Eindhoven University of Technology

MASTER

Advanced IT tools for management support systems

an exploration of the user requirements and technological possibilities of management support provided by information technology

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An exploration of the user requirements and technological possibilities of management support provided by information technology

By

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BSO/ORIGIN

Abstract

The dynamic developments in the fields of information technology (IT) and organisational management have lead to a situation in which the overall view on Management Support Systems (MSSs) is somewhat lost. During an eight month graduation project, the support that advanced IT can deliver to assist the manager of today's organisation is explored.

The developments of IT, the developments on organisational management and one specific support tool (Internet) are examined. Through interviews with managers, their opinion about support requirements and the use of IT was identified. General conclusions are formulated and discussed to act as a starting point for further research.

Preface

This paper marks the end of my study in "Industrial Engineering and Management Science" at the Eindhoven Technical University. The project that is described in it is not carried out as a solitary operation. On the contrary, without the help of many people I could not have done it.

First of all I would like to thank all the managers that allowed me to interview them. I greatly appreciate that they freed some of their precious time to let a student carry out his graduation project.
The same counts for Mr. Munnikhof and Mr. Pelzers, who allowed me to have a look inside their organisation.

More thanks to:
Mr. Cnossen for giving me a chance to work at BSO/Eindhoven
Mr. Loef and Mr. Vaatstra, who have represented Philips Display Components in this project
Mr. Pownall for checking the English grammar in this report
Mr. Nuyten and Mr. Bogerd, my corporate tutors
Mr Sol, Mr. Schuwer and Mr. Vodegel, my graduation mentors
and especially to my first mentor, Mr. Grünwald, for providing excellent, intense and enthusiastic support.

I hope you enjoy reading this paper,

Ralph Hulscher
Veldhoven, July 1995

Executive Summary

Over the past years, information technology has been gradually introduced on the manager's desk. This process, however, was not a smooth introduction. Changes in the possibilities of information technology and changes in the way organisations think about management support created a dynamic environment from which different generations of Management Support Systems (MSSs) have emerged (e.g. MIS, DSS). The developments within this dynamic environment are still going on and new generations of MSSs are on their way (e.g. EIS). There is no clear view about the functionality that a manager wants to see incorporated within the new generation MSS and about the functionality that technology allows to be incorporated. To get more insight in this situation, the following project assignment was agreed upon.

Examine how advanced information and communication technology offers new functionality, that can support an international manager in doing his/her tasks.
Elaborate the technologies that are very promising in such a way that the use of them within a Management Support System, can be better understood.

The assignment is approached in four different ways:

1. A technology survey is carried out to determine what kind of support today's and future IT can offer
2. An organisational survey is carried out to determine what influence organisational changes have on the manager's support requirements
3. Mangers are interviewed to hear their opinion on what support they need and how IT tools can provide in this
4. A support tool that complies to a direct support requirement has been the subject of an in depth analysis, carried out in a real, existing situation

Technology Survey
Based on a study of sources like literature, papers and magazines, a collection of some typical new developments on the field of IT was made. The technological developments are mentioned, but also new functionalities that the combined use of these technologies offer are described. One example can be the functionality of notifying you on flight delays, fully automatic and regardless of where you are. The process starts with an 'intelligent agent' (a special piece of software) that travels to the computer of the airline where you have booked a flight. It watches the flight schedule and notices that your flight has a delay of one hour. The agent travels back to your office computer and automatically sends you an email message telling you that your flight is delayed. You yourself are in a meeting at a client's office. Your small Personal Digital Assistant, that you carry in your pocket, sends you a discrete signal to tell you that an email message has arrived. You read the message and are glad that you have an extra hour to close the deal. Please note that this is not science fiction. The technology exists, the implementation needs to be realised yet. This and other examples lead to the following conclusions concerning the support that IT can give.
The power of IT has risen significantly. Not only the processing power of computers has risen, but also the power of software and peripheral devices. IT has also become more user friendly. This has brought it within the range of non-specialists. Networking technology is breaking through on a large scale. This can provide in efficient communication tools and it removes the

boundaries of time and space when exchanging digital information. If portable equipment is used that is wireless connected to a network, this effect is even stronger.

