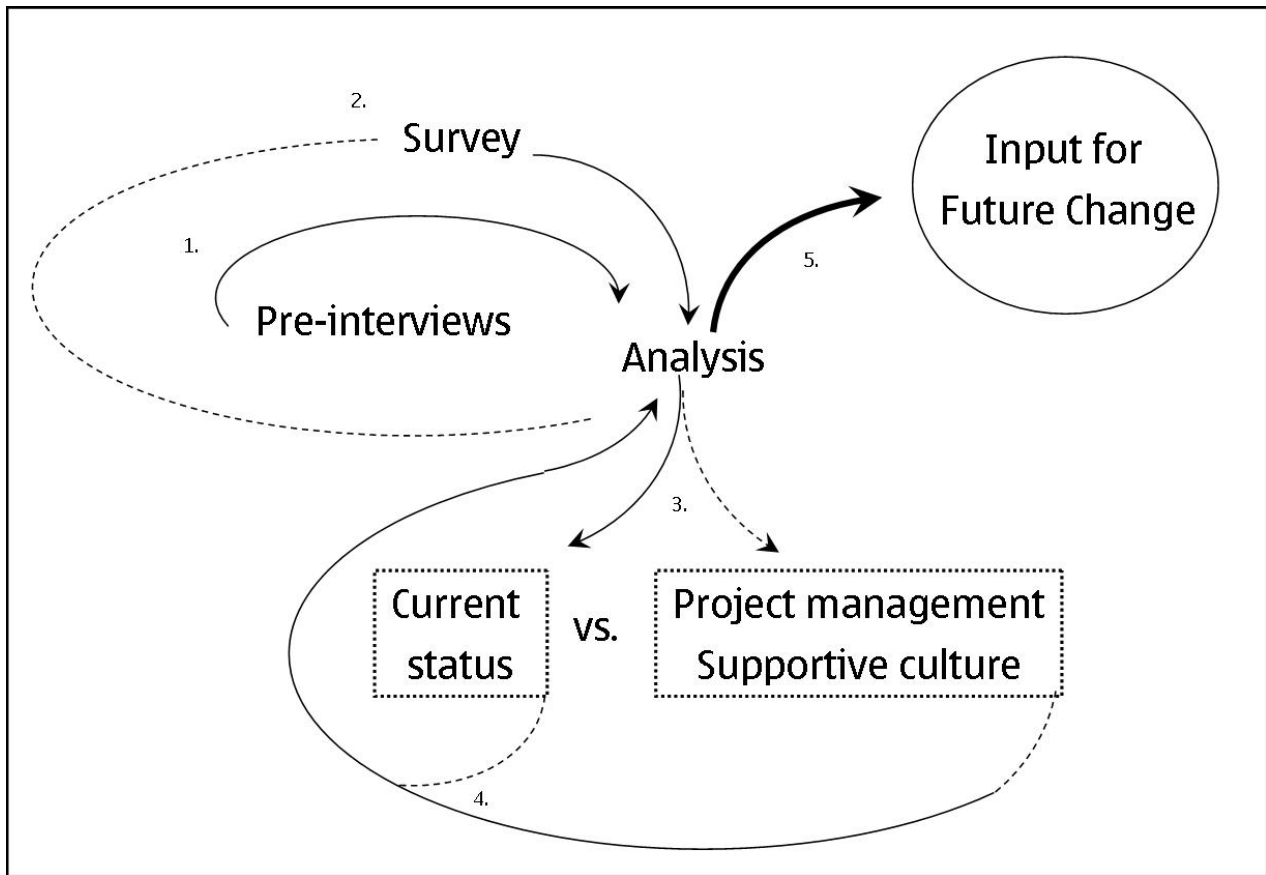
Figure 10: Analysis by cycles – extended version

5.2 Results of the Case Study - Part One

After collecting the survey responses the data was put together and summarized. This part of the analysis was also the interim report of the survey that was delivered to some of the decision makers in the organization. The survey responses were first consolidated in the database from which the data was summarized to background information and then the responses were combined question by question. The areas of the questions asked are the following: program manager's job and role, program management in matrix organization, responsibilities and communication in program environment, processes, tools and support for SFA work. Some of the questions ask the respondents to name at least three things that s/he sees to be relevant to the matter, e.g. question 9: "Mention at least 3 most important tasks in a program manager's work". Some of the questions elicit the opinion on matters discussed, e.g. question 12: "How do you manage the tasks that you have listed as the most important?" The questionnaire is appended (Appendix 2). The answers are categorized under different themes using Excel tables and counting the frequency and the similarities

of the answers and looking for the formation of patterns. The written comments were also added to the summary report.

5.2.1 Background Information about the Organization and the Respondents

Of the 30 SFA Program Managers 12 (40%) responded to the questionnaire in summer 2005. The response rate could have been higher, but in this case, the answers are of good quality and when summarizing the data, it shows that there are enough responses to capture the essential message out of the data. The questionnaire is constructed mostly of qualitative questions and due to a small amount of answers and qualitative data, the results cannot be generalized or have any external validity as such. That is not essential in a case study and the aim is to report the case specific findings only. The summary report is a collection of the opinions and experiences of a certain group of people, at a certain time and in a certain context. The report should be handled more like documentation reflecting the current state among the group in question, not as certain facts that apply to the whole organization. The information can be used as background information material for organizational development as well as for job evaluation and development within the organization.

The responses reflect the time when the matrix organization (Figure 11) consisting of vertical line organization (laboratories) and horizontal program organization (strategic focus areas, SFAs) had been operational for a year. Each laboratory consisted of several competence areas, led by a competence area manager, who reported to the head of laboratory. Each SFA consisted of some 10 programs each, led by a program manager, who reported to the head of SFA on the program dimension and the head of laboratory on the line dimension. Thus the program manager had a two-boss situation, as did the program staff, who reported to the program manager and the competence manager in the line organization. The competence area manager was responsible for the staff in terms of personnel matters and the competence development of their teams. The heads of laboratories and the SFA heads reported to the head of the whole organization. The project work was done on both dimensions. SFAs were responsible for carrying out the bigger strategically important programs focusing on specific strategic areas. The longer term technology exploration and smaller short term development projects were done in laboratories. One more organizational dimension was the globally distributed competence

areas. The laboratories had units in different countries, some having the whole competence area in one specific country, with a local competence area manager. But there were also competence areas which had staff at different locations and the manager could only be located in one place, therefore some competence areas had also the staff distributed in different locations. The same situation also applied to the project work. Most of the SFA programs had staff from different locations, thus the teams were virtual teams, which added to the challenges of program management.

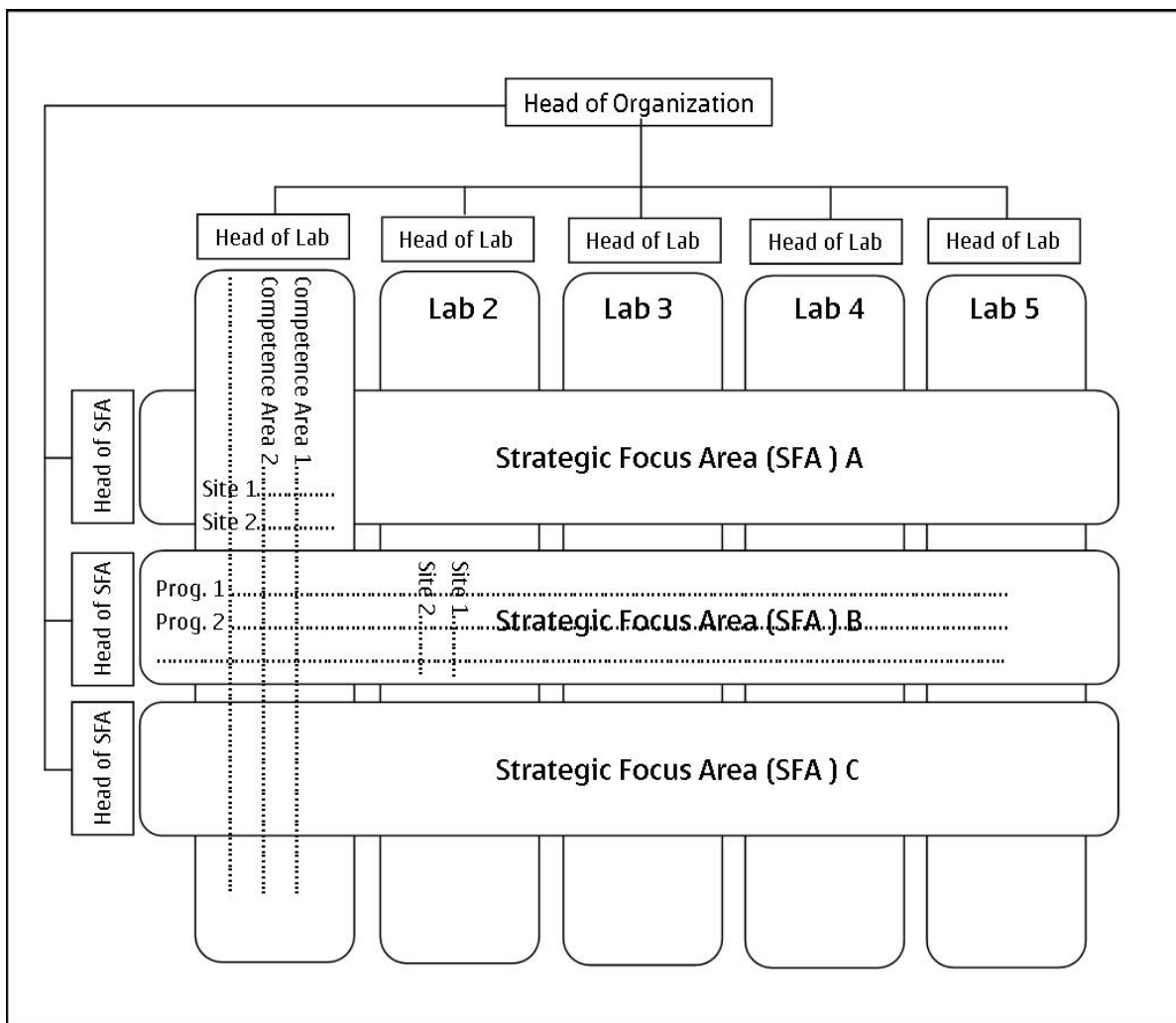Figure 11: The matrix in the case organization – division in competence areas, sites and programs create a multi-dimensional organization and adds in more complexity

Among the respondents, there were people from all three SFAs, also people of different nationalities and both genders represented, but these factors are not deemed significant in this interpretation of the results. More important is the fact that all program managers

were running programs with activities in more than one country, thus all programs were multi-site programs. Moreover, all the program managers had an academic background, a master's degree or higher. Some program managers also had two degrees in two different subjects. Most of the program managers reported having managerial experience prior to the program manager position. The programs which these program managers were running represent the different program categories and also the different program size ranges. A typical program manger responding to the questionnaire was under 35 years old and had worked between 5 and 10 years for the company. Comparing the background information of the respondents to the statistics of all the SFA program managers in the organization at the time of the survey, it can be said that the sample group responding to the questionnaire reflected the composition of the actual group of the program managers with regard to the distribution of SFA, nationality, gender, program sizes and structures, education, and experience. In that sense, it can be stated that in general the study represents the SFA program managers in the case organization. (The statistics are company confidential, thus the information cannot be added as an appendix.)

