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APPLICATION PORTFOLIO MANAGEMENT

A starting point from the current situation at Volvo Car Corporation

ABSTRACT

This master thesis concerns the subject of application portfolio management. Today, major organisations have many information systems that form a very mixed collection of different systems and system connections. A common problem today is how to handle and gain control of this great number of systems. One way to handle this problem can be to use a management methodology. Using a case study performed at Volvo Car Corporation and literature studies, a model was developed in order to solve the problem. The methodology provides guidelines for handling current and future application portfolios. When creating the methodology we proceeded from the need of dynamic documentation, the life cycle and the application business contribution.

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This master's thesis is the result of 20 weeks of intensive study within computer science. The study has been done during the spring term 2002 at the Department of Informatics, School of Economics and Commercial Law at Göteborgs University and at Volvo Car Corporation in Torslanda, Sweden.

We decided to study the thesis subject, the problem with application portfolio management, because many larger organisations find it difficult to handle and have control over their application portfolio.

We would like to express our gratitude to a number of people who have helped us along the way and made the accomplishment of this thesis possible. First of all, we would like to thank Kjell Engberg, our tutor at the department of Informatics, for his encouragement, support, and feedback of our work. We are indebted to Volvo Car Corporation in Torslanda for giving us the opportunity to work with the interesting field of application portfolio management. Thanks to our tutors at Volvo Car Corporation, Mikael Bergman and Joakim Scholtz. We would also like to thank the involved people from Guide IT Consulting AB for their interesting thoughts and suggestions. Lastly, our thanks to the interview respondents for their valuable contributions to the thesis.

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Cecilia Gottling and Louise Torgnysdotter

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1 INTRODUCTION

In January 1999 Volvo Car Corporation was sold to Ford Motor Company, which means that AB Volvo and Volvo Car Corporation today are two separate companies. This position gives Volvo Car Corporation access to Ford's resources in the fields of technology, purchasing, marketing, distribution and financing. The accumulated synergies make it possible to race volumes, cut costs, improve profitability and, not least, lead the development of new products.

Volvo Car Corporation is owner to a wide application portfolio, which intends to support the business. The portfolio has been developed for decades, in different technologies and under different business circumstances. It is difficult to have the portfolio governance and there is a need for a better overview and a plan for how to handle different aspects of it, all from integration questions to life cycle issues.

The selling of Volvo Car Corporation to Ford Motor Company has made the problem with the application portfolio even more actual because it affects major parts of the organisations. AB Volvo and Volvo Car Corporation can no longer have shared systems with each other. The two companies can not have access to each other's information that exists in the shared systems. This is one major problem in the divorce process between the companies. The selling has also implied that Volvo Information Technology, which is the Volvo companies intern IT supplier, now is being seen as an external supplier to Volvo Car Corporation. Volvo Information Technology has been handling the entire IS/IT portfolio without any implications from the business and without any demands on specific costs. Today the situation is different. Volvo Car Corporation wants to be able to compare costs with other external suppliers and press down prices. Because Volvo Car Corporation today is separated from the Volvo concern, it is necessary for the business to get all the information about the IS/IT portfolio that Volvo Information Technology possesses.

Volvo Car Corporation has decided that it is a high priority matter to solve the problem of managing an extensive application portfolio, because they have no or very little control over their application portfolio. Applications cost a lot of money both to use, support and maintain. The current situation at Volvo Car Corporation also creates problems when running projects without securing that they are in line with future strategies from an IT perspective. Finding out how applications integrate with each other is another important issue. It is also of great interest to find out the state of the applications in the life cycle curve, to be able to answer questions like; Is it time to terminate or should we upgrade the system instead?

In the future it is most important for many organisations, in a competitive perspective, to have effective systems. Because of the technology demands, updating and implementing of new applications, it can be very difficult to find out which of the old applications is not needed. Therefore, the company gets an increasing number of applications, which requires resources both from a capital and effectiveness point of view. Some of the older applications can be superfluous and have qualities that have been replaced by new applications. There is, therefore, a great need to have an overview and details about the actual application portfolio, as well as strategies for a future portfolio.

1. 1 A GENERAL PROBLEM BACKGROUND

Major organisations have a lot of information systems. In most cases the information systems constitute a very motley collection of different systems and system connections. A common aspiration is to get control over this great number of systems. The complexity and extension make it very difficult to have an overview of the large number of systems. The reasons can be derived from the explosion of newly developed information systems that most organisations experienced during the 1980's (Magoulas & Pessi, 1998, p. 70).

It is important to understand how the role of technology based on information systems has evolved, in order to be able to manage IS/IT more effectively in the future (Ward & Griffiths, 1996, p. 1).

Since the 1960's, organisations have created information systems as support for the activities (Magoulas & Pessi, 1998, p. 34). Early in this century there was a vision that one could concentrate data processing and manage all information support within an organisation with a total integrated system (Putman, Barlow & Stilian, 1966, pp. 17-18). This vision failed on its own absurdity. During the 1970's departments within the company developed their own detached information systems. This idea grew stronger in the 1980's when the personal computer made its entrance. The result was great manual insets of transferring information between information systems. Further problems of inconsistency and double storing were another problem. During the 1980's the development of information systems accelerated at an enormous speed, however the integration often accorded to its own principles.

The last few years new approaches have grown into organisations, as a reaction to the traditional forms of organisations that have difficulties handling an increasing dynamic and complex environment. Traditional, obvious and evident organisational borders are no longer clear. This change has led to the fact that the organisation's external and internal environments have been more and more related to each other. The rapid development of information technologies has involved increased focus on how it is being handled strategically. Information technology management has more and more become a critical area for most organisations.

The world of information systems that exists in many larger organisations, has been characterized as problematical islands of information (see 1. 1. 1) and also as information of labyrinths (see 1. 1. 2). At the same time as the problems grow, the organisations of today become more and more dependent on the information systems and the information technology to reach success. In private trade and industry there is great need for a fast and effective adaption to an increasingly dynamic and complex business world (see 1. 1. 3). For this demand, organisations' collection of information systems plays an increasingly important role.

Organisations of today exist in complex, dynamic and competitive environments that produce problems. One problem that might occur is that organisations have to work with many different information systems to reach success. This can be next to impossible to control. It can also be almost impossible to shape many information systems, where there are many heterogeneous user groups. This situation can lead to that information systems do not help anyone. Changes can not be surveyed and often unsuspected consequences arise. When changes are being made in one specific information system, other information systems must be changed as well. Another problem might be that information within the organisation's information system is not available for everyone who needs the information. The information is many times in islands of information. This tends to mean that decision often must be made, without access to essential information that exists in the information system. Another dilemma can be that the same information is provided and managed in many different places within the organisation. This tends to increase the risk of poor information quality and increased costs for information handling. Another point of view is that it also takes a lot of time to develop new information

systems or to terminate existing information systems. Maintenance and management of existing system requires enormous resources. Development of new information systems is often delivered later and becomes more expensive than expected. It also takes a long time to terminate existing information systems. Integrations with other systems are difficult to make without making changes in existing information systems. This delays and makes the development process even more expensive. The effects of the disturbances in an information system are very difficult to isolate and the effects are reproduced easily in other information systems. Vulnerability also increases (Magoulas & Pessi, 1998, pp. 3, 12-13, 31-32, 34-36).

1. 1. 1 Islands of information

Islands of information are one of the most common occurrences in today's organisations. This is a situation where two or more information systems, with content that complements or overlaps, grow and develop separately from each other. The fast growth of information technology use in organisations, combined with an inactivity and inflexibility in existing information systems, results in other information systems develop, combining islands of information in the organisation (see fig. 1).

Islands of information create problems when different areas make their own information systems and do not consider the whole activity's need for cooperation. This makes cooperation more difficult when important and actual information is not available to the other information systems in the activity. Other problems that may occur because of islands of information are poor information quality, duplication of work, increasing costs and unclear areas of responsibility.

When demands for cooperation increase, it is usually then that detached information systems start to connect. This is being done more or less on an ad hoc basis which leads to even more problems, information labyrinths (Magoulas & Pessi, 1998, pp. 36-38).

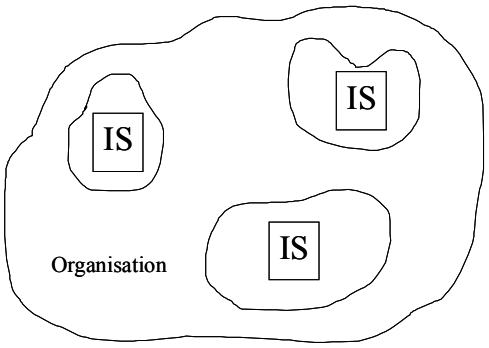

Figure 1 Island of information. Source: Own developed.

1. 1. 2 Information labyrinths

Information labyrinths are a phenomenon where two or more information systems are badly integrated with each other and cause different kinds of disturbances and problems. Integration means connections to other information systems as well as connections to the activity, which carry on within the information system. The integration can be like a "quick-and-dirty" effect to create ad hoc bridges to reach the system and by that eliminate the islands of information. The information labyrinth and its unforeseeable and permanently growing conditions, between both the information systems and the activity areas, leads to the fact that nobody gets control (see fig. 2).

Some of the problems concerning information labyrinths are their unforeseeability, inflexibility, high administration costs and slow change (Magoulas & Pessi, 1998, pp. 38-39).

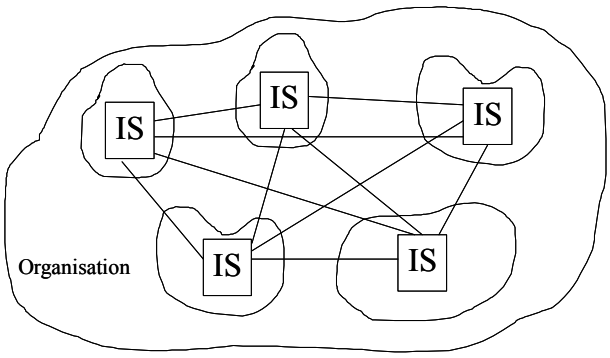

Figure 2 Information labyrinths. Source: Own developed.

1. 1. 3 Business orientation perspective

Companies' process- and system development is governed more and more by business ideas and goals. The effect of IS development is measured in terms of the contribution to the business goals and objectives. System development that does not contribute to development of the business goals should disappear, as it can not be motivated. There is no need for existing information systems that can not be connected to the business. Information systems have to be used, otherwise they should be terminated.

The companies today live with hard competition and demands on profitability from the owners. Information systems should be seen as strategic resources that support the business and they should be changed in the time that the business demands. People working with system development should became more business oriented and understand how information technology is being used in business.

Information technology development has been enormous during the last two decades. Strategic issues were in the beginning mostly technical but nowadays the questions are more business and activity based. A world of strongly integrated information systems means extensive costs for organisations. By having a more efficient structure of ones information systems, essentially cost reductions can be made (Magoulas & Pessi, 1998, pp. 58-59, 64, 67).

IS/IT planning evolution has gone from the computer room and through the IT department, and is today clearly a process that depends on users and senior management involvement for success. It is difficult to separate aspects of IS/IT planning from business planning. Therefore, it is really important to use the tools and techniques of business strategic analysis and planning to insure that IS/IT planning approaches are knitted into the business strategic management.

The investment in information systems and technology throughout an organisation can be directed towards the achievement of business objectives and goals. IS strategies must be developed within the context of the wider corporate and business strategic planning process. Success in managing IS/IT involves both maximising the return on investment of the money invested in information processing and enabling the strategic use of information. It is vital that managers of the business are involved in the process of information and systems planning. This means that the process must be clearly understood by those managers, by using tools that are familiar to them and in a language that they understand (Ward & Griffiths, 1996, pp. 44-45, 47).

There often exists a gap between the business and the IT department. It is important to try to understand the different perspectives in the organisation and get clarity regarding where improvements in cooperation should be made. To be able to try to solve this dilemma, it is important to encourage greater understanding for the other parts needs. When new IS strategies are going to be developed it is meaningful to hear the actual users opinions on an eventual implementation. The purpose is to bring business people and IT specialists closer together and thus develop more efficient systems.

1. 2 RELATED WORK AND ONE WAY TO HANDLE THE PROBLEM

1. 2. 1 Related work within system management

One of the perhaps most famous studies about system management was presented in a doctor's thesis written in 1980 by Lientz and Swanson. Their work was based on an investigation where computer chiefs in 487 different companies in the USA gave detailed descriptions of how they managed their systems. The result of that study showed that half of the ADB-organisation time went to maintenance. Lientz and Swanson came to the conclusions that there was a need for research regarding steering of system management. They also pointed out that the system users' role in the system management work should become more distinguished.

Another study about system maintenance management in the USA was performed between 1978-1984 by Bedifallah and Scacchi. They made two case studies and compared those with each other. The cases were two comparable word processors used at two academic institutes. They collected the data by interviewing the users of the systems. By doing this they tried to map the system maintenance work. Their conclusion was that how and why system management work is done depends on how the coordination work is performed. Another reflection they made was that in order to understand the problems in system management all of the ambient activities and the situation for the users and the system managers have to be understood. They showed how different people develop different roles regarding the use of the system.

In Sweden the project that Riksdataförbundet (today Dataföreningen) performed in 1980-1987 was exceptional within the system maintenance management area. Their main goal was to put together all existing- and to get new knowledge about system management. They wanted to create standardised concepts and stimulate the research and education within the area. They also wanted to move the system responsibility from ADB-staff to the activities. The result of the project was a general model for system management (Bergvall & Welander, 1996, pp. 24-32).

During the same period, 1984-1987, Riksrevisionsverket performed a maintenance revision where 20 civil authorities were investigated. Nine of them were more deeply examined. The investigation was issued from Riksdataförbundets project but also from Lientz and Swanson. They also had discussions with people qualified within the area. Riksrevisionsverket came to the conclusions that routines for system management should be developed parallel with system development. The report gave a number of suggestions on how to handle the maintenance problem, for examples improving ADB-systems anchoring and adaptation toward the business. Responsibility distributions, planning, control of the systems quality and use and control over the systems costs are things that can be looked at in order to achieve this. Further on, Riksrevisionsverket thought that organisations could improve system management by having better documentation and routines. They should also aspire to reduced person dependence (Riksrevisionsverket, 1987).

In 1996 one of the first academic works in system management was presented by Bergvall. The purpose of that study was to characterize system management, put brackets around established thoughts, and to study system management in as unprejudiced a manor as possible. Seven case studies were performed and the collection of data was gathered by self reporting, interviews and source studies. The most important conclusions in the present project is that system management being performed in order to adapt computer systems; also because there is a shortage of support methods for modification; and because the communication between users and IT staff functions very badly (Bergvall & Welander, 1996, pp. 32-35).

1. 2. 2 Related work within strategic IS/IT management

The earliest and most famous application portfolio model was developed by Gibson and Nolan (1974) and by Nolan (1979) during the 1970's. This model in turn used a hierarchical application portfolio model described by Anthony (1965). Anthony's model structured applications of three management activities, planning, control and operational. Nolan and Gibson did a study on the actual use of IS/IT and they proposed a model with four different stages of growth. Later Nolan added two more stages. The stages were initiation, contagion, control, integration, data management and maturity. The analysis involved six aspects of IS/IT and its management in the organisations that they studied. These were the rate of IS/IT expenditure, the technological configuration, the application portfolio, the data processing (IT organisation), IT planning and control and lastly the user awareness.

Traditional portfolio models consider the relationship of systems to each other and the tasks being performed rather than the business contribution. But in 1984, McFarlan and McKenneys developed a model that considered the relationship with business success. The model proposes an analysis of all existing and planned information systems into four categories based on current and future business importance. McFarlan and McKenneys', application portfolio matrix or Strategic grid, is one of the most referred to models for classification of applications. The model is issued from the strategic meaning of current and planned information

systems. The model has two dimensions; the strategic meaning of existing information systems and the strategic meaning of planned information systems (Magoulas & Pessi, 1998, pp. 205-207; Ward & Griffiths, 1996, pp. 2-3, 32).

During the 1980's Sullivan did a study of how 37 companies in the USA performed their information system planning. From the result he suggested a simple matrix to explain how forces outside the control of organisations were affecting the information system planning environment. He described two dimensions; the degree to which an organisation becomes dependent on information systems to carry out its activities and the degree of importance information systems have on the organisation (Magoulas & Pessi, 1998, pp. 207-208; Sullivan, 1985, pp. 73-81).

Ward and Griffiths explores the impact that information systems have on business performance and the contribution IS makes to the strategic development of organisations. According to Ward and Griffiths, it is important to manage the application portfolios with the businesses goals and objectives in mind. An IS/IT organisation is to support the business and therefore consideration should be given to the business and its processes. Their book, Strategic Planning for Information Systems, describes IS tools, techniques and management framework. It identifies opportunities for strategic thinking and shows how IS is an indispensable component in the implementation of a strategic plan. The book focuses on strategic planning (Ward & Griffiths, 1996).

1. 2. 3 One way to handle the problem

When looking at management of companies application portfolios, it is not enough to use only system maintenance methods or strategic IT management. We believe that in order to get control over application portfolios and to get wholeness it is necessary to combine both system maintenance methods and strategic IT management tools. Other ways of handling similar problems probably exist and our way is just a suggestion for a solution.

To have an overview and control over the application portfolio it is necessary to have a dynamic documentation, a system to keep track of all the applications. This system has to contain information about the applications and it is important to identify what kind of information the users want to know about the applications. There is also a need to find all the current applications and by that get the As Is portfolio. In order to do this we believe that parts of the system development methods can be used.