Organisational Survey

The implication of organisational changes on the manager's support requirements is examined by consulting literature.

Present and future organisations look more and more like what organisational theorists call the network organisation. It exists out of many, autonomous parts that interact in order to reach a common goal. The change towards this type of organisation will have a significant impact on the manager's tasks.

One major implication is that the manager of this type of organisation is every member of it. If everybody is responsible for their work, everybody needs support in managing it.

Communication and information will have an important role since it is essential for efficient co-operation and co-ordination between the different elements. The intensity of communication and information will therefore rise. The scope of organisational communication and information is expected to shift towards a more external view.

Interviews

To get a better view on what managers themselves think about how IT can provide in support that is needed to deal with today's problems, we asked the managers themselves. In total, eight managers agreed to be interviewed. They have functions in very diverse parts of our society. During the interviews, modern support tools like Internet or Desktop Video Conferencing were demonstrated to show the respondent what is technologically possible. Most of the demonstrations were presented on a portable computer and were fully functioning.

The support requirements that were discussed incorporated support on communication, presentation, information gathering, data analysis and personal management. One respondent introduced an extra category, namely relational networking support.

The conclusions of the interviews are that the main problems of a manager are related to the feeling that there is a lack of control over the whole situation. Two important aspects of these problems are communication and information gathering. Better support tools are however only needed in the field of information gathering. The tools that are already available in the area of communication (e.g. phone, fax, post, email) seem to provide in sufficient support.

In order to make support tools function efficiently, an information and communication structure is needed.

The user friendliness of IT is according to the interview respondents still not sufficient. Complaints refer especially to a lack of hardware and software standards and compatibility. The general attitude towards the use of IT is positive. Most managers have a computer and use it for standard applications like word processors, spreadsheets or databases.

In depth analysis

For the in depth analysis, a support tool that enables managers to access external information sources was examined. The support tool was Internet, or more specific World Wide Web.

The analysis showed that Internet can indeed be a useful source of external information. It is however not directly usable by a manager. The most important barrier is the unstructuredness of the available information. A menu solution that offers the manager a better structure in finding information can help in this situation. This may however not be realised at the loss of flexibility.

Besides the outcomes of the project itself, the analysis taught us that there is a real interest in the possibilities that IT offers to access external information. When this information is accessed, the user wants to be restricted to only relevant information without loosing flexibility. If the support can be customised to every individual, the user's acceptation will probably improve.

A company's policy concerning the information infrastructure, that is aimed at a dynamic environment, makes it possible to implement new solutions fast and easy.

The analysis also showed that a tool like Internet is not directly usable, but by using your own creative solutions, many of the limitations can be removed.

General conclusions

Each of the different research projects has brought up its separate conclusions. To get more general conclusions, the separate conclusions were compared and analysed. Three main conclusions have been found in this process.

1. Communication and information gathering are both very important areas of interest to the manager. The support requirements of a manager are however mostly focused on information gathering and not on communication.
2. There is a need for a policy concerning information. This is needed to create an efficient information flow throughout the organisation and to assure that information is interpreted in a consistent way by all the organisation members.
   The information policy must deal with every aspect of information, including the communication and information infrastructure.
3. There is still a lack of user friendliness when working with information technology. Complaints exist about the control of software and the problems that occur when making IT tools (both hardware and software) work together.
   A remark must be made concerning the software user friendliness. Most managers have not had any training in working with specific applications. It may not be realistic to expect that an application must be usable without any training.

An extra main conclusion is derived from the experience learned during the project execution. This conclusion is that demonstration models give a lot of additional value to interviews. It can change the interview from a *conversation* to a *confrontation*. This can bring up reactions that would never have been found in a normal interview.