5.2.2 Program Manager's Job and Role

The program managers were asked to list the tasks, skills and competences, as well as the personal characteristics deemed important for a program manager. The summary (Table 1) shows that the most important task is to manage the program team. Almost as important is to take care of the administrative work and the task ranked third in the task list is networking. Matters pertaining to tasks related to technical expertise and vision work (strategies and future plans) were found in the responses, but less frequently than the three highest ranked.

In the list of required skills and competencies (Table 1) of a program manger, the highest score was in administrative and management skills. In second place two competences were ranked equally - networking skills and technical competence. In third place were people management skills. Skills in communication and presentation area were also found important, likewise competence related to the field of strategy, vision and innovation. Change as an element of today's business world and challenges that the change in organizations causes is also found in the answers, implying a need for skills to handle the change in the organization. Regarding personal characteristics (Table 1), a program

manager should above all have leadership and management qualities. Almost as importantly as being characterized as a qualified leader and manager, the Program Manager should be passionate and inspirational. Openness and practicality were highly valued. Regarding personal characteristics the element of change emerged slightly more clearly than in the skills question. Qualities related to change, and especially a person being change tolerant, are found in the responses. Certain amount of toughness should also characterize a program manager, likewise natural interest in research and technology was mentioned.

Mention at least 3 most important tasks in Program Manager's work.			
1	Managing the team	Coordination and Guidance (9), information shareing/interacting (4), people management, involving Project Managers, internal marketing, removing distraction	17
2	Administrative tasks	Planning (6), follow-up (4), administration/bureaucracy (3), budget & funding	14
3	Networking	Networking/interfacing with customers (7), Nerworking/interfacing with other stakeholders (2)	9
4	Technical expertise related tasks	Technical work/leadership (4), Technology transfer	5
5	Vision work	Vision work (2)	2

Mention 3 to 5 skills and competencies that you consider important for a Program Manager			
1	Adminsitrative and Management skills	Administrative& management skills (5), prioritization skills (3), decision making (2), problem solving (2)	12
2	Networking skills	Networking skills (8)	8
2	Technical competence	Technical competence and vision (7), experience	8
3	People management skills	People skills (3), mentoring, easy to approach, leadership, team work skills	7
4	Communication & Presentation skills	Communication and presentation skills (5)	5
4	Strategy, vision & innovation skills	Strategic undersdtanding (2), visionary skills, innovative, passionate about the own field	5
5	Change	Fexibility towards new challenges, change management	2

Mention 3 to 5 personal characteristics that you consider important for a Program Manager			
1	Leadership and management qualities	Leadership (3), friendly/service oriented (2), couching, mentor, guiding, encouraging, facilitator, listening, diplomatic, street credibility, ability to mediate confrontation	14
2	Passionate and inspirational	Passionate (6), creative (2), inspireing/magnetic, idealist, active	11
3	Openness/communicative	Openminded/openness (2), Communicative (2), Straightforward (2), honest	7
3	Practical	realistic (3), interest in details , timely, accurate, pragmatic	7
4	Change tolerant	flexibility (3), multitasking, perseverance, patience	6
5	Tough	demanding, decisive, consistent	3
5	Technology oritented	Interest in research/technology	3

Table 1. The most important tasks, skills and competencies, and personal characteristics of a program manager.

The overall picture of the program manager and program management in the case organization can be seen by looking at the summary of tasks, skills and competences, and personality. The picture goes hand in hand with the descriptions found in the literature. Comparing the summary (Table 1) to Thamhain (2004) on effective team leadership, suggests that in the case organization the needs and requirements of the 21st century's program management have been recognized and understood among the program managers. Thamhain points out that in today's technology-based team environments there is an increased emphasis on the human side of project management. Thamhain mentions project management, but the same rules apply to the program management, which according to Waddell (2005), in many cases is an extended version of project management.

In project management and program management, it is not enough to be merely an expert in the technical area. Nor is it enough to master only the administrative tasks. In order to effectively and efficiently realize the goals set for the projects, project leaders must build and manage fast, flexible project teams that can dynamically and creatively work toward planned targets in a changing environment. This approach requires effective networking and cooperation among the individuals involved in the project, as indicated in the survey results. In additional to project team members and peers in other project teams, the people from the different organizations, support groups, subcontractors, vendors, government agencies, and customer communities also need to be taken into account in communication and delivering first class results. Teams need to be led by managers with carefully developed skills in leadership, administration, organization, and technical expertise, not to forget the inspiring and passionate attitude towards the team's area of expertise. (Thamhain, 2004) All these appear in the program managers responses to the questions about the program manager's job and role in the case organization.

The program managers in the case organization also felt that they were managing the tasks listed most important fairly well. Regarding how the program managers saw their own skills, competences and personality matching the requirements they themselves listed as important, it emerged that there is a fairly good match, but they also reported room for improvement, for example in communication and interaction with the multi-site teams, boosting enthusiasm among the team members and being a mentor. It was also mentioned that being a program manager on SFA dimension causes some alienation from program work on grassroots level and related to that, there should be also some time to update

technical competence. The responses reflect the program managers' confidence in their own managerial ability and skills, and also willingness to address certain weaknesses they reported in managing their tasks, likewise in their personal skills and competencies.

Regarding motivation and commitment to the program manager's job, over half of the respondents (7) reported strong motivation and commitment. In the comments, it is said that the position of a program manager is interesting, rewarding and challenging. Negative aspects included lack of time and frustration due to unclear processes and lack of commitment from the stakeholders. Balancing between Lab and SFA dimensions, "struggle of different things in managing the program" as in one comment, is considered problematic and troublesome. On the other hand, it is also mentioned that the internal customers' interest in the programs in the SFA area has increased, which has greatly improved motivation. It was reported that the role of a program manager had been better recognized after the matrix organization with a program dimension was created and that from the program manager's perspective things were much better than a few years earlier. "We are going to the right direction", is a comment that was given as an overall comment of the program management in the organization.

5.2.3 Program Management in a Matrix Organization

The program managers were asked about problems and challenges in their work as well as the strengths and positive things that they perceive in the matrix organization where they operate. Summaries of the answers (Table 2) show that overall two main problem areas emerge from the answers: working in the matrix framework and a contradiction between the line dimension and the program dimension. Two strong areas can also be identified on the positive side: coordinated cross-laboratory research work and availability of technical expertise for program work. When comparing the answers to the general understanding of the advantages and disadvantages (see on pages 21-23) in the matrix setting, it can be said that the program managers in the case organization see the situation quite similarly to views described in earlier studies and literature on matrix qualities.

		Challenges and problems faced in the work	
1	**Working in matrix framework**	Funding/budgeting issues (**3**), poor coordination/unclear and different planning cycles (**3**). Bureaucracy (2), no own cost centers in SFAs, unrealistic management expectations, responsibilities of the managers are unclear, isolation from line organization e.g. missing assistant services etc., prioritizing the program tasks, not enough info about other programs	14
2	**Contradiction between SFAs and Laboratories**	Resourcing (**5**), roles (**3**), competition/lack of co-operation (**3**), different understanding of budgeting/funding, competence building	13
	Other	Lack of customer feedback, IPR issues, lack of internal marketing	3
		Strenghts and positive things in the current organization model	
1	**Coordinated cross/laboratory research work**	Coordinated cross-lab programs/projects (4), aggressivness towards a certain direction , SFAs have strong and respected role and possibilities to influence	6
2	**Technical expertise available for program work**	Different competencies are available for programs (2), strong technical expertise in programs delivering the content, long term technology exploration is done in labs	4
	Other	Researchers can concentrate on research work when bureacracy is handled on program level, PGM has no line manager responsibilities	2

Table 2. Challenges/problems and strengths/positive matters found in the matrix organization.

The two organizational dimensions are perceived as separate and in many cases competing with each other; for funding, resources, and in importance of work. The responses to the question "What is causing the mentioned challenges and problems and do you have suggestions how to solve these issues?" mention, for example, that the responsibilities in the different dimensions are not clear. According to the responses there are some personal agenda and politics affecting the resourcing decisions that makes it problematic to get the needed resources for programs. Moreover, from the program managers' point of view, the line organization is deemed phlegmatic and without real responsibility to get things done. The SFA dimension has a mandate to carry on strategically important project work and, according to the program managers, the commitment from the labs is weak, which is a major problem when the staffing of the programs depends on the decisions taken in the laboratories – the type and amount of resources allocated to the SFA programs. It is also mentioned that there has been so many changes in the organization lately that the internal customers have also difficulties in keeping up-to-date with the changes, which is seen to cause lack of commitment from the customers whose support and steering is needed. It is suggested that the roles on the two dimensions should be clarified in order to achieve better coordinated planning and execution of the programs. More co-operation and communication are requested and it is mentioned that more "education" about the SFA programs and how SFAs function should be given to the lab dimension, because do not knowing about things causes misunderstandings. The dual roles of some managers are also

addressed. Being a line manager on the lab dimension and a program manager on the SFA dimension at the same time is seen as problematic and it is also against the original rule to separate these two roles. It is said that the program manager's job should be a full-time job, in order to manage the program efficiently. Another point is that matrix requires lots of managers and communication between them is needed, which indeed is one of the key things to manage the matrix effectively.

On the positive side, it is seen that the matrix organization has brought more cooperation between the laboratories as the program dimension combines different competences from the different labs. Also when the concentration on competence building and technology exploration is on the laboratory dimension, it is possible to have competent people working on programs that need people with different skills working together. One very positive aspect is that while working on the SFA dimension, researchers can concentrate on research work while bureaucracy is handled on the program level. The fact that the program manager has no line manager responsibilities is also seen as a good thing. When project work is coordinated in bigger administrative entities, in programs by program managers, the bureaucracy created in the matrix organization stays on the program level, without inconveniencing the actual research work too much.

On the question "How could these strengths and positive things be enhanced and utilized better?" the strong comment is that co-operation of the two dimensions should be further emphasized. "Enhancing the co-operation in cross-lab programs is the main/only value of matrix and that should be emphasized." "Labs and SFAs should make more co-op and vision bigger concrete things." These are typical comments. It is also requested that the transparency across all sites and labs should be made better, and that a common vision with the SFAs and the labs is needed, in order to bring out the maximum strength of the matrix organization. The two dimensions should not be seen as two separate and competing parts of an organization, but as two dimensions with a common strategy and vision, working together in an integrated way to achieve the greater goals.