Another important issue that appeared during our analysis of the problem was the distribution of responsibilities. It is important to define the distribution of responsibilities, such as system owner, responsible person for technical development and drift, etc. It is also important to create motivation to use and maintain the system. To cover this specific area we decided to use the existing theories and models about system management.

To get control and structure over the application portfolio and to be able to make future decisions, we are going to study and use a number of different theories. Applications need to be classified so organisations can plan for the future and be able to reach the To Be portfolio. Applications can be seen as products that evolve over time with different uses at different periods. Therefore, we are going to use the product life cycle model when creating the application portfolio management model. The product life cycle model was derived from an analysis by Higgins in 1985. We believe that maintenance of applications differs depending on were in the product life cycle the applications are. We are also going to use the Boston matrix, which is based on the product life cycle model, for the same reason. This matrix was issued by the Boston Consulting Group. To be able to create a management model for the application

portfolio it is also important to get some kind of view on how important the different applications are from a business perspective. To cover this particular area we are using the application portfolio matrix developed by McFarlan and McKenney in 1984. It is important to observe that any simplification of a complex set of problems has its limitations and that the matrices are very simplified, and to make it more realistic other variables have to be considered.

Figure 3 shows the way to handle the whole application portfolio. It is important to understand the problem and find the current application portfolio in the activity. It is first when it is known what one has got that one can measure and be able to manage applications in the future.

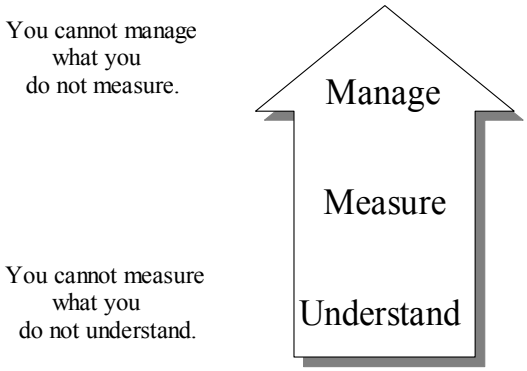

Figure 3 The application portfolio management process. Source: David Marco, 2002, URL http://www.dmreview.com/master.cfm?NavID=193&EdID=4963.

1. 3 PURPOSE AND QUESTIONS AT ISSUE

The purpose of our work is to create a management methodology regarding management and structure of an already existing application environment. The management methodology is created to eliminate the problem with the missing overview and the lack of structure. The report will also state the reasons why the management methodology is a good way of handling an extensive application portfolio. Some questions at issue are:

- How should an application portfolio management model be created in order to migrate from the current incomprehensible system environment to a comprehensive and meaningful environment?
- What existing theories can be useful when creating of the application portfolio management model?
- Why is the application portfolio management model a good way to solve the problem?

This report is meant specifically for people within Volvo Car Corporation involved in application portfolio management but it also turns to other organisations with the same or similar problems.

1. 4 DELIMITATIONS

1. 4. 1 Delimitations within the report

This report is not going to result in a designed and implemented database. Regarding the inventory, this report is only going to collect certain information about existing applications, their name and contact persons. No examining of the applications life cycle state are going to be done. No classification from a business perspective of the applications is going to be made.

1. 4. 2 Delimitations within Volvo Car Corporation

Volvo Car Corporation Information Technology is the IT department within Volvo Car Corporation that supports all the processes and their IT. This case study is concentrated within Volvo Car Corporation Information Technology and within the department Business Administration (see fig. 4).

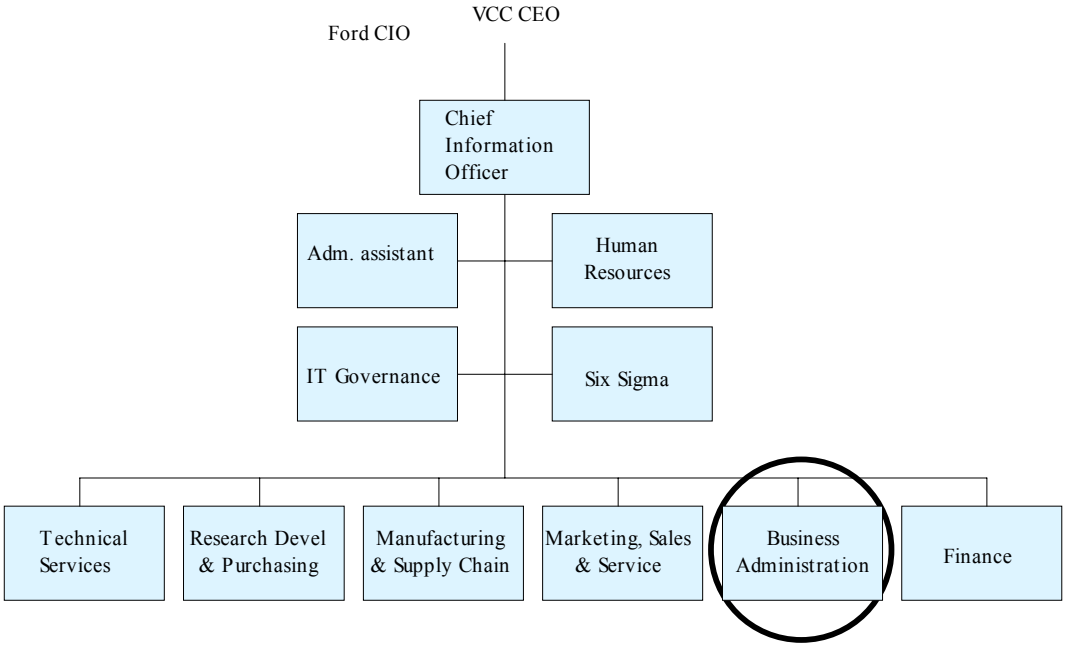

Figure 4 The organisation chart for Volvo Car Corporation Information Technology. Source: Volvo Car Corporation Information Technology with own modifications.

Business Administration handles backoffice functions and business support. The department handles five different areas, which are Finance, Human Resources, Intranet, Collaborative Services and Project Management (see fig. 5).

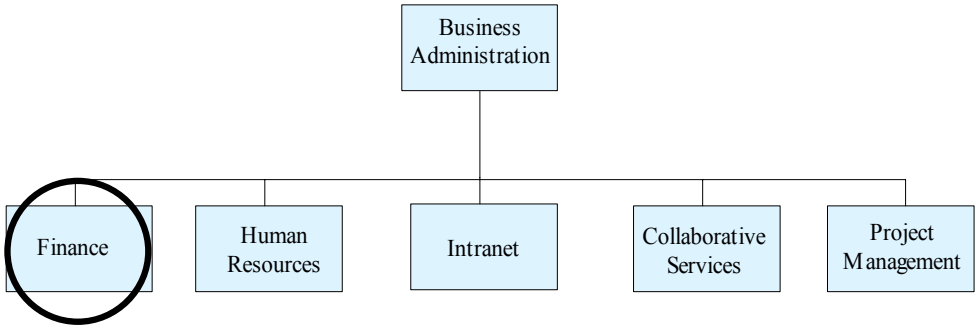

Figure 5 The organisation chart for Volvo Car Corporation Information Technology Business Administration. Source: Volvo Car Corporation Information Technology with own modifications.

Due to a limited time frame this study will focus on all running and new applications provided by ongoing projects within the area Finance. The Finance area supports all customers that work with financial control, reports and follow-ups. It also supports business planning and forecasting. Moreover, the study has made a geographical delimitation and will concentrate on applications located in Göteborg, Uddevalla, Köping, Skövde, Olofström and Gent.

1. 5 IMPORTANT CONCEPTS AND ENLIGHTENMENTS

We want to introduce a few fundamental concepts and enlightenments regarding our work.

We have decided to use the concept *application* as a cohesive collection of automated software components, procedures, and data supporting business objective. It consists of one or more components, modules or subsystems. It is frequently used synonymously with system, application system and information system. An application is a program that is able to run by itself.

The concept *application portfolio* means in general the collection of applications, i. e. those tools or facilities that a business or an organisation is using in their process (Ward & Griffiths, 1996, p. 32).

There are a lot of different names and abbreviations in the organisation, Volvo Car Corporation. We are going to use most of them in this report and therefore we want to state the different concepts. Volvo Car Corporation is often called Volvo Cars and its abbreviation is VCC. Volvo Car Corporation Information Technology is often called Volvo Cars IT and its abbreviation is VCC IT and VC IT. The department Business Administrations abbreviation is BA.

Lastly, we would like the readers to observe that the references to sources are always presented at the end of a section. One or several sections can have the same sources but we have chosen to put the reference at the end of the last section. The page reference is guidance for a quick and easy way to find the original source. In those few cases where no page references are listed the text above is a summary of a whole literature collection.

2 METHOD

A method is a way to solve a problem. Different studies require different methods to present a reliable solution for the problem. The purpose of this chapter is to describe the course of action within the collection of the required information that was needed in order to solve the problem and to fulfil the purpose of this report. We are going to give a detailed description of the different methods and techniques that can be used to solve the problem and our motivation for using them.

2. 1 THE RESEARCH PROCESS

2. 1. 1 Deduction versus induction

There are two different ways to reach conclusions, deduction and induction.

Deduction is built on logic and means that a logical conclusion is valid if it has a logical connection. On the other hand, the conclusion does not have to be true in the meaning that it agrees with reality. Theories are the starting point in the deductive research from which the researcher derives hypotheses, which then steer the research process. In the deduction perspective the individual is a spectator or observer of the world around (see fig. 6).

Induction is built on empirical analysis and means that public and general conclusions are made from empirical facts. Induction presumes quantifying. It is important to know that an inductive conclusion never can be one hundred percentage correct, because it is established on empirical material which seldom constitutes a complete enumeration. On the other hand larger or minor probabilities can be reached. Observations and analysis of phenomena are the starting point in the induction research which derive hypotheses and eventual new theories. In the induction perspective the individual is a part of the world around (see fig. 6) (Backman, 1998, p. 47; Befring, 1994, p. 14; Thurén, 1991, pp. 19-23).

We have been working inductively which is the explorative way. We have from the discovery and gathered information formulated a general theory. We felt that making the deduction to set the hypotheses and then trying it in reality did not suit this specific problem. We did not know what kind of information Volvo Cars IT wanted and how this information should be read and we did not have an available theory. Therefore, we could not relate the results to an already existing theory.

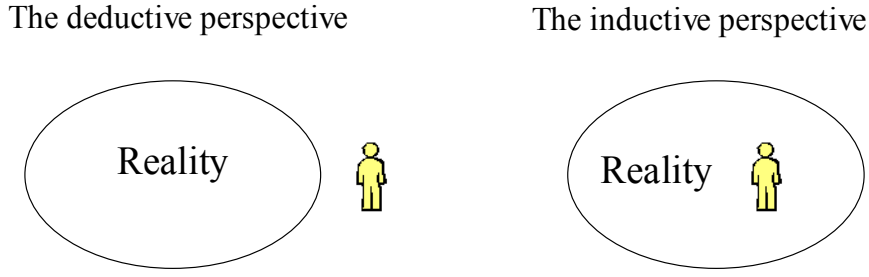

Figure 6 The deductive and the inductive perspective. Source: Backman, 1998, p. 47.

2. 2 SCIENTIFIC METHODS

The scientific method refers to the scientific way of approaching the theme that shall be written about and how to treat that subject (Ejvegård, 1996, p. 29).

2. 2. 1 Quantitative versus qualitative methods

There are generally two different methods for tackling a problem, qualitative methods and quantitative methods. The two methods give different results which are appropriate for different problems and situations. The methods can be used separately or be combined.

The quantitative method aims to describe and explain the thing that has been investigated (Patel & Tebelius, 1987, p. 45). The quantitative methods uses measurement, quantified by mathematics and statistics. They result in numerical observations, or are transformed into those, so that the researcher can perform a statistic analysis. The quantitative method answer questions like how much, how many and how often. The answers can be measured.

The qualitative method uses qualitative information like interviews, document analysis and observations. The qualitative method is characterized by the lack of figures and numbers. They have as a result written or oral formulations. The qualitative research shows a certain predilection for the use of case studies as an ingredients in the scientific work. Questions like whom, how, in what way, and why are often used in the qualitative method. The answers are expressed as words and sentences, rarely as numbers (Backman, 1998, pp. 31, 48).

In this investigation we have used the qualitative method because it is the most suitable solution for this report's problem and purpose. We wanted to investigate the application portfolio management problem in its realistic world and we got a good look of how huge the problem really was.

It is also possible to use a combination of both quantitative and qualitative methods in order to solve the application portfolio management problem. Regarding the case study, it would have been most interesting to measure how many applications VCC IT BA had in the different stages in the product life cycle and in the different squares in the application portfolio. This would have resulted in an analysis of the organisation's application portfolio. Unfortunately, this would have been too extensive for our time schedule because VCC IT BA has a huge number of applications and has, for the moment, a lack of structure in the portfolio.

2. 2. 2 Description

The simplest method is description. This is a description of how something is, what it looks like, how it runs, etc. But this is not as simple as it may seem. All the facts being collected have to be categorised, classified and used in order to show something. There has to be a connection in the description and the researcher always has to make a selection. The facts that are described need to be correct as well as relevant (Ejvegård, 1996, p. 30). The researcher can focus on describing relationships that have already taken place or on conditions existing right now. The researcher can also describe the background and the consequences of different phenomena or describe relationships between different phenomena (Patel & Tebelius, 1987, p. 54).

We were using the description method in order to describe the current situation at VCC IT BA and the background to this kind of problem. We have also used the description method in order to get some foundation while working with the method for managing business application portfolios. We have described different theories and models used both from a business perspective and from an IT view.

2. 2. 3 Explorative investigations

This investigation's purpose is to explore and can be used when a problem area is not known or when available information is hard to come by. The purpose of an explorative investigations is to gather as much information as possible about a certain problem area. This is often done by investigation lay ups and techniques that gives verbal information (Patel & Tebelius, 1987, pp. 53-54).

We have also chosen to do an explorative investigation because we have explored the problem with application portfolio management at VCC IT BA. We have gathered information from people in the business in order to find out why this is a problem and why it must be solved. During the explorative investigation we noticed how important it is to be creative and full of ideas to get the essential information.

2. 2. 4 Case study

The case study is useful in most scientific investigations together with other methods. One purpose of the case study is to take one little part of a bigger process and with this minor case describe reality (Ejvegård, 1996, p. 31). A case study, like the qualitative strategy, investigates a phenomenon in its realistic environment (Backman, 1998, p. 49).

We have done a minor case study in order to look at the problem in its real environment, this to easier understand the application portfolio management problem within major organisations. As described earlier, we came in contact with Volvo Cars regarding their problem with the overview and control over the application portfolio. The case study itself was to find out what information Volvo Cars IT wanted about their applications and also to find all running applications within a specific area. The case study is descriptive in the way that we describe the current situation today, but the study is also explorative when we explore different ways of solving the problem. The delimitation only investigates VCC IT BA's situation but it is also possible to perform several case studies within different organisations with the same or similar problem and compare the organisations. This is a way to get a more comprehensive report.

2. 3 SCIENTIFIC TECHNIQUES

There are many different techniques that can be used in order to collect information. Depending on the research problem, it could be everything from taking measures (natural science), of for example reaction rate, to taking notes when doing an interview (Patel & Tebelius, 1987, p. 83).

2. 3. 1 Literature search

Before and during the research process, it is a necessity to read and study earlier documentation within the selected area (Backman, 1998, p. 26).

Literature studies usually require a literature search. In research, literature is all kinds of material, such as books, articles, reports, essays, etc.

It is necessary to have a basic understanding of the area the researcher is about to investigate. Finding the right literature can be done by using the libraries databases, consulting with librarians, check interesting literatures list of references and scanning encyclopaedia for more references.

Some literature can be easy to find while others can be more difficult. In those cases where there is a lot of literature to study, it is important to sort out the relevant information. Some suggestions are to check the table of contents, view registers of things and names, read a summary, abstracts and key words. If the literature is very extensive this is a good way of getting a quick idea of what is important. One risk is that a book can have a poor table of contents, an incomprehensive summary and no register. This will make the book useless even if the book is valuable for the study.

One problem with literature studies is that it can be very difficult during the searching process to get the primary sources. This is because many authors refer to others who refer to yet others and so on (Ejvegård, 1996, pp. 42-43).

In order to get some answers to the main purpose in this report, it felt most important to search for knowledge about the problem and to find earlier solutions and research about the topic. During the whole process with the report we made parallel literature studies.

We have as far as possible tried to reach the primary source by searching for the original at libraries and via different search tools like databases and Internet.

2. 3. 2 Interviews and inquiries

To find opinions, thoughts, knowledge, etc. within a population, interviews and inquiries can be used. The interview is a verbal communication while the inquiry is written. The inquiry is often a questionnaire that is distributed to a large number of people. These techniques are good because they can be used in almost any type of investigation. If possible, it can be a good idea to contact experts. They can help make observations about problems with the questions and correct them as accurately as possible before the investigation starts.

It is important to be well prepared when doing interviews so that they do not have to be done again. The best way is to take notes when interviewing because this tends to have the least inhibiting effect on the respondent. The most common way is to interview one respondent at a time.

The inquiry is much simpler, cheaper and less time consuming than the interviews. With inquiries the researcher can reach many people and get written answers which are easier to handle. Furthermore, the people get the same questions and it is easier to compare the answers.

Interviews are most appropriate when experts are to be questioned and when strict facts are wanted. Inquiries are more suitable for questioning ordinary people and when attitudes and opinions are wanted (Ejvegård, 1996, pp. 44-46, 49-51).

As we described earlier, VCC IT BA needed to gain control and an overview of their application portfolio. We started our investigation by finding out what kind of information Volvo Cars IT wanted to have about their applications. To be able to study this we thought that qualitative interviews were the best choice. We chose to use interviews to prevent falling off when we knew that people in the business were very busy and because interviews need a shorter preparation time. Another reason was that we wanted to make personal contact and build trust to be able to directly solve eventual misunderstandings. We wanted to get their opinions about our work and about the system that would be created. We thought about the kinds of questions we were to ask in order to get the essential information. We got the names of the people in the business and in the IT department that we turned to for the interviews from our tutor at VCC IT BA. The interviews were first sent by email where we briefly described the study plus a proposal for some attributes. This gave the respondent the opportunity to prepare for the meeting and to go through the attribute list him/herself. In Göteborg we made an appointment with the respondents and met them in person. We did not bring any prepared questions but the interview became more of a conversation or brainstorming where we went through the proposal for the attributes and they gave their opinions on the list. Regarding the respondents in Uddevalla, Köping, Skövde, Olofström and Gent we used phone calls and email to carry out the interviews. We tried to have an objective and neutral attitude in order to reach as reliable result as possible. To ensure the answers we took notes during the interviews instead of tape recording. We wanted to avoid the inhibiting effect on the respondent and we did not want the interview to become too extensive.

Even though we did not use inquiries they can of course be used in similar cases. Inquiries can be better to use than interviews because they can reach a larger number of people and the group being measured would be larger. It is also easier to handle a large number of respondents when using inquiries. One disadvantage when using inquiries is that it is not possible to be one hundred percentage certain that the answers come from the right respondents.

2. 4 THE GATHERED DATA

2. 4. 1 Primary and secondary data

The gathering of new material and new information is of vital importance for all investigations. This is usually described as the data collection. A difference is made between primary data and secondary data.

Primary data is new information that the investigator him/herself has to gather in order to get more information for his/hers study. It could, for example, be collected by making interviews.

Secondary data is data that already exists. That data that has been used by others (Befring, 1994, p. 19).

In this investigation we have used both primary and secondary data. Secondary data is gathered from books, articles and reports but also from Internet and internal material from Volvo Cars. The primary data came from interviews and discussions that we have had with people at Volvo Cars. The investigation is based on interpretations and conclusions from the collected secondary data and on the relative primary data.

2. 4. 2 Criticism of the sources

To be able to make a judgement about facts or experiences it is necessary to critically check the material. This means that the researcher has to find out when and where the material was created. Furthermore the researcher has to know why the material was created. Finally, it is important to know if the originator has knowledge about the subject. It is important to use all kinds of material and not just the material that supports ones ideas. By only using certain material it can create a false picture of the subject. Therefore, it is essential to also submit and discuss contradictory facts. The researcher should always try to use the primary source. In general, it is always better to use a newer source than an older because the new one usually contains more facts and newer findings without missing earlier important facts (Patel & Davidson, 1994, pp. 55-56; Ejvegård, 1996, pp. 59-61).

We have critically viewed all gathered information, both regarding the primary and secondary sources. As far as possible, we have tried to reach the primary source with all secondary data.

2. 5 COURSE OF ACTION

The course of action that we proceeded from in this study is the development process called the waterfall process, developed by Royce in 1970. The process has a fairly small number of identifiable parts. These are usually the five phase analysis, design, implementation, testing and maintenance. Because the process aims to help humans understand something, and humans like to identify parts of things, the process has a small number of identifiable parts. This is also the reason why we wanted to use this development process, to visualise the way we worked. In this case we have modified the development process so the parts are the three phases analysis, inventory and management (see fig. 7).

The process implies that the activities are being done one after the other and for each activity being performed. The waterfall model is based on the assumption that humans do not make mistakes. If it were possible to make perfect decisions all the time it might be the way things worked. Unfortunately, it was not possible in our case because new information constantly became available. In practice, it is necessary to revise earlier decisions in the light of later experience. Therefore, we have chosen to draw this waterfall process with additional backward arrows, to reflect this reality, like some kind of iterative process or feedback which is necessary (Royce, 1998, pp. 6-8; Stevens & Pooley, 2000, pp. 47-48).

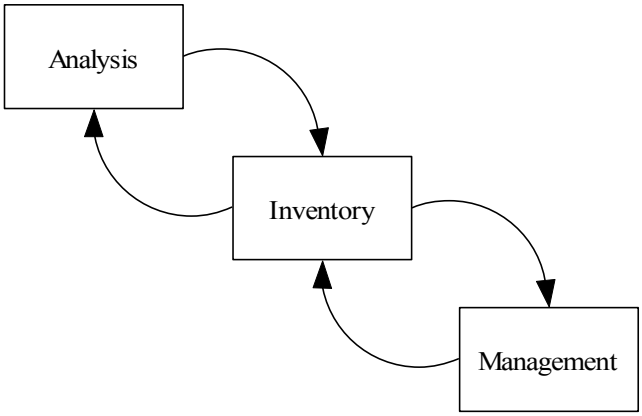

Figure 7 The waterfall process with correction. Source: Stevens & Pooley, 2000, p. 47 with own modifications.

Modern development processes see repetition as fundamental, and try to provide ways of managing, rather than ignoring, the risks. Risk management is a large and extremely important topic. One example is that any time you make a decision, you run the risk that it is wrong. More importantly, the later an error is discovered, the harder it is to make it right. Therefore, it is important to control risk by discovering errors as soon as possible. Anything which increases confidence that the stated requirements are correct reduces risk.

Boehm's spiral process, developed by Boehm in 1988, is another approach of the development process that we also have used to visualise the way we worked. This development process is also based on our phases and is a bit more comprehensive than the waterfall process. The spiral starts from the centre and is a project that follows the process of going through successive risk analysis and planning, analysis, inventory and management phases. The spiral has multiple iterations which try to reduce the abstraction. The number of iterations is arbitrary (see fig. 8) (Boehm, 1988, pp. 61-72; Stevens & Pooley, 2000, p. 48).

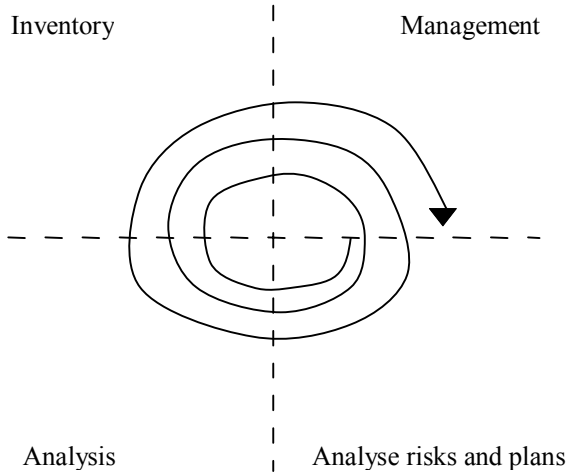

Figure 8 The spiral process. Source: Stevens & Pooley, 2000, p. 49 with own modifications.

In our course of action we used the waterfall process, with our three phases, to step by step reach a solution to the problem. We also found it necessary not to ignore eventual risks that might appear during the process. Therefore, we decided to also use Bohems spiral theory because it is more comprehensive and covers risk management. We thought that the combination of these two theories resulted in a good way of handling the problem.

3 SYSTEM DEVELOPMENT ANALYSIS

In order to create a methodology for maintenance of the application portfolio, we need to find out what information managers want to know about the applications and we also have to absorb all of the present applications. To do an analysis of relative attributes and to collect applications, we are using the system development analysis tools.

The purpose of the analysis phase in the system development is to get a picture of the reality that you are about to model. The analysis is also used to find out what kind of information that will become part of the system. The model will later became the foundation for the information system that you will design and construct but without the technical aspects. The important thing in the analysis phase is the problem area. The different steps in the analysis phase do not need to follow a specific order. It is possible to jump from one activity to another and prototyping is strongly recommended.

System development starts to create a model of a delimited field of activity, an area which has a problem to solve. The model is the foundation for an eventual implementation but also has the purpose of working as a means of communication between all parties concerned. The idea is that the description will be understood in one way for all those involved (Apelkrans & Åbom, 2001, p. 15).

The first part of the application portfolio investigation is to do an analysis of the specific problem and define the stakeholders.

3. 1 THE ANALYSIS METHOD

3. 1. 1 Analysis of the problem area

The problem area is the part of the environment that is administered, monitored or controlled with help of a computer system. In other words, the things the system is about. The problem area includes the part of the real world that the system is to administer, monitor or control.

The analysis of the problem area answers questions like what the project is all about and what the system shall be used for (Mathiasson, Munk-Madsen, Nielsen et al., 1998, p. 25).

Volvo Car Corporation case:
The project at Volvo Car Corporation concerns application portfolio management. Business requirements as defined by ongoing and planned projects have demands for new and improved functionality in the applications and the integration of the applications. VCC IT BA is missing an overview and details of the actual application portfolio as well as strategies for a future portfolio. The current situation creates problems in analysis and design of new solutions that are necessary to meet the business requirements. The purpose of the project, at VCC IT BA, is to create a dynamic documentation of the existing application environment. The purpose is also to establish a foundation for governing the portfolio that supports each business process and also to better understand how relationships between applications affect and support the goals the organisation wants to achieve. The system will be used to provide the decision makers in the organisation with a foundation for decisions about their current application portfolio and its IT related issues,

in the area of functionality, quality, cost and business benefit. The application portfolio management is done to guarantee time, cost and quality aspects.

3. 1. 2 Analysis of the user area

The user area is an organisation that administers, monitors or controls a problem area. You can say it is a part of the user organisation. It is the relationship between the problem area and the user area that gives the computer system its meaning.

The analysis of the user area answers questions like, for whom the solution of the specific problem is relevant and important. It can be a good idea to make some kind of stakeholder model (Mathiasson, Munk-Madsen, Nielsen et al., 1998, p. 20).

Volvo Car Corporation case:
At VCC IT the solution for the application portfolio management is of great importance. Applications cost money like any other resources. There are two targets groups within the application portfolio management system. On one hand we have the information owners, and on the other hand the decision makers. The information owners are all those people who have the information about the applications. They are the ones who have to provide the system with the input about the applications. The decision makers are the people who require information from the system in order to make good strategic business decisions. The decision makers can be application owners, business process owners, IT governance responsible, application portfolio steering committees, change management boards and ongoing projects. Sometimes a person can be both a decision maker and an information owner. The interested parties at VCC IT are finance, purchasing, security, technical service, ongoing projects, IT support, production development, marketing sales and services and manufacturing and supply chain (see fig. 9).

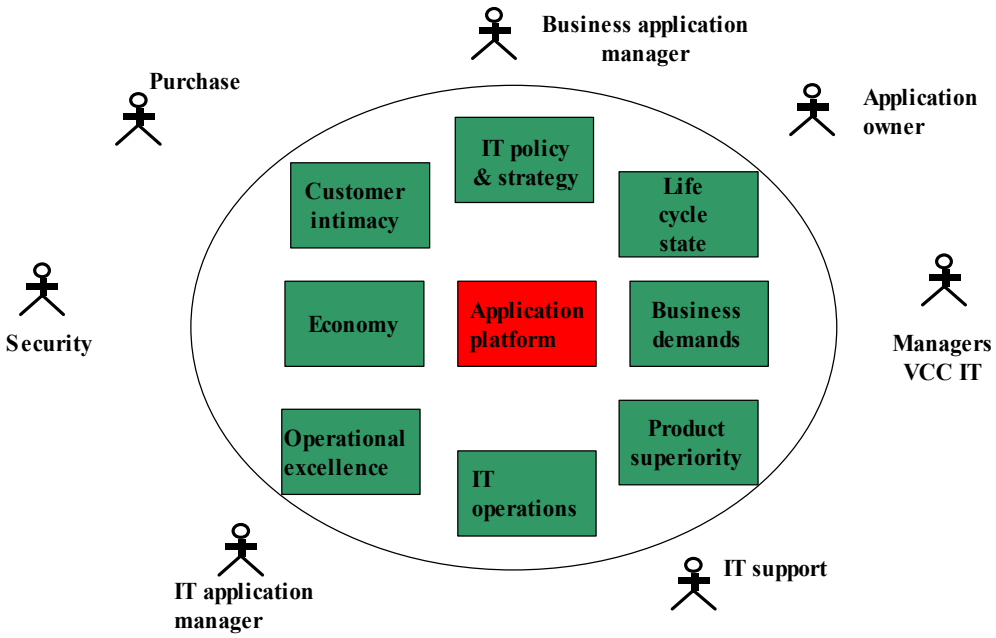

Figure 9 The stakeholder model of the Volvo Car Corporation case. Source: Own developed.

3. 1. 3 Describing the current situation with rich pictures

Rich pictures is a means by which pictures create a common understanding about the situation in a comprehensive and vivid kind of way. When you do this, you should be flexible and open for a discussion. The use of rich pictures is very useful to get an overview of the situation. When we work with rich pictures we are trying to reach knowledge about and feeling for essential relationships in the situation that we observe. At this point it is much more important to sense the essential relationships than to systematically deal with them (Mathiasson, Munk-Madsen, Nielsen et al., 1998, p. 39).

Volvo Car Corporation case:

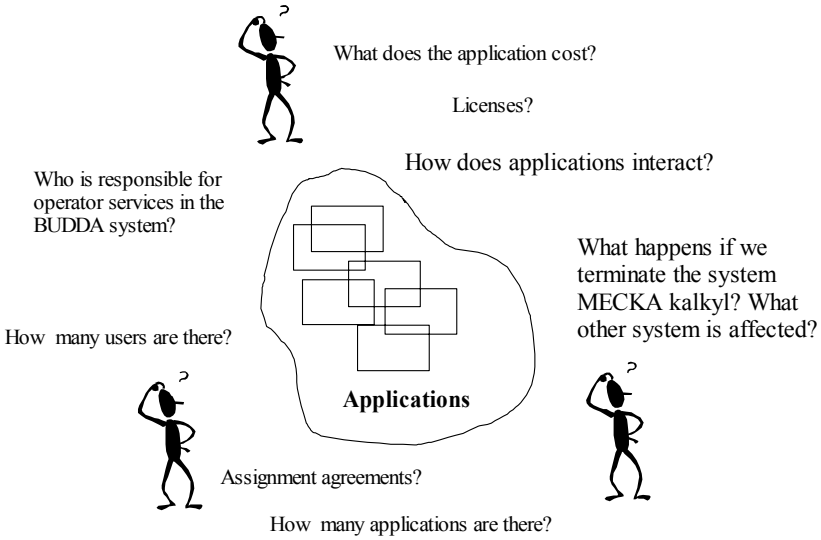

Figure 10 The rich picture model of the Volvo Car Corporation case. Source: Own developed.

3. 1. 4 System definition

The purpose of focusing on the current situation and thinking of new solutions is to get many relevant opinions and possibilities. The project scope should be short and precise and contain the most fundamental decisions concerning development and use. This supports the overview and makes it easier to compare (Mathiasson, Munk-Madsen, Nielsen et al., 1998, p. 37). The system definition is a statement of what the system is to produce. It says in general terms what the system will do, what functions will be part of it and which users it will service. It will also state what will not be part of the system. (Brown, 1997, pp. 190-191).

Volvo Car Corporation case:
This is a system to keep track of all the existing applications and their interaction with each other. The system will produce different reports from the stakeholders' perspective. Today, there is no definition of what kind of reports that the system will and will not produce, but one

example could be to answer the question; applications per life cycle state and number of interfaces grouped by total maintenance cost (see fig. 11).

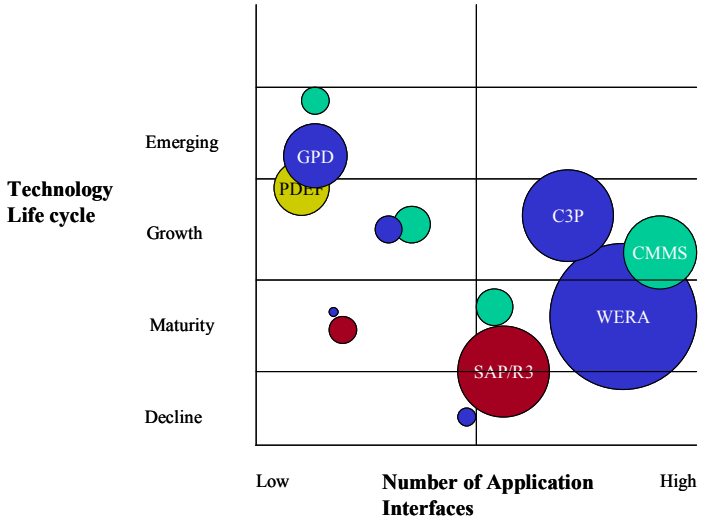

Figure 11 Applications per life cycle state and number of interfaces grouped by total maintenance cost. Source: Own developed.