5.2.4 Responsibilities and Communication in Program Environment

"Also it is said that in project management situations, the project manager will more and more often serve as a social architect who understands the interaction of organizational and behavioral variables, who facilitates the work process, and who provides overall project leadership for developing multidisciplinary task groups into unified teams and for fostering a project climate conductive to involvement, commitment, and conflict resolution." (Thamhain, 2004)

Thamhain mentions project managers, but the same can be applied to program level management. In the case organization it seems that the role division of the program manager and the other program members is quite clear and the position of a program manager can be seen to include the same contents as Thamain describes above. The program managers were asked what the program manager, sub-level leaders and program members, who have no leader position, do in the program. Most of all, the program manger is said to take care of the program level planning (strategy, vision, contents), reporting and steering and the administrative tasks related to these activities. Networking with the stakeholders, participation in the program work as a team member and presenting the program achievements and contents are the next common answers. The sub-level leaders (project leaders, work package leaders, task leaders) are said to lead, guide, plan and report the sub-level tasks and also have the technical responsibility of their own task area. Related to these main responsibilities, the sub-level leaders also assist program manager in program level tasks. The researchers, scientists and engineers working as program members may also have some special tasks over and about their research work, like contributing to program target setting and giving feedback on achievements and program progress. Some program members may also have a role in participating in different kinds of research forums as representatives of the company. In general, it seems that the responsibilities for different kinds of roles in a program organization are fairly clear and the same kind of understanding of the task division between the program staff is apparent in the responses of the program managers.

Regarding communication, among the program members and information sharing among other stakeholders, there are the similar answers from all. E-mail is the most common way to communicate and share information. The intranet pages are also used on many

programs. Face to face meetings are arranged in all programs and for both purposes, sharing information among program members, and communicating the program related information to other stakeholders. Despite communication and information sharing, it can be said that there is no regular or common way to arrange program communication. Some program managers reported that communication was adequate, but the general opinion among the respondents is that there is not enough communication and information sharing about the programs. One comment was that communication and information sharing were actually excessive, referring to the amount of e-mail that people easily leave unread. Another comment was that there is probably never enough communication, because people have limited time to manage the information sharing. Most of the program managers reported that their program members had a good understanding of the program they worked for, but it was noted that on some programs the program members know the area where they are working on well, but the picture of the whole program and its strategic significance were not so well understood. It was also mentioned that too little information is available on other programs and that the internal customers are also complaining of the lack of transparency. Hopes were expressed for more seminar or workshop type of sessions where different programs could be presented and discussed. It was also suggested that some sort of regularly published newsletter could be a good idea to advertise the SFA programs.

Networking was named as one of the most important tasks of a program manger and one of the necessary skills needed in a program manger. The program managers' views were elicited on networking and the contact network in the program environment. Overall networking was considered extremely important to the programs. It was also conceded that the wide network required a lot from the people working in a program and that it is a lot of work to maintain the contacts. It was reported that the wider the network is the better, and basically meaningful networking is based on common interests and goals. To quote one of the respondents: "Networking is vital for success. Networking also provides the greatest form of communication. It avoids duplication of work and encourages sharing the fruit of the program."

5.2.5 Processes, Tools and Support for SFA Work

In the organization three administrative tools are needed for program planning and follow-up purposes: one for planning the project/program costs, one for making the resource allocations to the projects and programs and a tool for reporting the working hours to the projects and programs. Creating and maintaining the cost plan for a program is the responsibility of a program manager, resource allocation is done on the laboratory dimension by a competence area manager (line manager for the research staff) and the reporting of the hours worked is the responsibility of each program member. These tools are used to create the cost plans and monitor the actual costs. There is no specific tool for planning the contents of a program and there are various processes for managing the various reporting needs. In SFAs there are controllers in charge of finance and control related tasks, overseeing the planning of the programs and monitoring the costs as well as supporting the program managers in the finance and control related matters. There are no specific auxiliary services available for program managers in the SFA dimension, but the assistants in the laboratory dimensions also serve the SFA people. On SFA level there is one assistant resource assisting the heads of SFAs and occasionally the assistant may also take part in arranging some program level events, but not in providing day to day services for the program managers.

Responses to the question "How clear and easy to follow are the current processes?" pointed out quite clearly that the processes need to be made more simple. It is stated that it takes a lot of time to learn everything in the beginning and too many processes and tools are used in program planning. It was also said that there should be clearer instructions and schedules about the things that program managers should do. Regarding program related reporting technology transfer was noted. It was clearly stated that technology transfer is important, but the current tools and processes are inappropriate to reporting needs. In other words, for technology transfer management there are no tools available, only some templates to use as the starting point, but for the approval process etc. there is a need for a better, clearer process and some other tools than e-mail. Another process issue mentioned is portfolio planning. The process by which the projects and programs for the next years project portfolio are planned and selected is considered unclear and changing every year.

One problem is also that even if the planning tools (costs and resources) are working sufficiently after one has learned to use them, there are not very good reports to automatically summarize and display the plans from the tools. A lot of manual work is needed for this. It is also mentioned that too much ad hoc reporting is requested from the programs, meaning that from the different parts of the organization there are some urgent reporting requests that need to be met at a very short notice. A clear reporting calendar is needed. Reporting as such is considered important, because most of the upper level managers do not have a direct view of program output and are not aware of the day to day program activities. In order to have the program status and progress displayed to the decision makers, some level of reporting must be done that summarizes the program progress and achievements in a unified way. For that purpose some improved and simpler processes and tools was requested.

Regarding what kind of support (for management, processes, tools, reporting) the program managers in SFA dimensions had available and if they were satisfied with the support that they received for their work, the responses were both positive and negative. One response is clearly "none" regarding availability of support. Two respondents did not answer and the rest reported that help was available from assistants and controllers, and some other sources like the intranet and personal contacts are also mentioned. Ten of the respondents stated "yes – the support is adequate and I'm happy with it". Two of the respondents state "no – the support should be improved". "SFA office (SFA Heads, controllers, assistant) gives a good support when needed", "Luckily, if I don't know something, so far I have had excellent support from ex-program manager, SFA assistant, controllers etc." The comments support that most of the program managers have the feeling that the support is there when needed. The improvements suggested was mainly related to reporting: fixed templates, really clear plan for reporting, "make the tools work better". Good quality secretarial services were also mentioned. "The Program manager should not be a secretary for a program as now."

5.2.6 Reflections

Reflecting the program managers' answers against the pre-interview material, there is quite a similar understanding of the things associated with program management and program managers in the organization and the matrix organization overall. However, there

are also some things that the program managers and the interviewees see differently from the views in their positions in the organization. Regarding most important tasks and personality of the program manager the answers are similar. Regarding skills and competences one interesting point is that the interviewees notably describe a program manager as a salesman who should sell the program and its contents, as well as the results, to the decision-makers, sponsors and all other stakeholders. Such a role is needed throughout the life-cycle of the program; in the beginning to raise the interest and gain the support for the proposed program; in the middle to show the progress and keep the interest and confidence in the results alive; and finally to ensure the marketing of the achievements and the successful technology transfer of the results to the development units. Associated with this salesman role, skills and competences like business understanding, people skills, networking and presentation skills are mentioned in the interviews. Similar qualities are also mentioned by the program managers themselves, but describing the program manager as a salesman, was less frequent meaning.

In the pre-interviews, it was said that in the research environment people are usually skilled and talented in their areas of expertise and the people in managerial positions tend to stress vision work and strategic thinking. "People have a tendency to have their heads in the clouds", was one comment given, meaning that there are many times much bigger plans than reality permits, taking into account all the constraints that limit the action (like funding, customer commitment, time and manpower). The role of a program manager has not been very clearly defined so far and one interviewee stated that at least earlier, the role had been too much in strategy and visionary mode. A need for "hands-on" type of managers in program management was expressed.

One thought thrown in the air is whether highly acknowledged researchers are necessarily the best program managers in the research organization. This also emerged in one of the program manager survey responses. The role demands considerable people management skills, communication skills and needs a lot of effort and energy for managing the administration, reporting and other activities that are considered to be bureaucracy and many times seen as waste of a researcher's time. It was pointed out that especially in today's business oriented world, it should be kept in mind that not everyone is a natural-born program manager with state-of-the-art leadership and management skills and that not everyone is keen to acquire such skills. The survey shows that the program managers

described themselves as more of "hands-on" oriented than might have been expected. This is obvious in the ranking of the important tasks and the skills, competences and personality in Table 1. Another comment in the interviews was that the people in program management have widely different management styles, which is somewhat problematic in matrix, because the program members working on more than one program may be confused by contradictory interpretations of doing certain tasks (e.g. reporting). The comment is that the processes and ways of working should be more unified and the program managers should also be trained to work more uniformly in the case of common processes.

About the advantages and challenges in the matrix, the comments from the interviewees also gave the same message as the program manger survey. It is clearly stated that the laboratories and SFAs seem to have a competitive attitude against each other and the politics related to different managerial things is considered a problem. Double reporting is said to be somewhat problematic, mainly because it is not so clear what should be reported and where and who is responsible for what kind of reporting. On the other hand, it is also said that double reporting is not only a bad thing, when there are two possible ways to advertise the results and have a larger audience for the work done on the programs. About the communication in the programs it was said that the program manager should have a visible role in communicating program related matters to different parties. It was mentioned that not all the program members are so aware of the programs and they do not necessarily know which program they work in, or who the program manager in charge is, while they only concentrate on the sub-tasks assigned to them. Overall, the picture of SFA programs should be better advertised and communicated across the organization. It is also said that a clearer division of the project work, creating a "pure matrix" as it is formulated, would be better, meaning that the short and middle term projects should be done in the SFAs only and the longer term exploration projects and scanning the research opportunities should take place on the laboratory dimension only. This would be better in terms of having a strong orientation in competence building in the line dimension and having the SFAs with skilled program and project management staff leading the projects that result with the technology transfer items and product concepts that can be utilized further in the company's product and service development.

To conclude this part, two very important things to pay attention to were mentioned by the interviewees. First of all, as an interviewed program member said, despite the competition experienced on the management level, there is no visible competition seen or felt among the people working in the grassroots level. In the research community and among the researchers, the work itself is seen to be more important than in which part of the organization the work is done. In the other words, the results and the research itself are the most important things that count for the research staff. This is probably the most significant thing in the research organization and if that condition could be held constant despite the continuous change in the environment it might be the key to success in many other things. The other matter that really makes sense was stated by the two other people. This was renewal. The matrix type of the organization enables renewal – the program dimension creates new programs and after these end, people change their places after the programs are finished. Change is seen as a renewing force and this natural change can be utilized in a matrix. Two elements – a solid research community with its unofficial organization and the renewal potential of the organization structure – might be the things that are worth further study.