3. 1. 5 Attributes

In the analysis phase of the system development it will be decided which data should be stored in the information system. The attributes show what the information is needed for. (Andersen, 1994, p. 285). Attributes are data elements carried by an entity that describe it and record its state, the things we need to know about our objects. In order to find the attributes, you can together with people in the organisation, the users, go throw the model and just list as many attributes as you can think of. There usually will be no problem coming up with a solid list of attributes. It is also important to define the attributes. For all except the ones you are quite familiar with, have the users tell you what each attribute is and use your judgement as to whether it is something that should be documented (Brown, 1997, pp. 69, 332).

Volvo Car Corporation case:
In order to find all the attributes, all the relevant information, about the applications, we interviewed people (the interested parties) in the business. We turned to both people in the IT organisation and to people in the ordinary business to find out what information they would like to receive from this kind of system.

One difficult task was to find the right amount of attributes for the applications to be assessed. Do not define too many attributes, or end users will not fill in all information, and do not use too few because the future system will not supply correct information and the system will have no value.

The attribute list is a suggestion for what information that can be part of the application portfolio system. The attribute list is based on the stakeholders at Volvo Car

Corporation perspective but can also be used as a reference document in other organistions. The attributes are grouped into different headings that during the interviews appeared naturally and they are not listed after specific responsibility roles. The attributes are listed in the appendix 9. 1.

3. 1. 6 Object model

Object models are the foundation in the object oriented design and are often used both in the analysis phase and in the implementation. The object model is a good way of quickly mediate which entities and conceptions that is handled in a system. An object model shall be as simple as possibly so that the users can understand it.

Volvo Car Corporation case:

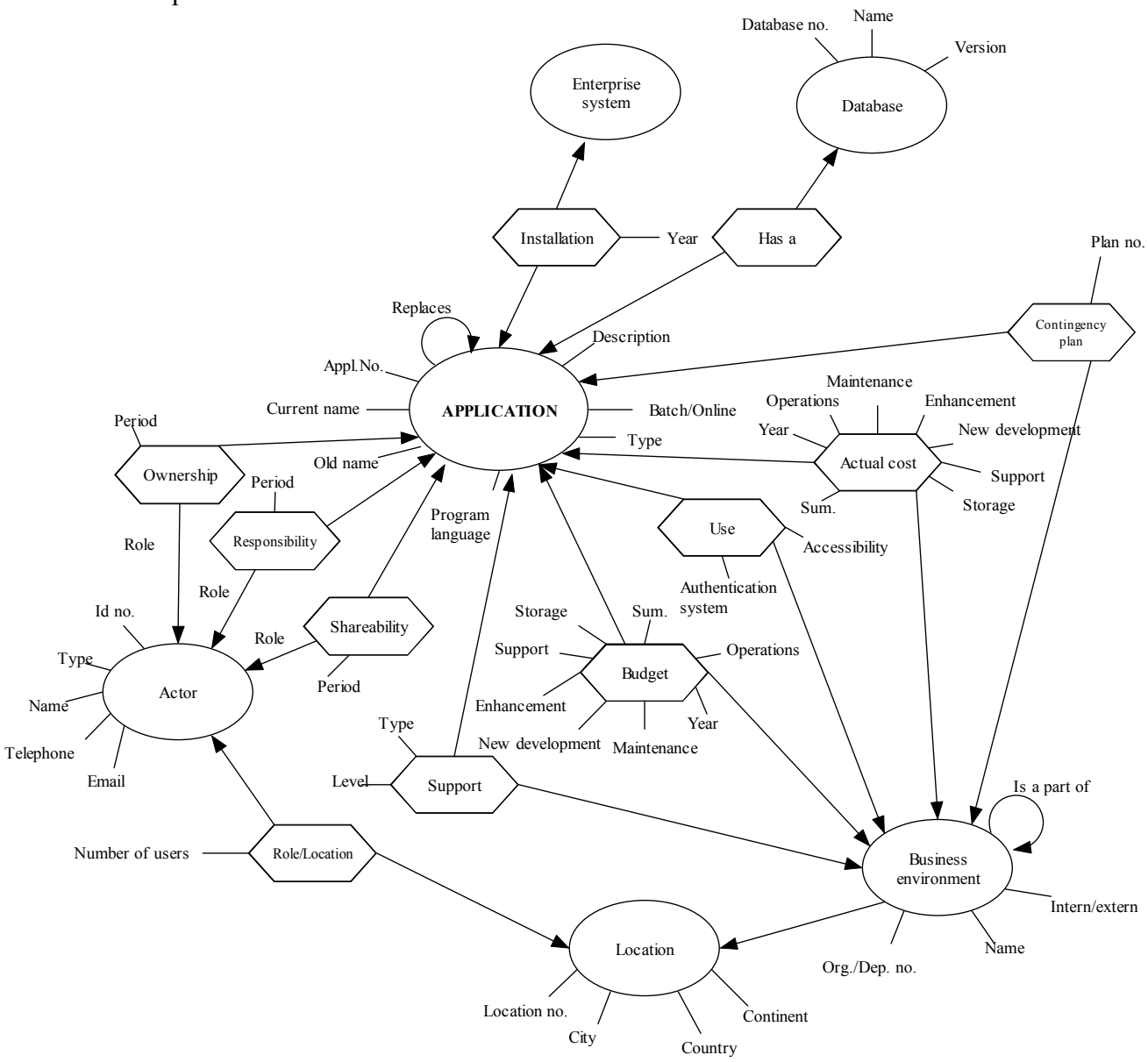

Figure 12 The object model of the Volvo Car Corporation case. Source: Own developed.

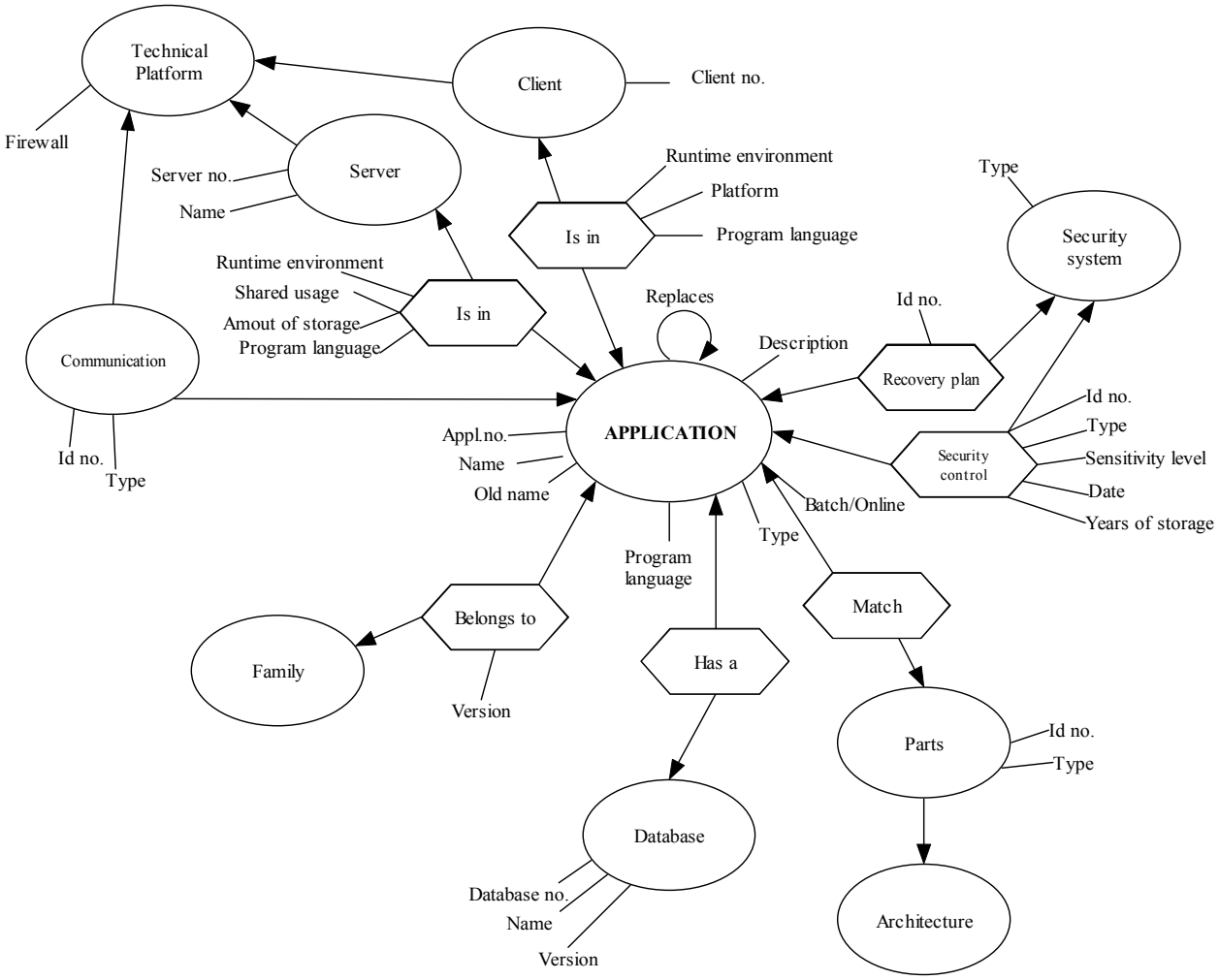

Figure 13 The object model of the Volvo Car Corporation case. Source: Own developed.

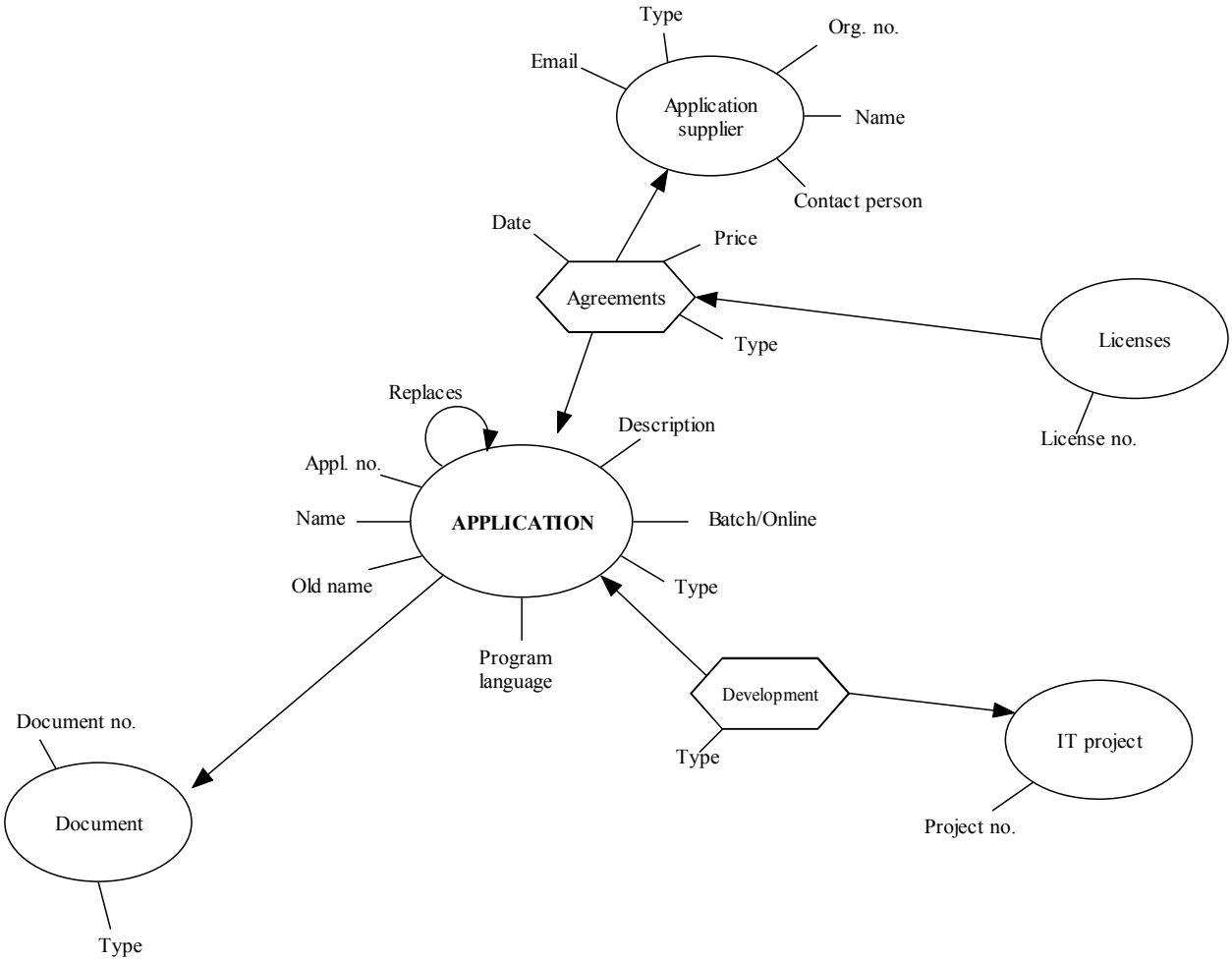

Figure 14 The object model of the Volvo Car Corporation case. Source: Own developed.

4 THE INVENTORY

Another part in the application portfolio management project was to do the inventory of all the existing applications in use and also the new applications soon in use. Applications can consist of one or several levels (see fig. 15). VCC IT wanted the inventory to include local excel sheet used as "application", therefore we proceeded from this application level and included the excel sheets in the inventory.

We turned to Volvo Information Technology and got an invoice list of the applications that they operate. We also worked together with other projects running in the business to secure that we had found all running applications. Lastly we gathered the information by interviews via personal meetings, mail and phone with people at Volvo Car Corporation and at Volvo Information Technology.

An important part in the inventory was not only to find the applications but also to find all ongoing projects that in someway would affect the current applications. Otherwise this system was doomed to failure from the start.

One question was how we were to be sure that all the application had been found. This was done by checking against the invoice list that we got from Volvo Information Technology and also by talking to people in the organisation to check the lists.

A list of VCC IT BA's applications are not presented in this report due to reasons of security.

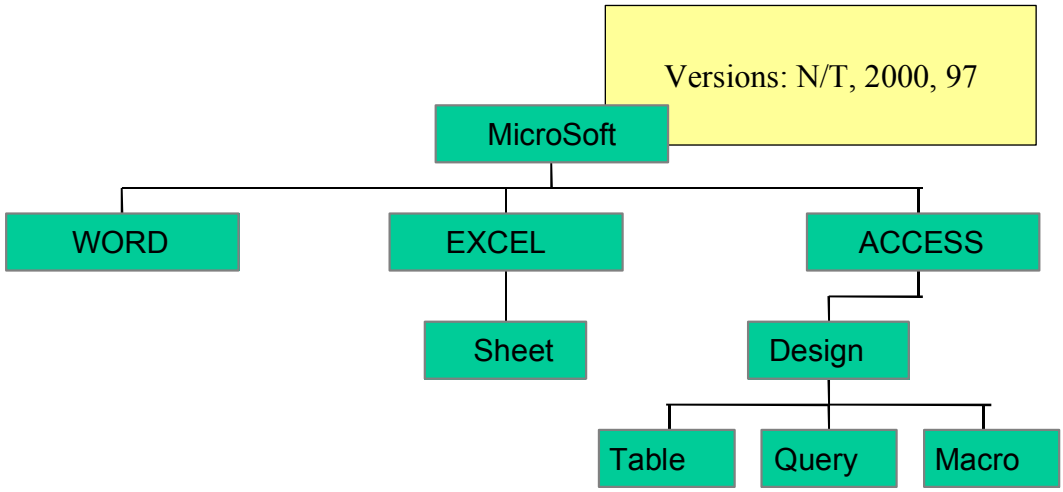

Figure 15 The application levels. Source: Own developed.

5 SYSTEM MANAGEMENT

"System management are all of those activities that are being performed in order to prepare, steer, administrate and perform the work with changes of existing objects and to support users" (Brandt, 2000, p. 11).

System management has existed as long as system development. As soon as an information system has started running changes arise. There can, for example, be changes in the business, changes in the computer environment or needs of new functions. All of these changes release a maintenance action in an information system. System maintenance is to continuously steer and change information systems, to secure its value in the activity. System maintenance is also about making an information system better in a constantly changing business environment. It has become natural to investigate how systems should be handled in order to follow the activities goals and objectives (Bergvall & Welander, 1996, pp. 9-12). The main reason for the increasing interest in system management during the last years is probably that organisations no longer can avoid the increasing resources that system management demands. Another possible reason is that the gathered value of the existing systems increases. Therefore, it is natural to investigate how the systems should be handled to respond to their organisations' expectations. Even though there is an increasing interest in system management there is still a lack of methods, techniques and tools that characterize system development (Nordström, 1993, p. 3).

5. 1 THE SYSTEM LIFE CYCLE

The system life cycle can be divided into three phases; new development, maintenance and termination (see fig. 16). System maintenance is a continuous process during the systems lifetime that begins when a system starts to operate. The maintenance phase includes further development, management and operation. In this section the focus lays on the management process.