5.3 Results of the Case Study - Part Two

Morrison et al. (2006) conducted a literature study in an attempt to finding the framework for a project management supportive culture. In their study they combined two domains, project management and organization culture, ending up with the formulation of an organizational profile that can be proposed to measure the degree of supportiveness for project management, especially in matrix setting. The proposed dimensions of a project management supportive organizational culture are presented in Figure 12. In addition to the project management capability (support infrastructure of project management tools and systems), it is stated that in a matrix organization, project management is integrally involved with the wider organization, typically relying on resources like functional expertise, facilities, information systems, administration processes, accounting procedures, and upper level managerial and decision-making processes on an ongoing basis. The scenario created shows that in the matrix there is strong interdependency, even competition, between project management and the rest of the organization and it is the organization culture that can make the difference to how the matrix organization actually works. The study finds the project management as an integral part of the wider

organization and it is emphasized that the wider organization's culture is a determining influence in this relationship.
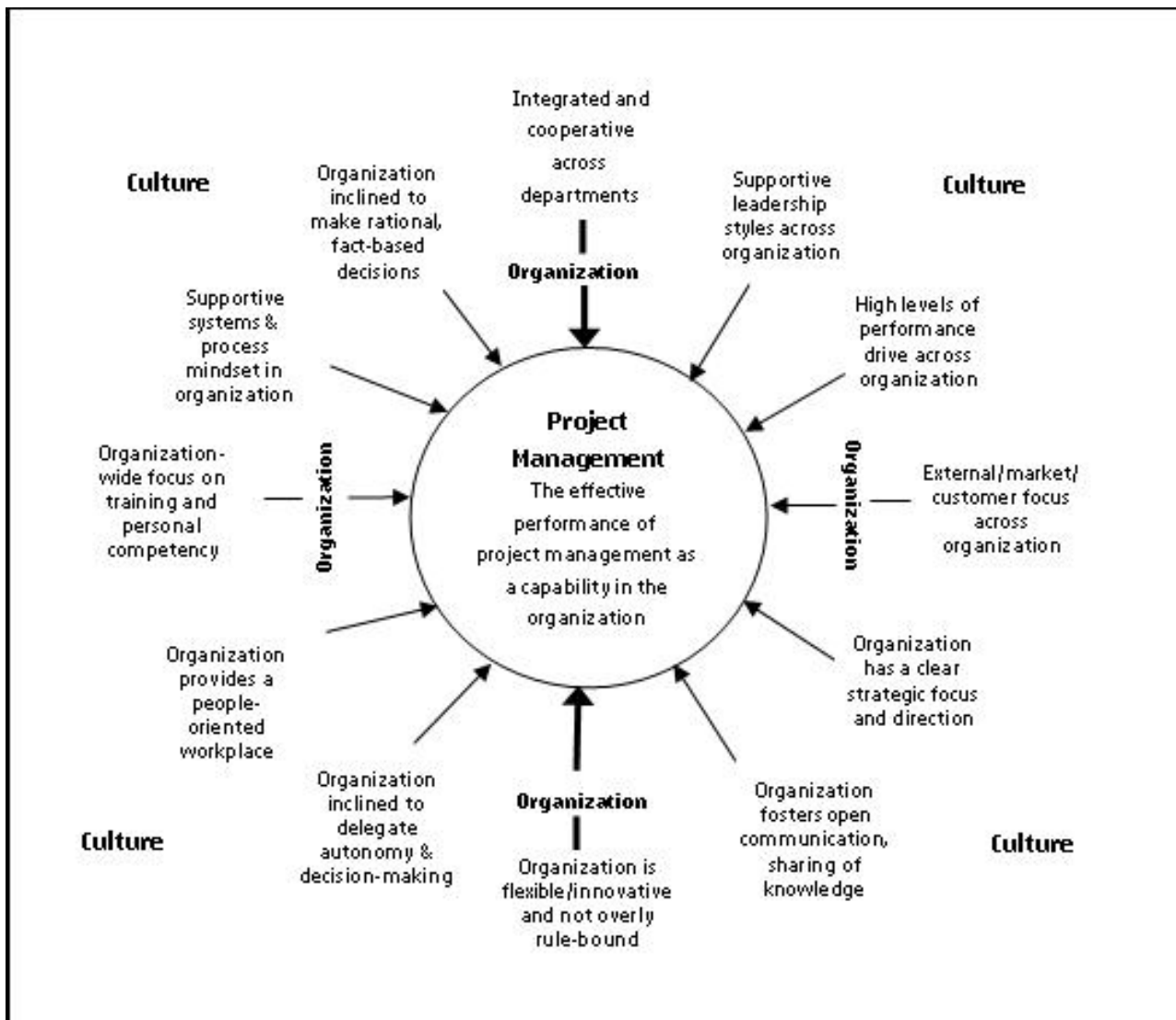

Figure 12: The proposed dimensions of a project management supportive organizational culture, Morrison & al. (2006, 48)

The study by Morrison et al. (2006) identifies twelve dimensions of organizational culture believed to play a role in regulating the flow of organizational support and contribution towards project management. These twelve dimensions are put forward as a profile which should be able to measure the organizational environment on a scale of project management supportiveness. The illustration shows the twelve dimensions worded in a positively oriented way toward project management. The findings of the study strengthen assumptions that organizational culture is indeed a relevant influence to project management and it should also support a belief that the proposed dimensions capture the

essential dimensions of a project management supportive organizational culture. In the following I will analyze the case organization by comparing the survey results and the pre-interview answers with the contents of these 12 dimensions defined by Morrison et al. In addition, as background material and to get a wider understanding of the culture and values in the case organization, I also use some company confidential material about the organization that cannot be included as an appendix or reference (documentation and presentation material e.g. about company values, ways of working, employee satisfaction survey).

In my study the subject is program management, so I apply the supportiveness factors considering program management an extension to project management. Programs consist of several sub-activities and I also use project as a term in my text to refer to program related activities. By identifying the status of the organization culture supportiveness for the program management in the case organization, I will try to find out the key matters that would strengthen the supportiveness for the program management and which should be noticed in the future organization changes. Finally, I will suggest how the findings about the support level of the organization could be used to improve the organization, so that the organization could deliver best-of-class research results, being fast, innovative, as well as efficient, despite of the turbulence and continuous change in the environment where the people need to operate.

5.3.1 12 Dimensions of Project Management Supportive Organizational Culture

In the following, the 12 dimensions of project management supportiveness are gone through comparing the information gained from the case organization (interviews, survey, other company specific material) with the criteria (written *in italics*) defined by Morrison et al. (2006). The aim is to find out the status of the organizational culture supportiveness for the program management in the case organization at the time when the survey was conducted (summer 2005).

Dimension 1: Organization is flexible/innovative and not overly rule-bound
- *The organization should be comfortable with change*

- *A project management organization should avoid an emphasis on bureaucracy and vertical reporting*
- *There must be an environment of creativity, innovation and stimulating work*
- *There should be flexibility in accepting leadership based on expertise as opposed to only position*
- *There should be flexibility within project execution*
- *There should be a fair level of risk tolerance and a capability to manage risks in projects.*

Dimension one seems to be partly in order in the case organization, but there is also a lot to learn and improve. In order to be flexible and innovative, the organization should be comfortable with change. In the case organization, change from functional organization with only the vertical reporting lines was the first bigger change in approximately 10 years that affected the whole organization. Thus, there is not really very much knowledge and experience of change and all the people need to familiarize themselves with the new structure, new operating mode, a totally new way of thinking. Based on the survey results and the pre-interviews, it can be said that the people have some change resistance as well as problems to accept that the program dimension was separated from the line organization and they are not quite sure how to operate in such an organization. One interviewee said that the value of the matrix organization is that it gives flexibility to make changes in the organization and the expected outcome of the changes is renewal and that again leads to innovation. He also mentioned that in the case organization there are a lot of things that were still done in the old ways and some people also wanted to keep things that way. In other words, the organization is not very comfortable with change. But, it was also mentioned by the program managers that change related competence and change tolerance are something that a program manager needs to have. It seems that there is, at least on the SFA dimension, willingness to adjust to the changing conditions and a part of leadership qualities is to understand the need of change as well as to be able to work in the changing conditions.

To avoid an emphasis on bureaucracy and vertical reporting is one of the elements of the first dimension. The program managers in the SFA dimension understand the meaning of people management and the importance of change in today's program management. They also understand their role as a program leader, whose job is to keep the most of the

administrative work on program level and free the research staff to use their time for the research work. This is the way the matrix is supposed to work in the research environment: most of the bureaucracy is kept on the management level and the research staff need not worry about the administrative details. This creates a more flexible working environment and boosts creativity. In the study material it is stated that the reporting requirements are not clear and especially it is not clear what needs to be reported from the program dimension to the line dimension (vertical reporting). There is confusion among the people and double reporting is mentioned. Matrix organization is a complex entity and requires rules and processes that need to be followed. Otherwise it is not possible to work in an organized way. Nevertheless, overly rule-bound conditions should be avoided. Double reporting is necessary to some extent otherwise it is not possible to control the organization.

What is clear is that the environment in the case organization has an emphasis on creativity, innovation and stimulating work. Flexibility in accepting leadership based on expertise is also found. Regarding technical details, the leadership is not only based on the position, but the leadership is delegated to those who are the best experts in the field in question. The emphasis should be more on flexibility and there should be as little micro-management from upper management as possible and more empowerment for people to take their leader roles naturally. Some more flexibility for planning and executing the program activities was requested by the program managers. Risk level tolerance and capability to manage risks in projects are strongly needed in research environment, but this area is not so clearly prominent in the study material.

Dimension 2: The organization needs to be integrated and cooperative across departments

- *The importance of a culture that encourages cooperation between functional units or departments*
- *The negative effect of interdepartmental conflict and power struggles*
- *A cooperative spirit in the organization in general*
- *A general comfortability with teamwork across functional borders in the organization*
- *Reward systems reflect seriousness with teamwork and cooperation*

- *Proper integration and sharing of responsibilities between functional and project management*
- *There is an emphasis on the collective capabilities of the organization*

The importance of a culture that encourages cooperation between functional units or departments is acknowledged in the case organization. This can be seen in both sets of responses, in the interviews and in the survey. The negative effect of interdepartmental conflict and power struggles is also noted as harmful, but unfortunately these matters are also found in the case organization. In general the co-operative spirit in the organization is strong. This is most likely based on the unofficial organization and the personal relationships (coffee table discussions and corridor meetings were mentioned in the survey) that have a positive effect on the functionality and the efficiency of the organization, even if the structure and the ways of working are not so settled and clear. Being comfortable with the teamwork across the functional borders in the organization is deemed very important. It was mentioned several times that co-operation increased after the change from the old organization to matrix. In any case, there is much evidence that there are matters that delay the more effective co-operation (like competition for resources, disagreements on project/program direction) and these obstructive elements should be removed. Proper sharing and integration of responsibilities between the two dimensions is not very well realized as mentioned in many answers in the study.

Overall, the second dimension of supportiveness is found in the organization, but there is a lot to be done, especially by management before seamless co-operation can reach optimum. There is a strong unofficial organization built on personal relationships and trust in colleagues that is a good ground for creating a more integrated organization. This point should be taken into account and turned to advantage in any kind of organizational development and change.

Dimension 3: An organization with high levels of performance drive across organization
- *There must be clarity of goals and performance criteria*
- *There must be clarity on responsibility and authority*
- *The organization must be competitive*
- *There must be a strong will to accomplish*
- *There is an emphasis on planning and control*

- *There is an emphasis on pro-activeness and a quick response to solving problems*
- *Rewards are strongly influenced by performance*

For the third dimension, the elements of supportiveness seem to exist, but some efforts are needed to harness the best benefits in use. The organization is very much performance driven and the success is measured by the performance. Performance and accomplishment are some of the key things in the case organization, on personal level as well as on team level. What is seen from the study material, clarity of responsibility and authority is not yet in place. But the strong will to accomplish is found there, likewise the emphasis on planning and control. It is understood that planning and control are needed in a big, complex organization, but what is missing is the strong culture in planning and control. There have not been very clearly stated processes and tools for planning and following up activities in project and program management in earlier organizational settings and it takes time to learn the new mindset as well as the required actions. Rewarding is very much performance driven and there are the measures and criteria in place for rewarding people for personal achievement as well as for team performance. The organization is competitive and people challenge each other to achieve greater goals. A high-level of pro-activeness and problem solving is desired and these qualities are not only desired from leaders, but also from team members. The program dimension in the matrix is said to give even greater possibilities for achievement when the larger programs and working in cross-functional teams allow people to plan bigger and more integrated things.

Dimension 4: An organization that has supportive systems and a process mindset in organization
- *The organization must have a general inclination to emphasize processes (means) and not only the ends*
- *There must be a sound information infrastructure in the organization.*
- *Information systems must be purposeful to serve the requirements of users*
- *The accounting systems should be capable of serving the needs of project accounting*
- *The organization should establish firm, standardized project management systems*

Dimension four has clearly not yet been achieved in the case organization. The elements are known, but are not all very well in place. The processes for project and program

management are not very clearly defined, but in general, the information infrastructure is in place. The infrastructure enables multi-dimensional teams to work together. In addition to the modern computer hardware and software available, there are the Internet, e-mail and modern networking tools that enable information sharing between the team members and it is possible to work together even if the people are located around the globe. What is not in order is that the systems are not all in place to serve the requirements of the users. It was stated many times in the survey answers that the processes should be clarified, and partly also new processes should be created, and also the tools should be made easier to use. More integrated systems were requested. E.g. the accounting system is capable of serving the project accounting, but the output of the data is not so well in place. The tools that could be used in project contents planning and in technology transfer phase are lacking but needed.

A lot has already been done for getting more visibility and transparency in processes and planning and reporting systems, but there is still a lot to develop further and learn more. Even if there are processes in place, they are interpreted differently in different parts of the organization, or the program managers have different ways to apply the processes, which can be confusing for program members working in more than one program. The process by which the project/program portfolio is planned and decided is notably missing. It was said that the process changed every year, so it is very difficult to anticipate how the process will go next time and with whom the plans should be discussed in the first place. In contrast to the need to encourage flexibility and freedom to be creative, a structured and systematic approach build around standardized routines, processes and control systems is also needed in a complex organization. In the case organization it seems to be more that the ends justify the means in program management. This can be seen partly as flexibility and freedom to do things, but in a complex organization, it might cause more pain than feelings of freedom when individuals apply own rules. It could be easier to have a defined path to follow than try to think for oneself.

Dimension 5: A supportive leadership style in the organization
- *Senior management demonstrates visible support for projects*
- *Senior management shows involvement in the management of projects*
- *Senior management displays an understanding of what project management entails*

- *The supportive orientation is evident in the use of project sponsors to facilitate senior management support*
- *Distance by senior management is seen as a negative factor*
- *Supportive and involved leadership styles are practiced within project management*
- *Participation by members in project teams are encouraged*

On program level, dimension five related matters are to be found in the organization. The program mangers have a supportive attitude towards the program members and they understand the involvement that is needed from their side in successful program management. The leadership aspect and strong emphasis on involvement and encouragement from program managers' side is to be found. What is not so well in order is the senior management involvement and interest in program management. Some comments were also found stating a slight lack of interest from internal customers and their effort in giving guidance and feedback (participation in steering of the programs). Also, it is apparent in the survey responses that there is some lack of involvement and understanding of program management needs from the senior management in the organization, while the reporting needs and requirements, for example, are not fully clarified. Ad hoc reporting requests are mentioned in the program managers' responses. The need to deliver different kinds of information on very tight schedules is not good and reveals senior management's lack of interest in and/or lack of time to concentrate on program management related matters. It can be seen from the survey responses that there is no real "matrix guardian" to be found in the organization, a thing that has been found very important in the earlier studies of the matrix organizations (e.g. Sy & D'Annunzio, 2005, 45-46). If there is no person in senior management whose job is to oversee, guide and evaluate the activities on the organization level, it is very difficult to get the integration done and best practices disseminated to the whole organization.

Dimension 6: An organization that is inclined to delegate autonomy and decision-making
- *The organization is highly decentralized in respect of decision-making*
- *High levels of autonomy and decision-making are delegated to project management function*
- *Within project management, decisions are delegated down to the specialists*

In a complex matrix organization there are a lot of people involved in decision-making, because the activities in programs entail the co-operation of more than one party from the organization. A matrix organization can be more democratic organization than a functional organization if the organization has trust in the people who operate in it on lower levels. Delegation and autonomy can enhance the functionality of the matrix if there is no need to confirm all the decisions on upper levels of the organization. The activities can run smoothly and no delay is caused by slow decision-making if the decision-making power is decentralized.

The comfort of decentralizing the decision-making is not very strongly found in the organization. More flexibility and freedom to decide on program related issues was requested in the survey responses. This request of freedom and flexibility is much related to the financials and use of resources. In these issues the program management function does not have very much freedom to decide on the actions and activities when the budgets and available staff are defined in a more centralized manner. It is the available funds and people which largely define the possibilities to decide on the contents of the program and what kind of activities can be included. But at the same time, on the program level while deciding on technical matters, the decision-making power is more delegated to the specialists and it is not always the position and status of the person, but the skills and competence, that define the decision-making rights granted to the project staff and the steering body that directs the program activities.

Dimension 7: An organization that has an external/market/customer focus across organization
- *The organization has an external or customer focus*
- *The organization display sensitivity towards its environment and external stakeholders*
- *There is a closeness to the customer at project management level*
- *Project management is practiced with a business or entrepreneurial mindset*

Dimension seven is apparent at least on management level. There is a strong emphasis on customer focus, but also there is a need to improve internal marketing and the visibility of the program work towards the customers. As clearly stated in the interview material, the "salesman" type of role in program management was at least desired, which tells about the

need to focus on the markets and customers. It is necessary to have eyes and ears directed to the environment. The mindset in the organization seems to be changing in the customer and market directions, but it is also a place to learn to be more customer-oriented in program work. Strong personal networks are found important in keeping up customer commitment and program mangers are key people to communicate via their networks. Customer participation in steering the research work is essential for the work done in the organization and when the customers are kept informed and involved in the work, it will accelerate progress. In the matrix there is an opportunity to use the SFA dimension as a vehicle to show the achievements to the wide network that is involved with SFA work. The cross-lab workforce can be used for disseminating the information internally within the organization, from the labs to the SFA programs and vice versa. SFA program managers' networks can be used to communicate the achievements to the company wide audience outside the organization and this option should be used effectively, thereby ensuring customer interest and support for the program work.

Dimension 8: An organization that has a clear focus and strategic direction
- *The organization has a clear strategic direction*
- *There is an aligned company value system*
- *Project goals are visibly aligned with the strategic direction of the organization*
- *There is a need for direction and a common outlook in team functioning*

Dimension eight is reasonably well fulfilled in the case organization. There are clear strategic directions coming from the company level and these are adjusted in the research organization so that the research objectives and goals are aligned with the company wide strategies. A company wide value system also exists. There is a strong emphasis on aligning the program goals with the strategic direction and it is found more and more important. A very great need for direction and common outlook in team functioning was also expressed, but according to the survey results, the direction and common outlook are not yet in place and this needs to be improved. In the matrix, the SFA dimension is formed especially to carry out the strategic programs following the priorities set on company level. This gives freedom to concentrate on the longer term explorative research on the laboratory dimension. This is very important for anticipating future trends and technologies. As mentioned in the survey, the strategy work in the organization is somewhat fragmented while there are own strategies planned in the two dimensions and each lab and SFA also

has its own strategy work. There is a major opportunity to maintain the high competence level in the organization by explorative work in laboratories and make good use of that expertise in the SFA programs. By combining the strategy planning and implementation done on separate dimensions, it would be possible to find even more unified targets to work together in a more uniform way.

Dimension 9: An organization that has organization-wide focus on training and personal competency

- *There is a general culture of learning, personal development and professionalism*
- *There is a culture of learning by the organization*
- *There is a general level of competency and managerial competency in the organization*
- *The organization should be trained in project management skills*
- *Extensive training for project staff*
- *Proper training for project staff*

In general it can be said that in the organization competence development is much emphasized and addressed in the research environment and among the project/program staff. There are also learning programs for managers; managerial competency and the need to develop the managerial skills are recognized. What is needed is the honing of project management skills, especially in the matrix setting. Overall the organization would benefit from matrix organization related training that should be specified for reflecting the special needs and requirements in the different layers of the organization. According to Sy & D'Annunzio (2005), it is often the lack of knowledge about the matrix organization (what it is, how it is supposed to work, what kind of roles and responsibilities there are) that causes the problems and creating extra challenges in the organizations.

Dimension 10: An organization provides a people-oriented workplace

- *The organization fosters a non-threatening, non-coercive climate*
- *The organization places an emphasis on the need for skills in managing people*
- *The organization has a Theory Y mindset instead of Theory X*
- *Members easily identify with the organization*
- *There is evidence of social cohesion between members*

- *The organization provides its people with career paths and prospects*

The matters listed in dimension ten are all to be found in the case organization. There is a strong emphasis on fostering a research favorable climate and people management skills are very important. This is also apparent in the program managers' responses. Trust in people and their skills as well as a tendency to think that people are capable of working independently and pro-actively and without constant monitoring and guidance (Theory Y, mentioned on page 16) is strongly present in the research environment. The social cohesion of the members and them identifying themselves in the organization is deemed important, and thus can also be found in the interviews and in some of the survey responses. About the career paths and prospects, the people may have many different views, it is a very personal matter. On the company level, there are possibilities to find different career paths and prospects in the large company. How easy or difficult it is to succeed in the career path and finding the prospects matching one's own wishes and expectations is then another question.