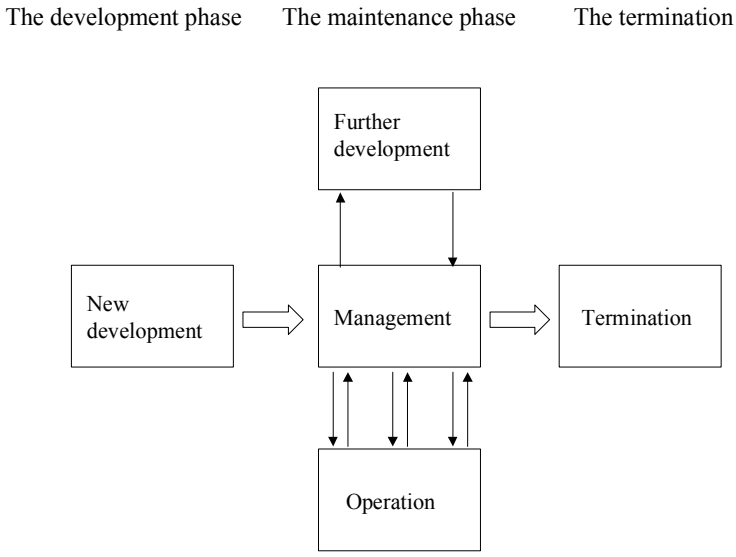

Figure 16 The system life cycle. Source: Bergvall & Welander, 1996, p. 20 with own modifications.

5. 2 SUCCESS FACTORS TO MANAGE THE APPLICATION PORTFOLIO SYSTEM

A system that keeps track of all the applications has to contain the correct information all the time to have a value for the business. We have defined six success factors in the management process that have great influence on the management success process. They are to define management, identify the management object, create motivation, define roles, create meetings and define routines for future inventory (see fig. 17).

It is necessary to define the term management so that people in the organisation have a common picture of what is going to be a part of the management procedure. The next factor is to identify what object will be managed. It is important to create motivation to use and manage the information in the system. Another important issue is to identify and define roles and responsibilities within the organisation to clear out who is going to do what regarding the system. The absence of a clear organisation, roles and overall coordination creates conflicts and inefficiencies. Resource conflicts between different projects are created, caused by unclear coordination of resources for maintenance and development. Unclear and undefined roles force the organisation to establish temporary solutions. Business organisations dedicate resources to manage IT related issues, instead of focusing on the business. The meetings are important to steer the application portfolio in the right way and to follow the future demands. Lastly, it is important to define routines for future inventory in order to keep the information up-to-date.

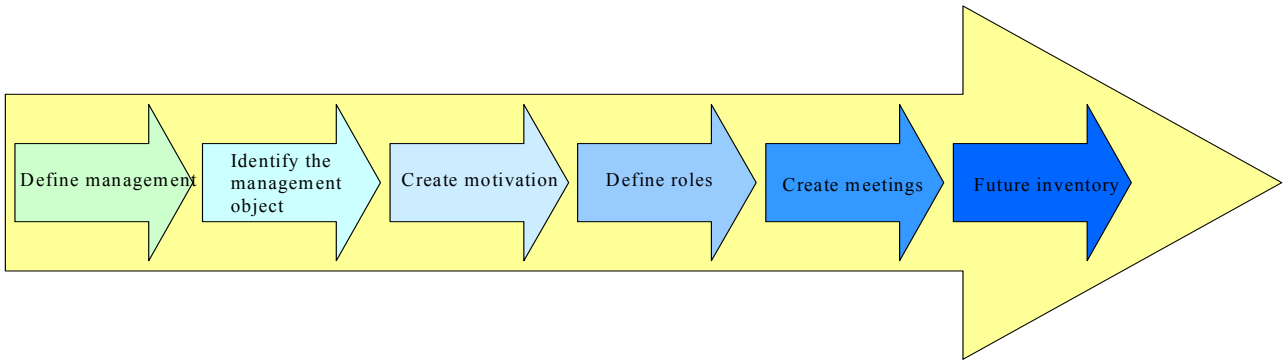

Figure 17 The success factor performance arrow. Source: Own developed.

5. 2. 1 Define management

The definitions of management vary a lot between organisations and within organisations. They can vary from being only corrections in information technology support to all actions taken after new developments. In other words, management can be a single action or a number of activities which carry through when the system is in use. Therefore, it is very important to decide a common definition from case to case. It is also of importance that everybody who gets involved in the management of a system has a common picture of the management for just that specific system (Nordström & Wealander, 2002, p. 4).

5. 2. 2 Identify the management object

The management object is that which is going to be maintained. In this case the management object is a system. One problem today is that many organisations just manage the mechanical parts and forget the activity and its business. By separating the information technology support and the activity like this, IT support tends to not support the activity in a desirable extension. Finding an optimal management object is an important key to success in the management work. This system model also includes layers of the business activity, product/process and technical platform to be as complete as possible (see fig. 18).

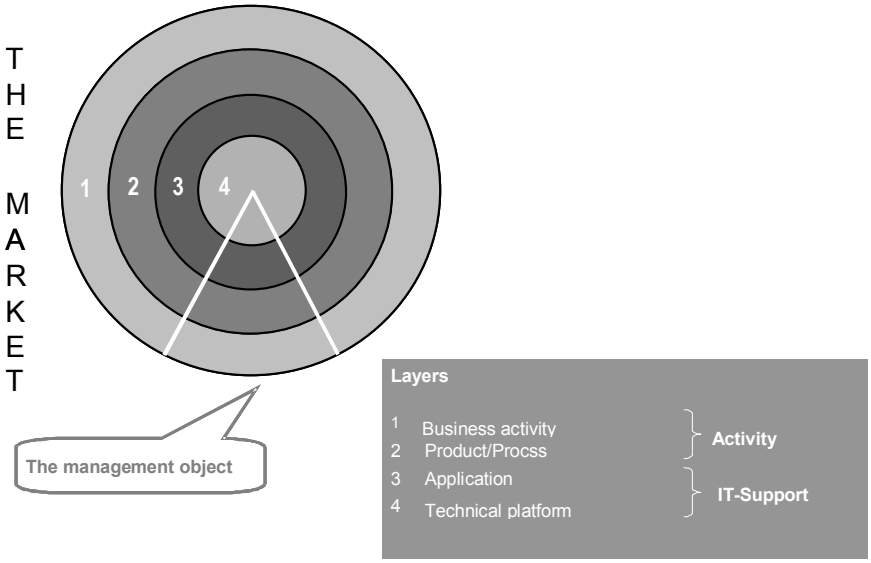

Figure 18 The system model. Source: Nordström & Wealander, 2002, p. 5 with own modifications.

The piece of cake in the system model illustrates one management object in an organisation. One management object should therefore include pieces from all the four layers.

Because the management wants to handle changes, it is important that the whole object follows with changes. The business activity makes the interface to the market. When the market changes the business activity must adapt to satisfy the markets needs. It is yet not obvious that the IT support will follow. To ensure that the activity does not falter in IT support, one must observe the whole management object. An IT support is an integrated part of the activity and can never be an end in itself (see fig. 19) (Nordström & Wealander, 2002, pp. 4-5).

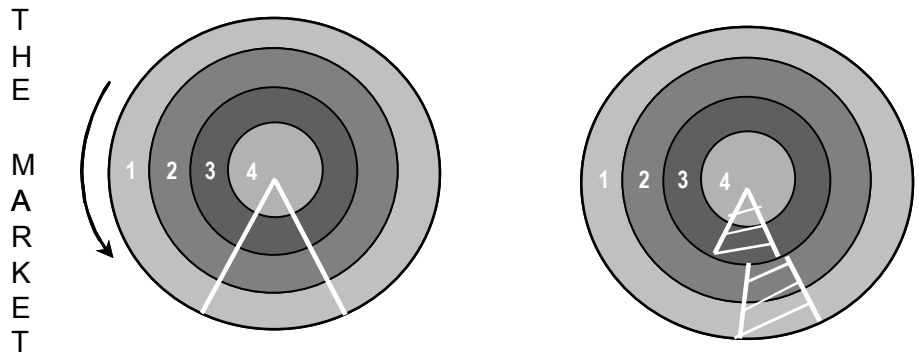

Figure 19 The markets' changing and the effect of a pure application management. Source: Nordström & Wealander, 2002, p. 5 with own modifications.

5. 2. 3 The cycle of motivation

Employees that will be affected by a new information system will assess if the rewards match the effort they put into their work. It is often up to the project manager to assure that people view the exchange as being in their interest and therefore are willing to make the effort. The basis for this is to understand individual motivation. People are willing to do things if they are acting in their best interest and if they are achieving their personal goals. Those who implement information systems have to consider what the interests are and work to help people satisfy them. In doing so people will respond positive because they will meet their needs and do themselves a favour.

Motivation is a decision process through which an individual chooses desired outcomes and sets in motion behaviours that will help achieve those outcomes. The cycle of motivation developed by Huczynski (1996) shows this (see fig. 20).

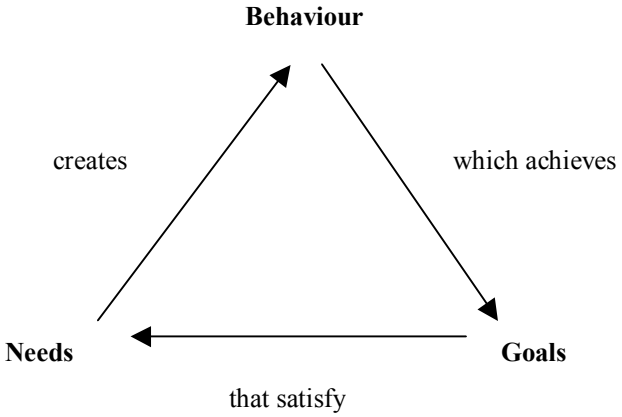

Figure 20 The cycle of motivation. Source: Huczynski, 1996, p. 100.

Psychologists disagree about needs and research shows that these are complex. Still practical guidelines for the manager are needed. The cycle of motivation is one way of guidance for motivational aspects of information systems. It is a theory which is understandable, portable and practical, even if it lacks sophistication (Boddy, Boonstra & Kennedy, 2002, pp. 146-147; Huczynski, 1996, pp. 99-101).

5. 2. 4 The roles

Different characters, roles, will be responsible for keeping the data in the system up-to-date in order to secure the systems. Within all organisations the distributions of responsibility is a central question to consider. Someone has to be responsible for those actions that have to be performed. How organisations choose to distribute the responsibility can vary within different organisations. The responsibility can either be concentrated to the management positions or spread out in many different levels within the organisation. The responsibility can furthermore be distributed on one or several persons in one function in the business or distributed in several functions. The responsibility is not always clear and some people can have a lack of interest in

taking responsibility for their actions. The responsibility for a working task can often be unclear and this causes problem. This problem can lead to the fact that a person performs actions that are not his or her responsibility. The result can also be, and this is much worse, that no one performs the important actions because everybody thinks that someone else is doing it! This can have serious consequences and should be avoided (Bergvall, 1995, p. 43).

Today there are no defined roles within VCC IT. In this report we are using the material which are under construction both within Ford Motor Company and VCC IT. We are also using scientific literature and our own ideas. These roles are general and can be used in other organistions with the same or similar problems. This is a proposal about who is going to be responsible for a certain issue. Everyone should know what responsibilities and authority they have. There should not be any uncertainty on how a certain decision is to be taken. The primary role for the IT organisation is that it should support the business. Only the business organisation can define the business requirements and must also make the necessary decisions about what IT services that are needed. The IT organisation has the primary role of advising the business about technical solutions, explaining the consequences of different alternatives and delivering the decided solutions (see fig. 21).

A role is defined by a set of responsibilities and authorities that are needed to fulfill a specific task. A role is also separate from a specific person and the formal position within the line organisation. The role requires certain skills and competencies. One person can have several different roles.

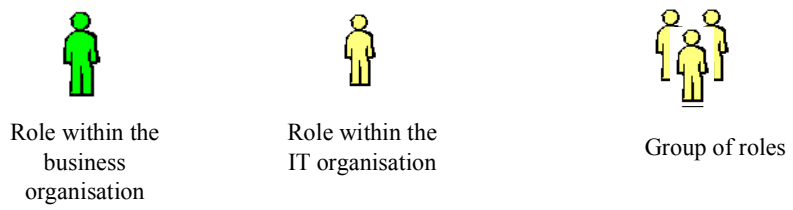

Figure 21 The general group of roles. Source: Volvo Car Corporation Information Technology.

Between the business and the IT organisation there are different perspectives. The IT organisation has the primary role to support the business with IT solutions that increase efficiency and create competitive advantages. Even so it is important to state that both the business organisation and the IT organisation have a shared responsibility for the IT solutions. The business has the primary responsibility to define the requirements and to manage the use of the solution within the organisation, for example, the business focuses on processes, functions, information quality, information structure, flexibility and total costs. The IT organisation has the primary responsibility to design and deliver solutions that meet the business requirements and to secure and maintain the services. For example, the IT organisation focuses on application services, data storage, data access, data integrity, integration and security. The complete role model should cover all roles within these domains (see fig. 22).

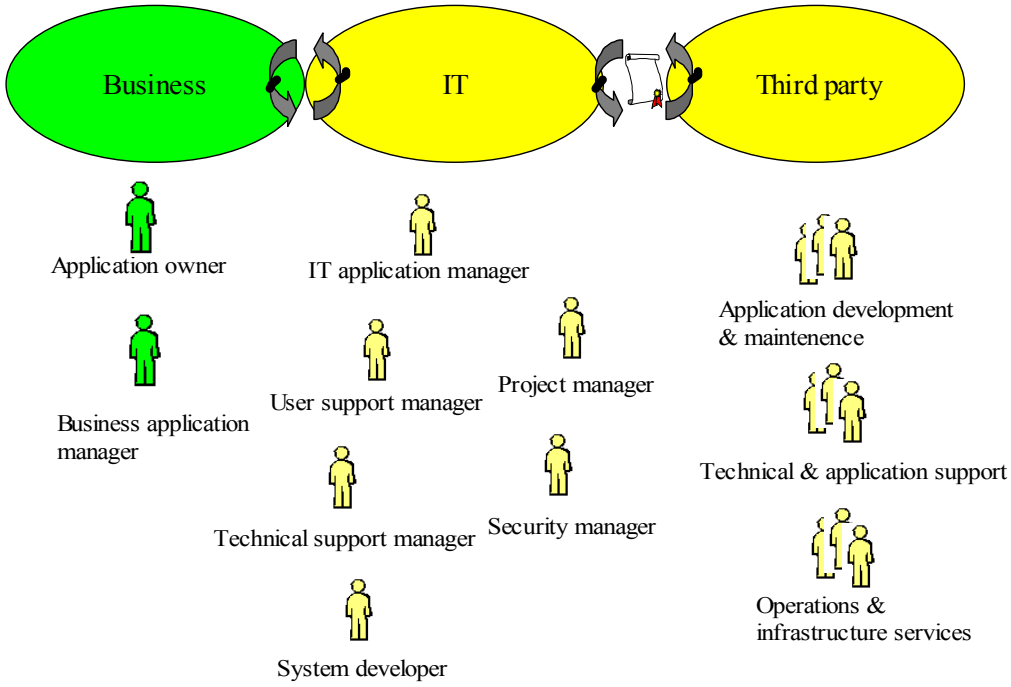

Figure 22 The role model. Source: Volvo Car Corporation Information Technology with own modifications.

Suggestions for the main roles are the application owners, the business application managers and the IT managers. The application owners are defined in order to assign a clear accountability from the business for each application. The business application managers are defined in order to dedicate and allocate necessary resources to coordinate the use of the application within the business organisation. The IT managers are defined in order to build and maintain competence on the application portfolio and to establish a central point of coordination for planning and coordination of maintenance and development within the IT organisation. The third party roles are the ones that manage the outsourced parts.

The system management organisation is divided into three levels (see fig. 23). In the steering level, goals, frameworks, guidelines and the distribution of responsibility are set. Here there is a need for overall business competence. On the administrative level, the needs are captured and priorities and plans for operations are decided. Here there is a need for business and application competence. On the last level, executive, the running activities are performed. Here there is a need for different competences, everything from applications to other IT support (Révay, 1992, p. 38).

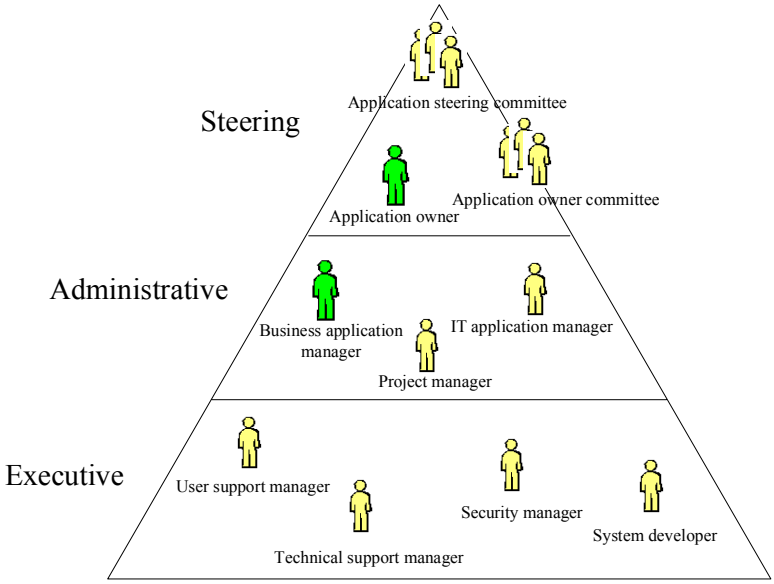

Figure 23 The organisation role pyramid. Source: Own developed.

Below follows a description of all management roles and drafts for their responsibilities. Regarding the application portfolio system, the role responsibility is just suggestions from the attribute list and is not comprehensive (see 9. 1). In the system for the applications, every role has the responsibility to make sure that the information about him/herself is up-to-date, for example email address.