Dimension 11: An organization that fosters open communication and sharing of knowledge
- *The organization must have a general culture of open communication*
- *There must be an openness to air views and to challenge opinions*
- *There should be visibility and transparency of goals and operational information*
- *People trust each other so that information gets shared*
- *Lessons learnt are disseminated*
- *There is an emphasis on the upward flow of communication*

Openness and communication are paramount in the case organization. These are both well presented in the study results. All the points listed in dimension eleven are also included in the case organization, but the degree to which these matters are seen varies widely. A general culture of open communication is a target, but the level of openness depends on the matters that are shared. Airing views and challenging opinions belong to the culture of the research community. It is good to have discussions with peers and colleagues and feedback in good and bad is needed. Transparency of goals and operational information is improving in the organization, but there is a lot still to improve. The tools in use make it possible to collect and share the information more easily than before, but there are still

some improvements requested in that area. Trust is needed in information sharing, but the level of trust is not evident in the study results. It would require some further questions to ascertain the trust level. Related to the unclear organizational setting, it could be anticipated that trust is not very strong on the management level, but on the grassroots level it may be stronger, while the disagreements and different conceptions of matters do not affect the work itself, as stated in the interview material. Documentation of the work done and disseminating the lessons learnt enable the improvement of the processes and the ways of working. This way the improvement of the work itself, or the results of it, could be done better. Reflecting the survey results, it seems that the documentation and utilization of lessons learned is not very well accomplished in the organization and improvement is needed. The emphasis on bottom-up communication is found in the case organization and is shown e.g. via the strong encouragement to evince the new ideas and research topics on all the levels of the organization.

Dimension 12: An organization that is inclined to make rational and fact-based decisions
- *There is a rational basis for selecting projects e.g. to support strategies*
- *Project selection must be based on measurable benefits*
- *Projects must be free from political, self-interest decision-making*
- *There must be stability in project priorities*
- *Project goals must be set realistically*
- *Goals must be set with due consideration to the resources available.*

Decision-making on a rational basis is desired in the case organization. The projects are selected on a rational basis and especially strategies are used in the selection basis. There is a strong emphasis on selecting the projects that can deliver measurable benefits. Politics and decision-making based on self-interest should be avoided, but unfortunately it was shown that in the case organization it is not the case in all decisions. Problems related to politics and pursuing one's own interests are mentioned as challenges in the case organization. Stability in project priorities is essential. This is also one aim in the case organization. Realistic goal setting is also mentioned as necessary in projects. This is deemed somewhat problematic in the case organization as it is mentioned that the people in the research organization tend to have quite visionary thoughts and "head in the clouds" mentality, which sometimes causes overly ambitious plans that are not feasible in the real

world. The imperative of setting goals with due consideration for the resources available is related to the "heads in the clouds" thinking and often results in overly optimistic plans.

5.3.2 Status of the Supportiveness

The understanding of the status of organizational culture supportiveness of program management as it was in the case organization in 2005 is based on the program manger survey and pre-interview data, and can be confirmed by comparing the material with the employee satisfaction survey of September 2005. The company wide survey and especially the research organization level results reflect a similar kind of understanding of the status in the case organization as the program managers and the interviewees state in their responses.

Four of the 12 dimensions can be said to be clearly on the positive side when the supportiveness of program management is measured. Still, these factors should be paid attention to in order to keep supportiveness high, or even to strengthen it. The organization seems to have high levels of performance drive across the organization (dimension 3), but there is still room for improvement. The confusion about the responsibilities and lines of authority between the organizational units may hinder performance. In any case, the most important point in having a high performance drive in the organization originates among the people and how they enjoy their work and how they get along with each others. In the case organization, it seems that the relationships among the research staff are in order, which makes the organization performance high, despite some deficiencies.

The strategic focus and direction are clear (dimension 8) and the culture of strategic thinking is strong. To make this strong supportive factor even stronger, more cooperation across the organization should be created to get the organization level strategy to work in a more integrated way. Then it would be possible to get even more support for project and program management in terms of project selection on the laboratory dimension and feeding the new program ideas to the strategic focus areas. Together with the strong focus on strategies, a wide focus on training and the personal competency of people (dimension 9) exists in the organization and it seems that the organization provides a people-oriented workplace (dimension 10). These supportive cultural factors show that there is a very

strong emphasis on people – the greatest asset in any organization. This is also the ultimate requirement in the research organization, which is an organization composed of professionals, who value freedom, trust and flexibility in their work, and who expect to have capable leaders as well as a diverse working environment that nourishes talented and skilled people.

One of the dimensions is decidedly on negative side in terms of supportiveness towards the program management. It seems that the processes, management systems and tools have not yet developed to the level that it could be said that the process mindset is in place and supports the program management (dimension 4). In a complex matrix environment, unified processes are pivotal. The lack of efficient processes and tools in planning and following up the work can also cause problems in the future, if the situation is not remedied. If there are unified processes and tools in place to handle the tasks required for the administration and management of the projects and programs, it would save different parties a lot of time and effort. Moreover, not only having the tools and processes, but having the best practices disseminated through the organization would be the best situation. When all the parties have the same kind of understanding of what is needed as well as similar ways of working, it would remove the confusion about what needs to be done, and clarify the roles and responsibilities. It is regretted that much ad hoc work needs to be done for reporting and managing the programs. If the processes were well defined and tasks scheduled in advance, it would be possible to plan the work in advance and free program managers' time for the other important things, such as communicating and interacting with their program team or customers. If the process mindset can not be created and the systems fail to be supportive, in the longer run there will be great dissatisfaction with the administrative and managerial tasks. It is most important in the research organization to deliver outstanding and innovative results by working in projects and programs. If the program managers' time is continuously used in ad hoc tasks and finding out what needs to be done, when and for whom, the effect on performance will be negative.

Seven of the 12 dimensions seem to have both positive and negative elements when the criteria of the dimensions and their existence in the organization are examined. The organization is flexible and innovative and not overly rule-bound, but at the same time, lack of flexibility and freedom was identified (dimension 1). The organization seems to be

partly very integrated and co-operative across the departments, but on the other hand, disorder and power struggles were also reported (dimension 2). It can be said that leadership styles were found, but conversely, there was lack of supportiveness in leadership (dimension 5). The organization is inclined to delegate autonomy and decision-making, but this is not yet totally working (dimension 6). An emphasis on customer focus was found, but it is not on all the levels of the organization (dimension 7). The aim is to be open with communication and knowledge sharing, but are there enough trust for real openness and enough effort in knowledge sharing (dimension 11)? The inclination to make rational, fact-based decisions is strongly present in the organization, but despite the emphasis on rationality, it seems that the decision-making does not always follow the rules of rationality (12).

With these dimensions, action should be taken to strengthen the positive factors and eliminate the negative ones. In a complex organization, or any kind of organization, it is very difficult to turn all things positive. It is a tough job to please everybody and get everything working without any problems. In a complex matrix setting, there needs to be flexibility and tolerance for some deficiencies, but also willingness and effort to make changes, whenever possible. In the following, I will sum up the key findings and thoughts of the case organization in terms of the functionality of the matrix organization in the research environment and organizational culture supportiveness for program management.

5.4 How to Proceed?

Going through the results of the survey (Chapter 5.2) and the supportiveness factors (Chapter 5.3), it is obvious that the case organization does not differ much from the matrix organization characterized in the literature. Comparing the results with the advantages and disadvantages studied e.g. by Davies & Lawrence (pages 21-22) and strengths and weaknesses listed e.g. by Sy & D'Annunzio (page 23) all the characteristics were more or less found in the case organization. The problems and challenges discussed (pages 26-27) can also be identified from the survey responses and the interviews. What is also clear is that the matrix organization is not yet fully developed and mature and some more development work and organization design actions are needed.

Many aspects were reported by the program managers. It seems that the program managers are reasonably content with the matrix organization in terms of the more prominent status of program management and strategic programs. Even if there are still some unclear issues, they feel that the strategic programs and the role of the program manager are better recognized than before and the matrix structure has made their lives slightly easier in that sense. The structure by which the program organization is separated from the functional organization gives the program managers freedom to concentrate on the programs, while the laboratories have the responsibility for competence building and the line management of the research staff. Program managers are able to concentrate on managing the program and the program team, while line management takes care of the people management. From the perspectives of research staff, the program organization seems to create a less bureaucratic working environment, while the program manger is responsible for handling all the administrative tasks at program level. Project leaders in the program, as well as the other team members, can concentrate on the technical content and carrying out the research tasks while most of the bureaucracy remains in program manager's hands.

One positive and very strong message from the program managers, as well as from the "non-program managers", is that working in the matrix organization has increased the co-operation between the different laboratories. In the matrix organization the more extensive communication is needed to get the things done, which naturally enhances the interaction and communication on all levels of the organization. Through the program organization, it is possible to find more synergies between the different parts of the organization, while the program members are composed of people from different laboratories and countries. This brings in creativity and innovative thinking and increases the efficiency of the work, while the co-operative action also makes the work inside the different parts of the organization more visible. E.g. there are more ways to identify similar ideas at an early phase and then combine the workforce to work on the same topic together, not to do small things separately and possibly to work on the same thing in parallel.

On the negative side the greatest dissatisfaction seems to be with lack of coordination and unclear roles and responsibilities, which make working in a matrix setting complicated. This was the case mainly at management level and especially in resource management and financial matters, which seem to be the most difficult items to plan and agree in the

complex matrix organization. These matters also create a political agenda and self-interest can play a deleterious role when there are two dimensions making staffing and funding requests and it needs to be decided how much and what kind of resources are allocated in the laboratory driven research work and SFA driven research programs. Contradiction and competition between the two dimensions is apparent in the case organization and a big challenge for management is to learn to work more together, in the same team, not competing with each other, but competing together against the real competitors.

In contrast to the management disagreements and problems, it is said that the research community within the organization has no major problems in working in the matrix as such. It is not too important for the researchers in what kind of organization they are placed and how the reporting lines are arranged. It is more important to concentrate on the work itself. If the work is interesting, meaningful and challenging and if the working environment is flexible and gives freedom to pursue interesting topics and tasks, the form of the organization structure does not really matter. When the organization changes its organization charts, it does not usually mean that the people go away and change. In most of the cases the people stay in the same spot at the office and despite complex reporting lines, still have the contacts with peers and mates as before. It is the unofficial organization, the personal network that is really valuable in organizations undergoing structural changes.