Application owner:
The application owner is the owner of a specific application. He/she represents the business organisation that is the primary user of the application. He/she is also a member of the application steering committee (see Application steering committee p. 39).

The application owner's responsibilities are:
- Makes decisions and approves major changes in the application. The decisions are based on recommendations from business application managers and IT application managers.
- Defines the business requirements, on a strategic level, that the application should fulfil.
- Main responsible for the total budget for the application.
- Assigns budget and funding for application maintenance and development.
- Assigns roles and resources in the business organisation for coordination and development.
- Responsible for the information.
- Main responsibility for seeing that computer laws are being followed.
- Main responsibility for the authority for the application.

The application owner is a decision maker and one of the end users of the system for the applications. He/she uses the system in order to get relevant information about the applications and to be able to make decisions. He/she is mostly interested in the economic aspects. The application owner has full access to read in the system. Regarding the responsibilities towards the system for the applications, the application owner is:

- Responsible for seeing that the application is being used.
- Main responsible for the information quality and structure.
- Main responsible to see that the information is continuously up-to-date by delegating the responsibility for the information inventory to the concerned parties.

Business application manager:
The business application manager coordinates the use and the development of the application on a central perspective assigned from the application owner. He/she represents the application owner and the business process that is the primary user of the application. He/she is also the primary channel between the business and the IT organisation.

The business application owner's responsibilities are:

- Identify areas of improvement. Coordinate, evaluate and prioritize requests for changes. These requests are provided by the IT application manger.
- Make decisions and approve limited changes of the application, within defined commission. The decisions are based on solutions provided by the IT application manager.
- Responsible for the quality of data and information structure.

The business application manager is both an end user and an information owner. He/she has full access to read in the system and can write and change the attributes he/she is responsible for.
In the system for the applications the business application manager is responsible for:

- Seeing that application identification and general information about applications are being inserted in the system, for example application name, description, type of application, processes, the location of users and the total number of users.
- Gathering some given information about global applications. One example is the total number of users for the application. He/she has to make sure that he/she gets this information from every area/city/country where the application is being used and then put together this information.

IT application manager:
The IT application manger coordinates all technical development and maintenance of the application, in close cooperation with the business application manager. He/she is the primary channel between the IT organisation and the business. He/she is also the primary channel to the third party, for example suppliers.

The IT application manager's responsibilities are:
- Responsible for the applications agreed functionality and correctness.
- Identifies and propose areas of improvement to the business. These suggestions are given to him/her from the user support manager. The IT application manager forwards this information to the business application manager.
- Deliver solutions based on defined business requirements.
- Makes decision on technical maintenance of the application, within a defined budget.
- Responsible for planning and coordinating all IT related activities regarding maintenance and development of the application.
- Coordinating resources for application support and training, for example helpdesks.

The IT application manager is both an end user and an information owner. He/she has full access to read in the system and can write and change the attributes he/she is responsible for.
Regarding the system for the applications, the IT application manager is responsible for:
- Seeing that general information, information about suppliers, economically attributes and business contingency plans are being inserted into the system, for example licenses, budget, actual cost and supplier contact persons.
- Providing the business application manager with all the requested information, for example location of user and the number of users at that location.

User support manager:
The user support manger is responsible for the daily use of the system from a local perspective. He/she is the primary channel between the users and the IT application manager. He/she is also a user of the application and has good competence and understanding of both the business and the application. He/she works together with other user support managers regarding global applications. This role can exist both in central and local departments.

The user support manager's responsibilities are:
- Application support for the local users acute questions.
- Identifies need for training and documentation.
- Trains, or assists in training of local users.
- Collects and processes change requests and gives this information to the IT application manager.
- Coordinates training at the local site.
- Receives failure messages and report from users and forwards the information to the technical support manager.
- Follows up to see that the error errands have been fixed.
- Reports to users that the error has been fixed.

The user support manager is an information owner. He/she has access to read, write and change the attributes he/she is responsible for. In the system for the applications the user support manager is responsible for:
- Seeing that information about, for example, user manuals and administration support are being inserted into the system.
- Providing the IT application manager with all the requested information, for example the location of user and the number of users at that location.

Technical support manager:
The technical support manger is responsible for the technical maintenance. He/she works closely with the user support manager. This role can exist both in central and local departments.

The technical support manager's responsibilities are:
- Handling operations and maintenance.
- Responsibility for the storing of old information.
- Responsibility for integration and communication solutions.
- Installing and handling software which are needed for the users so they can dissolve their working duties.
- Installing and handling hardware which are needed for the users so they can dissolve their working duties.
- Responsibility for security and vulnerability, back ups, etc.
- Receiving error reports from the user support manager and taking care of the problem.

The technical support manager is an information owner. He/she has full access to read, write and change all the attributes. In the system for the applications the technical support manager is responsible for:
- Seeing that information about, for example, general information, technical support levels, server, client, database, retention storage, backups and integration are being inserted into the system.
- There is need for an administration role in the system and our suggestion is that a technical support manager is given this responsibility. Adding or deleting of fields in the application is only his/hers privilege. When an application is terminated it is the administrator's role to delete all the information about the application from the system.

System developer:
The system developer shall create system solutions that fulfil the demands from the business via the steering committee. This person/s can sometimes be an outsourced party.

The system developer's responsibilities are:
- Implementing modification suggestions.
- Participating in the development of new solutions and modules.
- Improving and correcting existing system solutions and modules.
- Creating technical specifications from specification of system requirements.
- Making cost approximations regarding changes and new applications.
- Creating and maintaining program and system documentation.
- Making system validations and verifications.

The system developer is an end user of the system for the applications. He /she has full access to read in the system. He/she uses the system in order to find out technical information, integration, costs and project that affect his/her work, etc.

Security manger:
The security manger is responsible for all issues regarding security. He/she is responsible for quality controls, sensitive information and other juridical domains. This person supports both the business and the IT organisation.

The security manager's responsibilities are:
- Checking that computer laws are being followed.
- Seeing that applications meets the quality control demands.
- Making sure that the quality control documents are being done correctly.

The security manager is an end user and an information owner of the system for the applications. He/she has access to read, write and change the attributes he/she is responsible for. He/she uses the system to check if quality controls have been made. In the system for the applications the security manager is responsible for:
- Approving the quality control documents and inserting the information that the control has been done.

IT project manager:
The IT project manager allocates resources, shapes priorities, coordinates interactions with the customers and users, and generally tries to keep the project team focused on the right goal. The IT project manager also establishes a set of practices that ensure the integrity and quality of project artifacts.

The IT project manager's responsibilities are:
- Answering to the daily management of the project.
- Responsibility for the project group's work.
- Planning, controlling and steering the project in order to follow the agreed time and cost plans.

The IT project manager is an end user and an information owner. The IT project manager wants to receive information about everything from technical and integration issues to the number of users of the applications. The application system will also make it easier for the project leader to find the contact persons he/she needs to discuss with regarding his/her project. He/she has full access to read but can only write and change the attributes he/she is responsible for. In the system for the applications the IT project manager is responsible for:
- Inserting information about his/her project, like project number, brief description and time plans.

The communication between the different roles is shown below (see fig. 24).

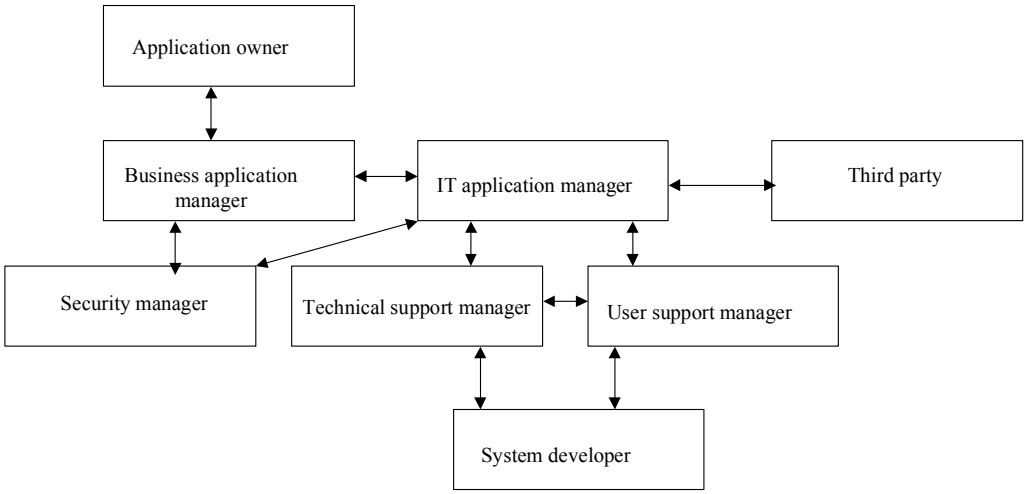

Figure 24 The communication and information flow. Source: Own developed.

5. 2. 5 Meetings

System management meetings are the forum where the management organisation or parts of it are gathered to ventilate the activity and the system. The purpose of these meetings is to be retrospective and to look forward. When glancing back it is with help from error reports, analysis, actions, time reviews and budget reviews. These are used as help when plans are made for the future. Special committees should be put together in order to discuss future decisions about applications (Nordström, 1993, p. 16).

Application steering committee:
This committee is organised to ensure the IT support in the business. The steering committee is responsible for the total application portfolio for the process, with focus on business aspects and strategic issues, like decisions on closing or replacing applications. The committee is shared by the business organisation and consists of respective application owners and IT application managers within the IT organisation. Business application managers and other IT organisation staff are assigned as members when needed.

Application steering committees should be implemented to manage strategic decisions on application portfolios, for example:
- To analyse, give priority to, decide, plan and give directives about activities carried through for budget and strategic directives.
- Make system diagnosis and approve evaluations.
- Decisions about closing down or replacement of vital applications.
- Decisions about new applications.
- Take responsibility for the total application portfolio within a main process.
- Have the authority to order inventory occasions.

Application owner committee:
An application owner committee can be formed to manage a portfolio of related applications with different owners. The application owner committee takes the same responsibilities as the individual owner. The purpose for the committee is to develop the activity and to state goals and objectives for the development of the IT support. The group ensures that the development of the activity and the development of IT are going in the same direction.

The application owner committees' responsibilities are:
- To formulate visions and goals for the process.
- To develop the process.
- Specify IT support demands.
- Improve and develop methods and routines.
- Put together a budget for the system area within the process.
- Report to the application steering committee about reached results.

5. 2. 6 Routines for future inventory

There is a need for a system to handle future inventory. Inventory can be done in three different ways; regular inventory, ordered inventory and inventory for new applications.

The regular inventory is the inventory that is being performed continuously. We suggest that the information about economy, licences, etc. be given in connection to final accounts. Regarding more static attributes like general application information, technical information, processes, users, storage information, integration attributes and business contingency plans, it is not necessary to up-date them more than once a year. The organisation should decide what month this should be done. We suggest that this should be decided by the application steering committee. Information about projects should be inserted when a new IS/IT project is started or finished and this responsibility lies with the project manager. When application quality controls have been made and approved this information has to be inserted into the system. This can be done several times a year. Regarding role switches it is the new person's responsibility to change the information in the system as soon as he/she has been assigned the role character.

Ordered inventory is being performed when application owners or chiefs want to receive some special information on other occasions than the regular inventory.

Inventory about new applications is done only once. Usually when the system is put in use.

6 MANAGING THE APPLICATION PORTFOLIO

Those theories that we have found useful for future analys of the application portfolio are the product life cycle, the Boston matrix and the application portfolio matrix. These are three relatively different platforms that can be used to get some perspective on how the applications are within the business and in what state they are in the life cycle. All of these models have a more economic background which we think is suitable regarding the strategic planning of the application portfolio.

6. 1 THE PRODUCT LIFE CYCLE

A company's product portfolio can be seen through the product life cycle that describes the changes a product goes through over time. The product life cycle shows how a product develops over time from concept via acceptance through high demand to eventual decline, according to market demand. The purpose of the product life cycle is to show that it is not just the sale volume in the products demand on the market that are being changed. The change also includes a number of other changes that lead to changed supply- or branch relations and company behaviour. When the product life cycle is sketched good assumptions can be used to decide in which developing phase the company's products are. Because applications can be seen as products, we use the product life cycle as an application life cycle to find out what kind of application portfolio the company has (Ward & Griffiths, 1996, p. 66).

A company's products are usually being developed from the product life cycle. It often takes a long time before a new product becomes profitable on the market. At the same time, mature and profitable products are being threatened by other new products. That is why a company has to have balance in its product portfolio so that there are mature products that can generate income to pay for the development of future replacements (Aniander, Blomgren, Engwall et al., 1998, p. 86).

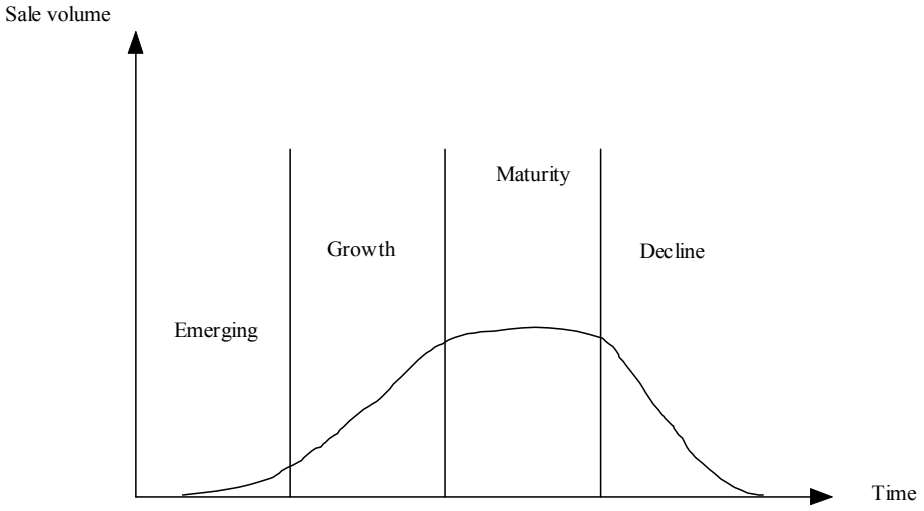

Figure 25 The product life cycle. Source: Aniander, Blomgren, Engwall et al., 1998, p. 86.

The product life cycle consist of four phases, the emerging phase, the growth phase, the maturity phase and the decline phase (see fig. 25).

The emerging phase is characterized by the few users of the product, because of the recent release of the product on the market. Do not expect any profit in the emerging phase, because the expense for distribution and marketing are major relative to the number of sold products. The product is expensive because of the poor quantity, but you still need a big margin because of the low expense. This phase is insecure, the product is not yet fully tested and that is another reason for the high price. In case anything goes wrong there has to be a buffer. Often there are few or no competitors with similar products in the emerging phase.

In the growth phase the number of users of the product increases the profit. The product has been accepted on the market and consumers start buying the products. Similar products increase and the mass has to start. The price continue to be high depending on the demand. The marketing cost continue on the same level to meet the competitors and to increase its place on the market. The opportunity of profit starts to been seen because the price of the product is not declining as fast as the cost per product.

At some point a product growing rate starts to decline and the product enters the maturity phase. In this phase the product normally exists longer than in the other phases. Most of the existing products are in the maturity phase and therefore this phase is seen as the most critical for the product's success. At this point the capacity is bigger for the company than the demand on the market and the price becomes the major thing to compete with.

During the declining phase the demand declines. The product has aged and the customer's preferences have changed. The profitability declines and companies have to leave the market. Companies with one single product should, before this phase, design a new and better product so that they can enter the growth phase again (Olsson & Skärvad, 1994, p. 342).

6. 2 THE BOSTON MATRIX

A famous development of the product life cycle is the Boston matrix, which is developed by the company Boston Consulting Group. The matrix is based on the company's product portfolio in rate of growth and market share. The four squares in the matrix reflect the stages in the product life cycle and their relative success. The matrix shows needs to have products in the different development stages. The matrix can be used both in order to look at a specific product but also to look at a whole business. The position the product has in the matrix can give indications on how different strategies can be used in the future development.

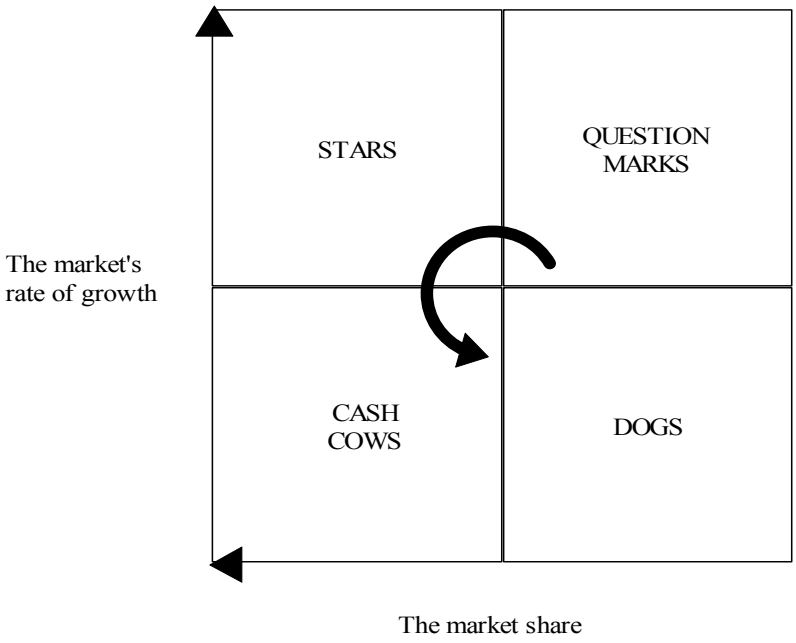

Figure 26 The Boston matrix. Source: Aniander, Blomgren, Engwall et al., 1998, p. 87.