5.4.1 Solving the Problems

To even try to solve all the problems found in a complex organization structure is utopian. However, to concentrate on the most critical issues can make a difference if solutions are found and some action is taken to avoid the worst pitfalls. Reflecting the status analysis of the case organization, the following actions are suggested for eliminating some of the biggest problems:

1) Clarify the roles and responsibilities
2) Clarify the processes
3) Create management tools that serve the needs of the users
4) Name a Matrix Guardian
5) Train people to work in the matrix setting

The roles and responsibilities should be clarified on both dimensions (reporting lines) and between the dimensions (who is responsible for what action and in which directions). One thing that seems to be missing in the case organization is agreement about which one of the two managers is the senior in a two-boss relationship? In other words, whether the matrix organization is a functional matrix with strongest command in the functional dimension, or if the matrix is a program oriented matrix with the strongest command in the program dimension needs to be clarified (Figure 7). An ideal option is seek a balance between the two dimensions, but in a balanced matrix especially, it is important to have clear agreement on the roles and responsibilities of the two dimensions. This can be a hard task to accomplish and much collaboration is needed to find the balance and equal power in decision making and authority.

In order to perform efficiently, the people who have two managers, one on each dimension, should know what pertains to each dimension and to what extent they are expected to report in each direction, vertical and horizontal. The managers who have common subordinates should take joint action and agree on the roles and responsibilities on a general level (create a policy to be applied to all similar relationships). After comprehending roles and responsibilities on each dimension in general, the individual roles and responsibilities can be adjusted to match the specific requirements of each two-boss relationship. The details of the individual roles and responsibilities can be discussed and agreed with each person in a two-boss situation, all the three parties participating in the discussion. For instance, a program manager on SFA dimension has a line manager on laboratory dimension and another manager on the program dimension. If the general principles of program manager's role, responsibilities, authority, and key tasks are agreed, everyone knows what the role is about and then the individual tasks and responsibilities can be agreed taking into account the objectives and the nature of the program and how many and what kind of team members there are in the program.

Clarification of the processes can potentially solve many of the problems recognized. The processes definitely need to be in place and clarified and once that is done, people could plan and schedule their own actions better. Clear processes would increase the awareness and transparency of the planning and execution of the research work, which would benefit the whole organization, not only the program managers. With clear processes, it would also be easier to coordinate and synchronize the activities across the organization. There should

be basic processes for program planning and execution, as well as the clear process and schedule for reporting. Together with clarified roles and responsibilities in the organizational level, the clarified processes can also have an effect on decision-making efficiency. The process descriptions should include the actions needed, the schedule to execute the actions, the roles and responsibilities in the process, likewise the decision-making power of individuals in each of the process steps. Portfolio creation and planning and technology transfer were two of the processes claimed to be at least partly missing and difficult to follow. Clarifying the processes and actions needed in these important tasks would have an effect on performance in the programs. With the similar processes and schedules set for all, program managers could allocate their time more efficiently and manage the different planning and reporting activities with less confusion about deadlines and other matters related to these activities. It would also be easier to communicate the different program management responsibilities, schedules and activities to the program staff and steering group members, if general principles were defined in process descriptions. The confusion created by different ways of managing the programs would also decline, if all the programs were run with similar processes and guidelines.

Various tools are needed for the administration of the programs. There were many complaints about the tools in use, because this is considered too time consuming to learn and the usefulness of the output from the current tools were also criticized. It was claimed that there are no very good summaries available on the tools and the different tools are not well enough synchronized and it requires quite a lot of manual work to get the data modified for the various reporting purposes. In order to make the administration of the programs easier and less time consuming, the tools should be further developed to meet the needs of the users. One important thing to take into account with tool development is that the tools should help to avoid double work (e.g. in reporting). There are also comments that the tools were much better than earlier, but much improvement is still needed. It is also said that some new tools are needed, e.g. to manage technology transfer. There are no common tools to use in technology transfer and this was found problematic. A more organized way, a unified process, as well as a tool to manage technology transfer would certainly enhance and activate the technology transfer of program results to product development.

In Sy & D'Annunzio's study (2005), the five biggest challenges of top- and mid-level matrix managers are identified. One of these considered critical was having a Matrix Guardian to

oversee the action in the organization (discussed on page 27). A person whose job is to monitor performance in the matrix, to identify the best practices and to disseminate these throughout the company is recommended for the case organization as well. The survey and interview material show that there is no really specified person in the case organization, whose role is to coordinate the action in the matrix: to monitor what is going on, getting an overview of the whole organization, and taking corrective actions when needed. If there were a dedicated person, highly respected and empowered to take action when needed, it would enhance the functionality of the organization. In Sy & D'Annunzio's study, it was stated that the Matrix Guardian is not only needed for setting up the matrix operations, but also after the biggest issues are resolved and supporting systems created, the Guardian is needed to continuously monitor performance and take corrective actions when needed.

Referring to one of the key findings in Sy & D'Annunzio's study (2005) about the challenges in the matrix, it was pointed out that in a complex matrix structure there is potentially a big damaging gap in employee training. The lack of knowledge and skills, how to operate in a matrix structure, can cause the whole system to fall. It would be beneficial for the organization to arrange some training targeted at different organizational levels, clarifying the roles and responsibilities, as well as the general principles of matrix organization structure and how it is implemented in the organization where the people work. From the perspective of program management, as mentioned in the survey responses, the line organization (managers, research staff), as well as the support functions (e.g. auxiliary services) should be educated to understand how the SFA dimension operates. It is clearly stated that there is a lack of understanding of the ways of working in a matrix, and especially how the SFA dimension works, and that is seen to create unnecessary conflicts between the dimensions. Having an overall conception of the ways of working would help people to modify their own tasks and assignments to the requirements of the matrix. The general understanding of the organization and how things work in different dimensions would also reduce the misunderstandings in the daily work.

In conclusion, to get rid of some negative features in the organization, it would be a good move to nominate a Matrix Guardian and the tasks for this person would ideally be to 1) coordinate the clarification of the roles and responsibilities in the organization, 2) to identify and create the best processes and practices for introducing throughout the organization 3) to coordinate the creation of management tools that serve the needs of the

users and then, 4) to arrange training on the matrix and how to operate in it for people who work on the different levels and positions in the organization. These actions certainly require a lot of time and effort from many members of the organization, but in the longer run, it would certainly be worth it.

5.4.2 Taking Advantage of the Strengths

One way to improve the organization and its functionality is to define and solve the problems. Another, or additional, way is to look for the positive areas and try to make them stronger. It is clear that in the case organization the people are the greatest resources. Keeping the people motivated and interested in their work is very important for success. The strong and wide personal networks and unofficial organization within the research community is a good thing and the relationships within the organization are one of the key elements of successful performance. Some key observations made about the positive things and benefits of the matrix structure in case organization are discussed in the following.

First of all, there is a marked emphasis on Theory Y mentality in the case organization (as described on page 16). It can be said, in light of the survey and the interviews that the people in the case organization resemble theory Y people. The "can do" attitude, pro-activeness, trust in peers and leaders, ability to do things and act independently and work without constant supervision, describe all the research staff, not only the managers. It should be noted that the people are treated well and their expectations and needs are taken into account on the individual level. It was said that one of the good things in the matrix organization is that people management and competence building are taken care of in the line organization and that way the challenging programs in SFA organization can have the best workforce to work in the programs. This allows the program teams to perform well and achieve the set targets. Paying attention to competence building by training people and giving them challenging tasks seems to be well done in the case organization and this is one of the most important and valuable things to emphasize in the longer run, too.

Freedom and flexibility to work on research topics is highly valued among the people in research and development, and that freedom and flexibility should be guarded in order to keep the motivation high and people performing well. However, in a complex and large organization, it is not possible to allow total freedom and flexibility for people to work as they please. The work and tasks need to be organized rationally and some bureaucracy,

rules and regulations are needed to keep the organization up and running. It is necessary to plan and follow-up resource usage as well as the outcomes of the work, otherwise it is not possible to measure how well the organization is performing and if the organization is working on the things that make sense. In the case organization it was mentioned as a good thing in the matrix structure that when the administration and management of the research work in programs is done by a program manager and on the program level, it makes the team members' lives more pleasant. It is seen that the research work organized in the SFA dimension gives more space and flexibility for the research team members and most of the unpleasant bureaucracy does not bother the staff as it did before. When the research work is organized in larger entities and a nominated person is responsible for the administrative work, it gives the maximum time for research team members to concentrate on the work itself. To keep this positive aspect strong in the organization, it is important to pay attention to the selection of the program managers and competence building for these people. A program manager needs to have technical competence, but s/he also needs to be interested in management responsibilities and have tolerance for the administrative work. A lot of people management skills are also needed. In a matrix, quite a lot of managers' time is needed for meetings, communication and administrative work and less time can be used on research itself. As mentioned in the response, the most competent technical people are not necessarily the best program managers.

Related to the people, as well as the interaction between the different parts of the organization, it is noteworthy in the case organization that it seems that the personal networks and unofficial organization play a really strong role. The competition between the two matrix dimensions, as described to be found on management level, is not perceptible among the research staff on grassroots level, which is very positive. It shows that people care about their work and the people around them, not so much about the organization and its complex structures. Maintaining the unofficial connections and strengthening the networks of people is needed especially when there are changes in the organization structure. This is important to keep interaction alive between the labs, with the customer organizations, and with research community outside the own organization. People who know each other also trust each other more. A strength found in the matrix is the natural mix of the people working in the strategic programs. People from different parts of the organization are assigned to work together towards a common goal on a program or some other tasks and that creates potential to cultivate stronger networks and build trust within the organization. Care should be taken that the people who need to work together also have

a chance to get to know each other better. Team building events, adequate communication and time spent together are needed to create the positive atmosphere and motivation to work and achieve together.

One capability in the matrix is the potential for renewal. Renewal is a major consideration in today's business environment and one reason for matrix form is the need for fast renewal. In the matrix, as there is the natural capability for creating wider networks, there is also a natural capability in the organization to renew itself when the people change their places after certain period of time. Renewal happens when the new programs are created to replace previous programs which have come to the end of their life cycle. The people are redeployed to work in different program teams, with the new people and the knowledge and competence of people is used efficiently to create renewal and change in the organization.

To summarize, the matrix organization structure was found to have created or strengthened certain positive aspects meriting attention, in order to maintain the research supportive culture in the organization.