The Boston matrix consists of four phases, which are the question marks, the stars, the cash cows and the dogs (see fig. 26).

When the rate of growth is large, but market share is poor, the products are called question marks. These products can often become a problem because they require a lot of investment and give very little in return. The business hopes that these question marks will turn into tomorrow's stars and future cash cows.

The star in the matrix represents products with the best profit and growth potential. They have a large rate of growth and large market share. The star products will generate a lot of cash, but may also require substantial cash injections in order to establish themselves in the markets.

Mature products often have a poor rate of growth but a relatively large market share that is why they are often profitable. They are the company's cash cows because they generate more income then they demand. The cash cows are therefore stars that are well established and no longer require investments to give profitability. They now generate significant positive cash flow and during this period the firm endeavours to maintain a level of quality for these products so as to preserve their share of the market and to continue the cash generation for as long as possible.

After a further period of time, cash cows may turn into dogs, which are products with a poor rate of growth and poor market share. This is because the market share is gradually eroded by the introduction of new products or by the effects of fashion or gradual reduction in value as perceived by the customer. At this point the product is nearing obsolescence and the company must be wary of putting more money into the product. In some cases it is not worth to reinvest in the product, the business will do better by terminating it (Ward & Griffiths, 1996, pp. 66-69).

The matrix' point is to make the products go through all the different phases. New products are question marks, fast growing products are stars while products with large sale volume are cash cows. Older products, dogs, are those products that lower the profitability for the company. They cost more than they generate back. The company should to be profitable in

the long term, and plan to have a product portfolio with products in the entire matrix' phases (Aniander, Blomgren, Engwall et al., 1998, p. 88).

6. 3 THE APPLICATION PORTFOLIO MATRIX

The application portfolio concept means bringing together existing, planned and potential information systems and assessing their business contribution.

Applications need to be planned and managed according to their lifetime and future contribution to the business. Traditional portfolio models consider the relationship of applications to each other and the tasks being performed rather than the relationship with business success. The application portfolio matrix developed by McFarlan and McKenney considers the contribution of IS/IT to the business now and in the future based on industry impact. The model proposes an analysis of all existing, planned and potential applications into four categories based on assessment of the current and future business importance of applications. An application can be defined as high potential, strategic, key operational or support (see fig. 27), depending on its current or expected contribution to the business success.

STRATEGIC	**HIGH POTENTIAL**
KEY OPERATIONAL	**SUPPORT**

Figure 27 The application portfolio matrix. Source: Ward & Griffiths, 1996, p. 32.

High potential includes applications that can be very important to reach future success, but they are still uncertain. The potential value for the activity can be large but it is not confirmed. These applications are characterized by a rapid prototyping development with a power to refuse failures before spending a lot of resources.

Those applications that are strategic are critical for the activity and of highest potential value. These are applications that the company strategically trusts on to reach future success. They are developed to meet the activity's goal and to realise business advantages as

much as possible. The applications have a flexible solution and can be adapted to meet the changes that will occur in the activity's environment.

The key operational applications are those the organisation is dependent on in the present-day situation to reach success. The key operational applications are important for the primary process and increase their value. The applications are of a high quality with solutions of long duration and effective data handling, to make sure of stability and low costs by the changes over time.

The support includes applications that support the activity but are not in strategically valuable. The support systems are not critical for the organisation's future if they are not wasteful with valuable resources or if the market share is being changed. The applications often cost less, have long-lived solutions and usually have a compromise between the users to hold costs down (Ward & Griffiths, 1996, pp. 32, 272).

6. 4 PORTFOLIO MANAGEMENT PRINCIPLES APPLIED TO THE APPLICATION PORTFOLIO

There are some obvious resemblances between the application portfolio matrix and the Boston matrix (see fig. 28). The similarities are important, since products or applications must be managed according to their contribution to the business over an extended life cycle. Applications and products both have life cycles, and they will move around the matrix over time.

Both applications and products require investment funding. Applications and products need to be managed and have resources allocated in accordance with their business importance. The Boston matrix offers useful input to the application portfolio matrix because it reflects the competitive business environment.

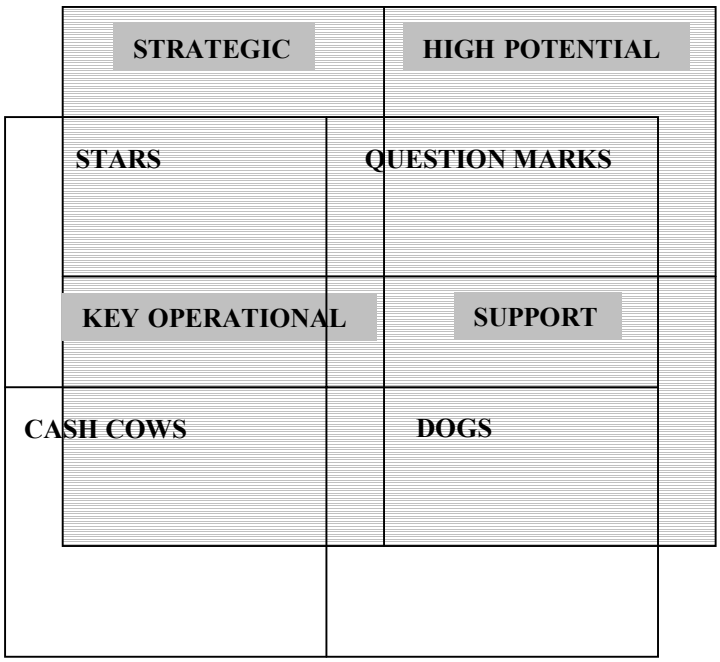

Figure 28 The business application portfolio matrix. Source: Ward & Griffiths, 1996, p. 299.

IS/IT high potential applications resemble question marks products due to the degree of uncertainty of success and the amount of risk. The objective with these applications and products is to identify them and then try to transform them into success into the next phase of the life cycle curve. High potential application and question marks are both risk investments. They need to be carefully assessed as to whether or not they are strategically important or can became star products. A problem that can occur with question mark products is that they satisfy the designer but not the customer. There is a similar problem with applications. They satisfy the technical professionals but not the users. This problem must be avoided. Prototyping should be undertaken to find out how the organisation can benefit most from a new use of IT and not to discover all that the technology can do. Many current new IT applications are producing disappointing results due to evaluations that are prejudiced by existing activities to which they are attached. New products have a similar problem with the contribution to the business. The product is impossible to assess and commitments that have been made make decisions to pull out expensive. There is great need to have control over the costs.

A strategic application or a star product are the ones that the company is dependent upon for future success. The value can only be judged by its effectiveness against the competitors. In order to increase the value added by the system, it is important to know what the system does and how it does it. Whether to spend money or not will be based on both the return on investment calculations and on the risk to the business if the system fails to stay ahead of the competition. In order to achieve innovation the business system user has to decide how the systems ads value to the business process. Most applications in this box should be associated with an information intensive part of the business. The process of value adding is expensive and it requires a lot of resources. This can only be justified when and where IS/IT sufficiently can change the business environment.

As with its cash cows, an organisation expects its key operational applications to make a significant contribution to the business. This depends on keeping the product or the system in line with current market and business demands in the most effective way. Key operational applications should only be enhanced and redeveloped in response to changes in the business that threaten to put the business at risk. The risk should be quantified to ensure that the expenditure involved gives benefit over time. If the applications are expected to have a long life they must have high quality. Low support costs depends on quality control, data and processing integrity and consistency of the system within the network of the organisation's system. Key operational applications can not be afforded the same resources as the strategic applications. It is best to share resources and expertise with other systems to reduce the costs. The best way of managing these applications is to reduce costs while not reducing the business value of the system.

Support systems and dog products are not critical to an organisations future unless they waste valuable resources or if the market place changes. To reduce an organisation's commitments to systems, the organisation can use software packages or outsource their operations and support. Alternative solutions are available for these applications and service/package providers can make a profit on handling similar applications in many companies. This disinvestment process will automatically reduce the pace of enhancement to that of the generally available service or package. In general systems should not be enhanced unless the economic implications are absolutely clear (Ward & Griffiths, 1996, pp. 293, 298-303).

7 DISCUSSION

Introducing a management model involves many changes. It is not enough to have handbooks and manuals that describe how to work with different assignments. The work process must be established in reality and in the every day life. Introducing a model step by step will ensure that it will really be put into practice, rather than end up in a bookshelf without ever being read.

In this chapter the discussions from previous chapters are tied together. The chapter will also end with some suggestions for further studies in this field.

The discussion is based on our application portfolio management workflow, which has evolved during the thesis process, and resulted in the following model (see fig. 29). The discussion will follow the different steps in the model.

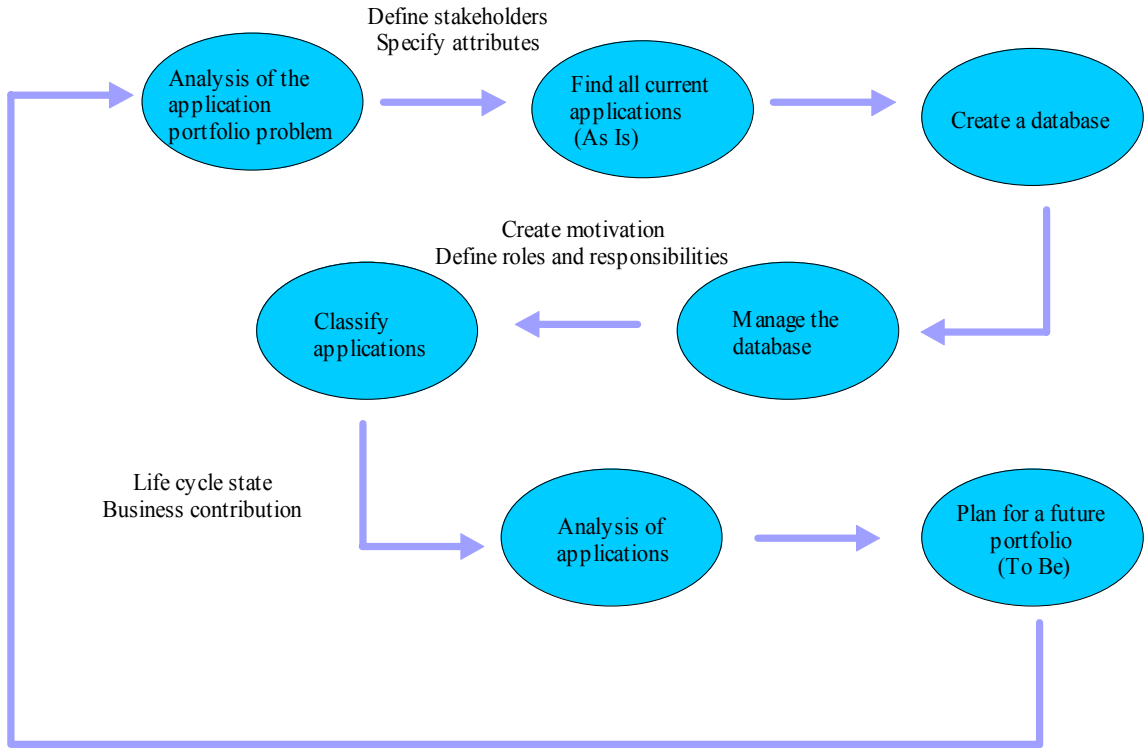

Figure 29 The application portfolio management model. Source: Own developed.

Today, no established models for handling application portfolios exist. The model that we have created is therefore original. The practical value of the model creates overview, gives awareness and meaningfulness. Overall, we believe that the parts in the model that we have tested at VCC IT BA have worked well. We also believe that the complete model is a good tool to manage application portfolios. The methodology considers the gap between the business and the IT department when they are both involved in the development process. We would like to emphasise that the model is not the solution to the application portfolio management problem. It is only an assistant to the managers. The solution to the application portfolio management problem is found in the guidelines of a process, and the professional experience and knowledge of skilled managers.

7. 1 ANALYSIS OF THE APPLICATION PORTFOLIO PROBLEM

We discovered at an early stage that a dynamic documentation is a necessity for getting control over the application portfolio. Islands of information, described in 1. 1. 1, are information system environments that grow and develop separated from each other in an organisation. This phenomenon often develops in major organisations. A dynamic documentation will reduce this development of isolated system islands because the organisation then will have a complete picture of the whole application portfolio. Through this, organisations can avoid duplicate applications, they can cooperate and mutually decide what systems that shall be used. It also makes it easier to see that the systems follow the business objectives. When the application portfolio is known it is easier to steer and make decisions about applications and their integration. This will also reduce the problem with information labyrinths described in 1. 1. 2.

Like in all system development, an analys of the problem area and of the user area is of great importance (see 3). One of the first assignments in the analysis is to identify the stakeholders, i. e. those people who are going to use the system. During the work we had difficulties in finding the right competence that was needed in order to clarify exactly which data that should be part of the system. In the role as system developer it is important to get in contact with those people who possess the knowledge that one needs. In order to define attributes we had to interview different people in the organisation with different knowledge and work assignments. One of the major difficulties in this process is how limitations should be drawn within respective target groups' subject field. Therefore, it is very important from the beginning to clarify the ambition level for the system and the stakeholders requirements. A piece of good advice when creating an application database is to lower the ambition level and to focus on a few subject fields and within those not enter too deeply. If the stakeholders' requirements are directed towards financial issues a good way is to start looking at only these attributes. The system has a better chance of survival if it starts from a small scale and then is further developed.

7. 2 FIND ALL CURRENT APPLICATIONS (AS IS)

To be able to manage an application portfolio it is important to find the As Is portfolio, i. e. all the current applications running in the business. This is something that can be done parallel to creating the database.

In major organisations it is a good idea to set limitations on where in the organisations the inventory of applications will begin. This to simplify and reach completeness in a specific area. The inventory is easier to perform if one area at a time is investigated. For example, staff applications could be collected at first, or financial applications. It is also a good idea to start the inventory within a specific activity in the organisation. One major difficulty we discovered when searching for applications was that some applications belonged to the same area but were owned by different activities. In some cases the ownership was not stated and this made it even more difficult to create a complete list.

Another important issue is to decide on which level the portfolio should be seen, i. e. how deep down in the application hierarchy the study should go because an application can consist of one or more levels (see 4). When this is decided the investigation can start from a bottom-up or top-down perspective. The business also has to make a decision about what applications they want to have information about, own developed, customised, licensed or all of them.

Other problems that appeared during the inventory process were that it was difficult to reach out to the right people who possessed the information and be sure that we had found all the applications. One solution to ensure that all applications had been found was to check invoice lists from maintenance suppliers and to discuss with IT managers and business people. On the other hand, we do not see this as a major problem when information about applications discovered later can always be inserted at a later stage. Regarding future inventory, we believe that a web based interface is preferable so that people that possess the information can themselves insert it directly into the database via the web.

When searching for the existing applications it is also of importance to find out the ongoing IS/IT projects that will effect the applications in any way. This is because the information has to be up-dated as soon as something has been modified in an application. The information in the application database has to be fresh to have any value for the stakeholders. One suggestion is to also create a database for all projects running in the business if this does not already exist. This is needed to be able to mate the two databases with each other.

If the information in the system should always be up-to-date, it is necessary to have routines for how often the inventory should be done (see 5. 2. 6). Through routines, rules, habits and regularity are created. Routines are one of those success factors that ensure the system's survival. Without routines people have a tendency to not give priority to work assignments even though they have motivation and the responsibility to perform the tasks.

7. 3 CREATE A DATABASE

A database is an excellent tool to manage the application portfolio. This is because the database will always provide the concerned parties with fresh information about the applications. For this to be able to work the information has to be accessible for everyone at all times. Therefore, we suggest that the application database is a web based solution and that it can be reached through the organisation's Intranet. Different people in the organisation should have different access to the database based on their responsibilities and role in the company (see 5. 2. 4). We believe that a web based solution is a necessity to avoid that the application portfolio database ends up in a bookshelf without ever being read.

7. 4 MANAGE THE DATABASE

If the application database is going to survive, it is a must that users are included and motivated to use the system. When we performed our interviews we thought that people were a little bit reserved concerning the survival of the system. This is because they had experienced that similar projects about application inventories ended up with the information being stored on an excel sheet and ended up in a bookshelf without ever being read. Because the information was not available for the users, the up-dates were not easily reached and therefore the database had no value at all for the users. The solution with a web based application, in combination with those success factors presented in 5. 2, and starting on a smaller scale will result in a successful application portfolio management tool.

To create motivation the users must be included all the time in the system development process so they can give their ideas and responses on the project. If there is no motivation to use the system, the tendency to insert and up-date the data that exists in the system is reduced. To get control over these problems, it is important to create awareness and improve the social relations between the system users. Motivation is a constant ongoing process that can be done by showing the systems use and by education through workshops and seminaries. Another action to stimulate a more accurate handling of the data that should be inserted in the system is to create motivation by arranging bonus systems, etc. (see 5. 2. 3).