1) Maintaining a level of competence in the organization

- line organization taking care of people's individual competence needs

- programs offering challenging tasks where the competence can be used

- selecting and training competent managers and leaders in order to match the organization's management skills with the requirements of the changing business environment

2) Freedom and flexibility in the working environment

- program dimension allows research staff to concentrate on research work, while competent managers are in charge of the administrative tasks related to research work

3) Co-operative culture

- increased interaction and strong networks of people

- working in matrix enables wider personal contact networks and increases the trust among the people

4) Potential for renewal through natural change

6 TACKCLING CONTINUOUS CHANGE

It is not necessarily the complex organization structure (matrix) that makes it challenging to manage the organization. It is the way the changes are handled. In any change it is necessary to keep in mind the people who are working in the organization. As mentioned earlier (page 16), it seems that the people working in the area of research and development have not changed much within the decades. It is the environment and competitive business world that require changes in organizational structure and ways of working. Managing the organizational change and taking care that the people learn how to work in the new organization after the change are the most important considerations.

In conclusion, it can be said that the matrix organization model in the case organization was a step to the right direction. The greatest advantage was definitely the increased cooperation and communication between the different functional parts of the organization. The risk that was taken was the increased complexity to manage the multi-dimensional organization and get it to function so that it would produce the research results fast and efficiently. At the time when the case study material was collected, the matrix organization had been operational for a year and it was certainly not yet mature, but still, much good has come about, at least from the program managers' point of view.

Later on, after the beginning of this study, the matrix organization as it was in 2005 was first modified by combining the three horizontally organized strategic focus areas into one entity in the beginning of 2006. The change did not have much effect on the organization as such, but it made the management and steering of the strategic research activities more unified. However, the actions needed to make the matrix work better did not proceed very well. It was decided in the summer of 2006 that the organization needed to be changed more radically in order to achieve more agility and get rid of the complexity in management. Adjusting the matrix was not seen as a good option, and the matrix in research organization was dissolved in the beginning of the year 2007. A team based organization was formed to replace the matrix structure. This change was possibly the biggest that had ever been made in the case organization, even bigger than the previous change from a functional organization to a matrix organization. The matrix was gone, teams forming bigger entities creating a functional laboratory structure. The horizontal

program dimension no longer existed, but many of the cross-functional strategic programs formed the basis of the new team organization and many of the program managers of these matrix teams became team leaders in the new structure. This move was a step towards a more flexible organization with easier management structure, but it can also be seen as a step back to the functional kind of laboratory organization and some disadvantages also need to be recognized.

The phase of having a matrix structure in the research organization can be seen as a unifying process and the matrix structure served that purpose well. The interaction and co-operation between the different parts of the organization was increased in the matrix. The natural change and renewal did happen and the new re-organized laboratory organization is based on the cross-functional teams formed in the matrix. The main idea in the team structure is to have the teams working on one project each, having the people located close to each other and the team is led by a dedicated manager, a team leader. This makes communication within the team easier and also clarifies the roles and responsibilities. But this change made the roles of program manager and competence area manager disappear, while the team leader is responsible for both, managing the work done in his/her team as well as the competence building and personal development of the team members. Care must be taken that the research staff does not suffer from the removal of the separation of competence management and program management, likewise that the communication through the teams and laboratories does not vanish. When there is no natural mix of people in programs creating a natural exchange of information through the different parts of the organization, interaction and collaboration need to be arranged some other way. The personal networks created during the matrix period is certainly an important way of keeping up the exchange of information and maintaining these unofficial connections between the different parts of the organization must be seen as a high priority.

The organization change in the shift of 2006 and 2007 was major and it certainly created the similar issues to solve as the change from the functional organization to the matrix earlier. In conclusion I would say that the lessons of the matrix organization, the problem areas listed on page 73, as well as the strengths formulated on pages 79-80, can be implemented in any re-organization or change that takes place in a research environment. No matter what the organization structure is, there need to be 1) clear roles and responsibilities, 2) clear processes, 3) management tools that serve the needs of the users,

4) a person in senior management whose role is to make sure that the organization works as it should work, 5) training for the people to make sure that they have an understanding of the organization and how they are positioned there and how they are expected to work in the particular setting. In terms of taking advantage of the strengths, the people are also the key to make things happen. To keep the people motivated and the performance level high, attention should be paid to ensuring that a) the individual competence needs are taken care of, b) freedom and flexibility in the working environment is ensured, c) the co-operative culture is maintained by emphasizing the personal networks and encouraging people to interact across the organizational boundaries, d) the renewal still goes ahead despite the fact that the natural renewal that was accomplished by matrix structure, is no longer there.

It is fairly clear that in the modern world of high technology and turbulent business environment nothing can be taken for granted except the need for continuous change and renewal. It can be seen that change is constant and the need to adjust to the demands of the environment must be accepted. Knowing this, it can be anticipated that the total clarity of e.g. roles, responsibilities and processes in the organizations cannot be achieved, at least in organizations with high complexity and large number of employees. In a research environment especially, it is seldom possible to provide the perfect setting and perfect resources to accomplish the work that is planned, because in R&D many things cannot be predicted very well.

Referring to an interesting article by Daniel Ward and Christopher Quaid (2003) about heroics, process and program management in organizations: " --- it is better to have champions working for (and with) you than zombies", and "---heroes are necessary for the life, vitality, and continued success of any organization", one might ask if the total clarity is even needed in research and development? This would be an interesting topic to study and discuss further. The point in Ward & Quaid's article is that the pursuit of a perfect organization and clarity of processes and procedures for achieving the best results, we tend to forget that the greatest achievements are often the outcome of some unexpected event or personal effort under not so clear circumstances. Action that is planned in detail and orchestrated to follow the exact rules may create inefficiency when there is no room to be creative in accomplishing the work in innovative ways. Perfect order to do things can create zombies, which are not wanted to sandbag innovativeness in an organization.

Instead of trying to create the perfect organization with perfect order and command, it could be better to tolerate some deficiencies and allow people to find innovative ways to manage the changing situations.

In today's world, due to the continuous change, there is seldom an opportunity to create perfect circumstances and resources to work on and get the things done. It appears that heroic activity is what makes the organizations work and achieve the best results, because the best skills and talent tend to emerge under pressure and when it is difficult to see beyond the obstacles and have faith and courage to carry out the work. When there are difficulties ahead, it is a place for a hero/heroine to step out and get things done: "They inspire groups, raise the benchmark on performance, and drive individuals to be better people or play a better game" (Ward & Quaid, 2003). It seems that success is always about the people, not only (or perhaps not at all) the structures or processes. In any effort at organization design and change this must be kept uppermost in mind, if success and high performance is pursued in the continuously changing circumstances.

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APPENDIX 1 Pre-interview themes and questions

May 2005

Organization/Program management

Experiences, opinions and impressions related to the job and tasks of a program manager, and managing the programs in the organization

Program Manager's job description
        The most important tasks
        What kind of characteristics program manager needs to have?
                Skills, competences
                Administration, technical skills, HR skills
                Personality

Program management in matrix organization
        Is the current organization functional in terms of running the programs?
        Challenges? How to manage those?
        Strengths? What is good? What is bad?
        Are the program managers doing their job as they are expect to do?

APPENDIX 2 Questions asked in the program manager survey

Program Manager Questionnaire Summer 2005

A   Background information

1   My program belongs to
     a) xx SFA
     b) xx SFA
     c) xx SFA

2   I am
     a) Finnish
     b) other nationality than Finnish

3   I am
     a) female
     b) male

4a   My program has activities in different countries.
      yes
      no

4b   If you have activities in different counties, in which sites?

5   What is your education and what kind of manager experience (project/line/program... manager) you have gained during your career before your current position ?

6   My program is managed as
     a) a big project (only program level codes, only program level pools in management tools)

b) one big entity with separate sub level tasks (work packages or projects have separate codes, but only program level pools in management tools)

c) a program with a separate project structure (work packages/projects have separate codes and own pools in management tools)

7   What is the size of your program

_____ person years

_____ Eur

8a   I have worked for the company

a) less than 5 years

b) 5 to 10 years

c) more than 10 years

8b   I belong to age group

a) under 35

b) 35-40

c) over 40

B   Program Manager's job and role

9   Mention at least 3 most important tasks in Program Manager's work:

10   Which skills and competencies are required from a Program Manager? Mention 3 to 5 that you consider important(e.g. administrative skills, technical competence, networking skills...):

11   What kind of personality a Program Manager should have (straightforward, passionate, interest in details...)? Mention 3 to 5 characteristics that you consider important:

How do you evaluate yourself as a Program Manager compared with your answers for questions 8, 9 and 10? What are the best qualities you have and what needs to be improved?

12   How do you manage the tasks that you have listed the most important?

13   How your own skills, competencies and personality match with the requirements you have listed in questions 9 and 10?

14   What would you like to say about your own motivation and commitment to Program Manager's job?

15   Other comments/feedback about Program Manager's job and role:

C   Program Management in Matrix organization

How does the current organization work in program management point of view (Laboratories - SFAs)?

16   What are the challenges and problems that you are facing in your work?

17   What is causing these challenges and problems and do you have suggestions how to solve these issues?

18   What are the strengths and positive things that you can find in the current organization model?

19   How could these strengths and positive things be enhanced and utilized better?

20   Other comments/feedback about Program Management and organization?

D   Responsibilities and communication in program environment

How the responsibilities are shared in your program? How much Program Manager is participating in activities of different areas and how much responsibility is delegated to/shared with the Work package/Task/Project Leaders or all program members? Who is taking care of e.g. planning, budgeting, technical details, using the management tools, technology transfer, reporting, giving presentations about the program and its contents etc.

21   What does the Program Manager do in your program?

22   What do the Work Package/Task/Project Leaders do in your program?

23   Do the program members (other than in leader position) have any special tasks besides the research work?

How is communication arranged in your program, how often and what kind of communication (meetings, seminars, e-mail, phone...)?

24   Internal communication - information sharing within the program?

25   External communication - information sharing with other NRC people than program members, customers, other interest groups?

26   Is there enough communication and information sharing about the SFAs and programs?

27   How well you think your program members know the program they are working for (goals, contents, plans, results...)?

28   Would it make a difference in program members' work if they knew more/less about the program they are working for?

29   What would you say about contact network and networking in program environment (importance, how wide the network should be, meaning of networking...)?

30   Other comments/feedback about responsibilities and communication:

E   Processes, tools and support for SFA work

Give your opinion about the current processes and tools related to program work (planning, administration, reporting, technology transfer...). Also give your feedback about the support that is available for managing the program, following the processes and using the tools.

31   How clear and easy to follow the current processes are?

32   Your experiences of using the management tools, good/bad ?

33   What is your opinion about program related reporting (financial, research results, technology transfer)?

34   What kind of support you have available when help is needed with management/processes/tools/reporting or other program related issues?

35   Are you happy with the available support and if not, what should be improved and how?
      a) Yes, the support is adequate and I'm happy with it.
      b) No, the support should be improved.
      Areas to improve:
      Suggestions how to improve the support:

36   Other comments/feedback about processes, tools and support:

37   Other comments and feedback related to the issues covered in this questionnaire?

Thank You for Your Time!