For database survival it is also important to clarify who is responsible for what. Usually different roles exist in an organisation and a good idea is to use these to build up responsibility areas regarding the application database (see 5. 2. 4). It is important to accurately define the roles and their responsibilities clearly. A common problem that might occur is that when a problem appears no one wants to take the responsibility for it. In Riksrevisionsverkets revision, mentioned in 1. 2. 1, they pointed out the importance of routines and reduced person dependence. By constructing different roles we have eliminated the person dependence and we have also built routines for the management of the application database.

7. 5 CLASSIFY APPLICATIONS

To handle an application portfolio and to make an analysis of the As Is condition, the managers have to classify the applications. This is done to be able to make future decisions about the portfolio. The application portfolio management model proposes that the life cycle states and the contribution that applications have towards the business are being used (see 6). During our work we became aware that both the applications life cycle state and its business contribution are of importance for future decisions. To do this classifying, the managers have to ask business people, IT managers and users of the applications. To ensure that they get a correct and comprehensive classification, it is a must to contact more than one person in every category. It is also important that the different phases in the theories are explained in detail so that no misunderstandings will occur when the respondents answer.

7. 6 ANALYSIS OF APPLICATIONS

When the questions have been answered the results are read and put together in an analysis. The analysis is built on where the applications are in the life cycle and its business contribution. We have matched the chosen theories and from there discovered four main states that an application can belong to during its lifetime (see 6). These are i. e. 1) emerging/question marks/high potential, 2) growth/stars/strategic, 3) maturity/cash cows/key operational and 4) decline/dogs/support (see fig. 30). The similarities in the different theories are very clear and through these similarities it is easy to constitute the four states. Other combinations might appear, though in this case it is not relevant to speculate about them because we believe that they are so unusual.

GROWTH **STARS** **STRATEGIC**	**EMERGING** **QUESTION MARKS** **HIGH POTENTIAL**
MATURITY **CASH COWS** **KEY OPERATIONAL**	**DECLINE** **DOGS** **SUPPORT**

Figure 30 The four main states. Source: Own developed.

The analysis can also be established on different output reports, like diagrams and lists from the system (see 3. 1. 4).

7. 7 PLAN FOR A FUTURE PORTFOLIO (TO BE)

We are of the opinion that a plan for a future portfolio should be performed by a group of people with different knowledge about the business and the IT support. This group should meet regularly to discuss and analys the application portfolio (see 5. 2. 5).

From the four different states (see fig. 30) recommendations and suggestions can be discerned about how applications should be managed.

Applications that are in the emerging/question marks/high potential phase are important to identify to find out if they have any value to the business. This prevents one from investing in an application that will not live up to the organisation demands. User participant is very important regarding applications development and it can be a good idea to build a prototype before implementing the real application. This ensures that users are satisfied with the application and that it follows the business goals. By doing this, the application will hopefully enter the next phase. These applications require a lot of investments because they are new development projects which are insecure because they are yet not fully tested. It is important to notice and keep down the costs but it is also important to remember that these applications can be crucial to reach future success and therefore it is sometimes a necessity to invest. Considering to the high risks, it can be smart to have an alternative solution if the application should fail.

In the growth/stars/strategic phase, applications are further developed to meet the activity's goal and to realise business advantages. These are applications that companies strategically trust on to reach future success. It is important to have knowledge about what the application does and how it does it to find out where the new development should be done. Here the users play a considerable important role because they often have much good advice about how to make the application better and more useful in their daily work. It can be very expensive

to invest in these applications but it is usually a good investment because one wants the applications to enter the maturity phase.

Applications in the maturity/cash cows/key operational phase must have high quality and follow the business changes to have as long lifetime as possible. In this state the applications generate more income than they demand and the business should take advantage of this and try to keep the application in this phase for as long as possible. Applications in this state should only be redeveloped if changes tend to put the business at risk. To get the application to remain in this phase one possibility can be to attract new users and find new target groups for the application. It is also good to start looking at future investments that can replace this function if the application enters the decline phase.

When applications enter the decline/dogs/support state the organisation should consider terminating them if they cost too much to maintain. These applications have no value to the business because new and better applications have entered the market. Instead, it is more profitable to invest in other applications where the need is greater. At this time it is high priority to start design and develop a new and better application that can enter the growth phase.

7. 8 FURTHER STUDIES

During our work with this thesis, interesting questions have been encountered but due to the limitations of this study, they could not be covered in this thesis. However, they would definitely be interesting to investigate further. One such area touches on the last steps in our model. It would have been most interesting to classify the finance applications at VCC IT BA. Classification would give a total picture of the current application portfolio and ensure that the theories are sufficient to measure and manage the portfolio. It would have been interesting to do an analysis and to be a part of the suggestions for the future.

Another interesting subject would be to explore Sullivans matrix when studying an organisations application portfolio. The matrix is mentioned in 1. 2. 2. This could illustrate degree of importance that the applications have towards the business. Managers can, for example, count on alternative costs for a computer based system. This shows the real business value for the organisation.

A further topic, which would be interesting to learn more about, would be to do an investigation about how satisfying the application database has been for the users. Finding out the value of the system and seeing if the role characters were enough to cover the responsibility areas.

A further development of the application portfolio management methodology could be to include use case scenarios in the analysis phase. This would make the model more comprehensive and make it easier to define what reports the users would like to receive from the system.

8 REFERENCES

Andersen Erling, (1994), *Systemutveckling-principer, metoder och tekniker*, Studentlitteratur, Lund.

Aniander Magnus, Blomgren Henrik, Engwall Mats, Gessler Fredrik, Gramenius Jacob, Karlson Bo, Lagergren Fredrik, Storm Per & Westin Paul, (1998), *Industriell ekonomi*, Studentlitteratur, Lund.

Apelkrans Mats & Åbom Carita, (2001), *OOS/UML-En objektorienterad systemutvecklingsmodell för processorienterad affärsutveckling*, Studentlitteratur, Lund.

Backman Jarl, (1998), *Rapporter och uppsatser*, Studentlitteratur, Lund.

Befring Edvard, (1994), *Forskningsmetodik och statistik*, Studentlitteratur, Lund.

Bergvall Malin, (1995), *Systemförvaltning i praktiken-en kvalitativ studie avseende centrala begrepp, aktiviteter och ansvarsroller*, Linköpings universitet, Linköping.

Bergvall Malin & Welander Tommy, (1996), *Affärsmässig systemförvaltning*, Studentlitteratur, Lund.

Boddy David, Boonstra Albert & Kennedy Graham, (2002), *Managing Information Systems-An Organisational Perspective*, Pearson Education, Essex-The Great Britian.

Boehm Barry, (1988), *A Spiral Model of Software Development and Enhancement*, Computer, The Institiute of Electrical & Electronics Engineers Inc., May, pp. 61-72.

Brandt Peder, (2000), *Systemförvaltningshandboken v 6.0*, ITligence AB, Stockholm.

Brown David, (1997), *An Introduction to Object-Oriented Analysis-Objects in Plain English*, John Wiley & Sons, The United States of America.

Ejvegård Rolf, (1996), *Vetenskaplig metod*, Studentlitteratur, Lund.

Huczynski Andrzej, (1996), *Influencing within organizations-Getting in, rising up and moving on*, Prentice Hall, The Great Britain.

Magoulas Thanos & Pessi Kalevi, (1998), *Strategisk IT-Management*, Vasastadens Bokbinderi AB, Västra Frölunda.

Marco David, (2002), *Meta Data and Knowledge Management-IT Portfolio Management*, URL http://www.dmreview.com/master.cfm?NavID=193&EdID=4963.

Mathiassen Lars, Munk-Madsen Andreas, Nielsen Peter & Stage Jan, (1998), *Objektorienterad analys och design*, Studentlitteratur, Lund.

Nordström Malin, (1993), *Praktiskt taget systemförvalting-Genomförande och resultat av kvalitativ empirisk undersökning om systemförvalting*, Rapport 1993:12, FoU-enheten, Högskolan i Östersund, Östersund.

Nordström Malin & Welander Tommy, (2002), *Affärsmässig Förvaltningsstyrning-en referensmodell i (system-) förvaltning*, På AB, Stockholm.

Olsson Jan & Skärvad Per-Hugo, (1994), *Företagsekonomi 99-Faktabok*, Liber-Hermods, Malmö.

Patel Runa & Davidson Bo, (1994), *Forskningsmetodikens grunder-Att planera, genomföra och rapportera en undersökning*, Studentlitteratur, Lund.

Patel Runa & Tebelius Ulla, (1987), *Grundbok i forskningsmetodik*, Studentlitteratur, Lund.

Putnam Arnold, Barlow Robert & Stilian Gabriel, (1966), *Samordnad företags kontroll-Totala informationssystem i praktisk belysning*, Bokbeckman AB & J Beckmans Bokförlag AB, Stockholm.

Révay Péter, (1992), *Modern systemförvaltning*, Studentlitteratur, Lund.

Riksrevisionsverket, (1987), *Systemförvaltning*, Dnr 1984:646, RRV, Stockholm.

Royce Walker, (1998), *Software Project Management-A Unified Framework*, Addison-Wesley Longman, The United States of America.

Stevens Perdita & Pooley Rob, (2000), *Using UML-Software Engineering with Objects and Components*, Addison-Wesley Longman and Person Education, Essex-The Great Britian.

Sullivan Cornelius, (1985), *System Planning in the Information Age*, Sloan Management Review, Massachusetts Institute of Technology, Winter, pp. 73-81.

Thurén Torsten, (1991), *Vetenskapsteori för nybörjare*, Runa Förlag AB, Stockholm.

Ward John & Griffiths Pat, (1996), *Strategic Planning for Information Systems*, John Wiley & Sons, The United States of America.

9 APPENDIX

9. 1 THE APPLICATION'S ATTRIBUTES

ATTRIBUTENAME	DESCRIPTION
Application identification	
1. Name	1. The present name of the application.
2. Old name	2. The earlier name of the application.
3. Description	3. A short description of what the application does. For example, a report system.
General application information	
1. Installation year	1. The year the application was installed. For example, YYMMDD.
2. Version	2. The version number of the application.
3. *User manual*	3. *If there exists a user manual for how to use the application.*
3. 1 Administration manual	3. 1 User manual for administration staff.
3. 2 Distribution manual	3. 2 User manual for access to the application.
3. 3 System overview	3. 3 A system overview.
3. 4 User manual	3. 4 User manual for the users of the application.
4. Replaces application	4. The name of the application which had this function before, if there was one.
5. Type of application developer	5. How the application is developed. For example, standard, own developed or customised.
6. Accessibility	6. How often the application is accessible. For example, 7 days a week and 24 hours a day, office hours etc.
7. Application family	7. Which family the application belongs to. For example, SAP, MS Office etc.
8. Type of application	8. What user area the application has, from a business perspective. For example, Office program, mail, budget etc.

9. Support level, start–stop	9. How much IT-support is needed for the application, for example, when making new functions.
10. Support level, contingency activities support	10. How much operator service and supervision does the application require.
11. Support level, administration support	11. How much user support is necessary.
Application quality controls	
1. Architecture standard check	1. If the application follows Fords standard architecture, EIA review.
2. ACR 552 test date	2. The date of the quality control that is demanded by Ford before the application is put to use. For example, YYMMDD.
3. SCRP test date	3. Annual quality control to check that the SCRP control agrees with the ACR control.
4. Sensitivity	4. The classification of the information sensitivity of the application. For example, sensitive or not sensitive.
Process	
1. Mega	1. The department within VCC. For example, BA.
2. Sub	2. A sub process of the mega process For example, Finance and Control, Accounting or Treasury.
3. SubSub	3. A sub process of the sub process.
Users	
1. Locations	1. The geographic location of the users. For example, local or global.
2. Users	2. The total number of users of the application.
3. Shared usage	3. If the application is shared with other organisations. For example, AB Volvo, Ford, PAG etc.

Business organisation/roles	
1. Application owner	1. The owner of the application. Represents the business organisation that is the primary user of the application. For example, the owner's CDS id.
2. Owner cost centre	2. The department number which the application owner belongs to. For example, 50980.
3. Application manager	3. The person who represents the application owner and the business process that is the primary user of the application. Is the primary channel between the business and VCC IT/BA. For example, the manager's CDS id.
IT organisation/roles	
1. IT application manager	1. The person who coordinates all technical development and maintenance of the application. Is the primary channel between VCC IT and the business. For example, the manager's CDS id.
2. VCC IT cost centre	2. The department number which the IT application manger belongs to. For example, 50980.
3. Technical support manager	3. The person who is responsible for operations and maintenance. For example, the manager's CDS id.
4. User support manager	4. The person who is responsible for user support. For example, the manager's CDS id.
5. Security manager	5. The person who is responsible for security. For example, the manager's CDS id.
6. Application supplier 6. 1 Name	*6. The applications supplier of the application.* 6. 1 The name of the application supplier. For example, Volvo IT etc.
6. 2 Responsible	6. 2 The contact person's email.
7. Application management	*7. The organisation running the support, the supervision, the security, the distribution, the inventory, the maintenance, the integration issues of the application (Software).*
7. 1 Name	7. 1 The name of the organisation. For example, Volvo IT etc.

7. 2 Responsible	7. 2 The contact person's email.
8. Server operations and communication services 8. 1 Name	8. *If someone else than the application supplier is running the operator service (Hardware).* 8. 1 The name of the organisation. For example, Volvo IT etc.
8. 2 Responsible	8. 2 The contact person's email.
Economy	
1. Legal owner of application	1. The legal owner of the application. For example, VCC or FMC.
2. Licenses 2. 1 Owner	*2. For standard applications.* 2. 1 The legal owner of the application. For example, Microsoft etc.
2. 2 Licensed until	2. 2 The expired date of the licence. For example, YYMMDD.
2. 3 Price	2. 3 The price of the application licence.
3 SLA/Assignment agreements	*3. If there exists any agreements. Information about agreement number.*
3. 1 Operations	3. 1 The operation agreement number.
3. 2 Support	3. 2 The support agreement number.
3. 3 Application management	3. 3 The maintenance and support agreement number.
4. Budget	*4. The predicted cost of the application.*
4. 1 Operations	4. 1 The predicted cost of operations.
4. 2 Maintenance	4. 2 The predicted cost of maintenance.
4. 3 Enhancements	4. 3 The predicted cost of minor changes.
4. 4 New development	4. 4 The predicted cost of major changes.
4. 5 Support	4. 5 The predicted cost of support.
4. 6 Storage	4. 6 The predicted cost of storage.
5. Actual cost	*5. The actual cost of the application.*
5. 1 Operations	5. 1 The actual cost of operations.
5. 2 Maintenance	5. 2 The actual cost of maintenance.
5. 3 Enhancements	5. 3 The actual cost of minor changes.
5. 4 New development	5. 4 The actual cost of major changes.
5. 5 Support	5. 5 The actual cost of support.
5. 6 Storage	5. 6 The actual cost of storage.

Information	
1. Retention requirements (business)	*1. Storage for old information.*
1. 1 Archive	1. 1 Number of years for storing old information.
1. 2 Storage location	1. 2 The city where the old information is stored.
1. 3 Storage responsible	1. 3 The person responsible for old information storage. For example, the person's email.
Integration	
1. Communication with others	1. Communication internal Ford or external.
1. 1 Sends to	1. 1 To which other application/s the application sends information.
1. 2 Receives from	1. 2 From which other application/s the application receives information.
1. 3 Communication solution	1. 3 The type of solution for exchanging information. For example, DBI, MQ, VCOM etc.
1. 4 Batch/Online	1. 4 If the application is batch or online.
Technical platform	
1. Client	*1. The client type.*
1. 1 Runtime environment	1. 1 The operative system. For example, UNIX, Windows 2000, GCE etc.
1. 2 Program language	1. 2 The program language. For example, Cobol, Java, C etc.
1. 3 Platform	1. 3 The interface. For example, GC, WEB/GUI, 3270-terminal etc.
2. Servers	*2. The server type.*
2. 1 Name	2. 1 The server name. For example, Dell, Compaq, IBM etc.
2. 2 Location	2. 2 The geographical location of the server. For example, Göteborg, Gent, Singapore etc.
2. 3 Runtime environment	2. 3 The operative system. For example, UNIX, Windows 2000, GCE etc.

2. 4 Program language	2. 4 The program language. For example, Cobol, Java, C etc.
2. 5 Shared usage on server	2. 5 If there are any other applications running on the server.
2. 6 Storage	2. 6 The amount of storage the application requires on the server.
2. 7. Database engine 2. 7. 1 Name	*2. 7. The type of database.* 2. 7. 1 The database name. For example, Oracle, Access, DB2 etc.
2. 7. 2 Version	2. 7. 2 The version number of the database.
Planned/ongoing development and/or maintenance activities	
1. Maintenance and development plans	1. If there are any major projects that will affect the application.
2. Ongoing and planned projects 2. 1 Project number	*2. If there are any ongoing and planned projects.* 2. 1 The project number.
2. 2 Brief description of project	2. 2 Enhancement or replacement.
2. 3 Project leader/Project owner	2. 3 The name of the project leader/project owner. For example, the project leaders/project owner's email.
2. 4 Time plan	2. 4 The time plan for the project.
Security	
1. Security system	1. Type of security system. For example, ACF2, RACF, Active directory etc.
2. Authentication system	2. How to get access to the application. For example, Password, Web single login etc.
3. Firewall	3. The type of firewall. For example, VCN, 136, Safe zone etc.
Risk management	
1. IT disaster recovery plans	1. If there exist any IT disaster recovery plans. For example, backups etc.
2. Business contingency plans	2. If there exist any business contingency plans.