The main conclusions give some insight in the aspects on new management support tools, but eight interview respondents are not sufficient to get significant conclusions. More research is needed to validate the conclusions and to answer new questions that may arise from the outcomes of this project. Three possible approaches are advised for further research.

One approach is based on interviews with a large number of respondents (one hundred or more). The interview questions can be more to the point because this project has already given indications about what is important and what not.

The other approach is based on case studies in organisations where solutions to important management support problems are already put into practise. The experiences learned in these organisations may prove to be very valuable.

A third approach is the same as the one used in the in depth analysis. Other interesting tools can also be examined in this way.

The research project can be part of a graduation assignment for two or more students.

Hints to the Reader

To help you read this paper, please consider the following suggestions.

This paper exists out of three main parts, the project setting, the project execution and the discussion; marked by these icons.

Project setting   *Project execution*   *Discussion*

A fourth icon used in this paper is the book icon (📖) in a section heading. The number that follows the book icon corresponds with the literature mentioned in the *bibliography*. The section content is in these cases derived from the corresponding literature.

The execution part describes four separate, although related, research projects that all have their separate conclusions. The reader can choose to read only the parts he or she is interested in.
If you are a very busy reader, you may consider reading only the conclusion (chapter 9) and the management summary.

It is inevitable to use technological terms when writing a paper on IT. I tried to avoid this as much as possible, but still some basic knowledge on IT is expected from the reader. Terms that can not be considered common knowledge are written in this special font and are explained in the *Definition of Terminology* on page 50.

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Part Three: Discussion

Appendixes, etc.

Figures

1 Introduction and Problem Definition

Over the past years, information technology has been gradually introduced on the manager's desk. This process, however, was not a smooth introduction. Changes in the possibilities of information technology and changes in the way organisations think about management support created a dynamic environment from which different generations of Management Support Systems[1] (MSSs) have emerged. The developments within this dynamic environment are still going on and new generations of MSSs are on their way.

BSO/Eindhoven BV, a full service supplier in the field of information technology, is involved in the research and development of MSSs. To anticipate on future developments, the company wants to know what is taking place in this field now. Philips Display Components, a business relation of BSO/Eindhoven, has been using MSSs for several years now. They consider MSSs a very important tool for running a successful company. Like BSO, they also want to keep track of developments concerning MSSs.

The two companies have joined their efforts in research on new developments in MSSs. This graduation paper is part of that research.

1.1 The initiators of the project

As mentioned above, the initiative to do this project was taken by BSO/Eindhoven and Philips Display Components.

BSO/Eindhoven is part of BSO/Origin, an international company offering high-quality services both to large, local companies and to international enterprises in trade, industry and the public sector.

The services incorporate supporting the client in introducing new technologies in the broadest sense. This support is extended in the form of consultancy services, management, development, implementation, systems integration, systems operation, facilities management, and education and training. BSO/Eindhoven acts as a so called 'Full Service Cell', which means that a broad range of disciplines can be found within this cell.

Philips Display Components (PDC) is a Business Group of Philips Components, a product division of the multinational Philips Electronics. Their core product is Cathode Ray Tubes (CRTs) for use in televisions and monitors. Within the PDC organisation there is the strong belief that MSSs can help to improve the organisation's performance.

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[1] All words printed in this typeface are explained in the *Definition of Terminology* on page 50

1.2 Problem

The introduction mentions that today's MSSs have evolved from former generations of MSSs and that new developments are still going on. The dynamic environment in which these developments take place, plays an important role since it determines both the user requirements and the technological possibilities (see section 1.3.3). This makes it difficult to get a clear view on the situation at the moment and in the near future.
The initiators of this project need this view to develop and use new and improved MSSs, which constitutes the main **problem**.

There is no clear view about the functionality that a manager wants to see incorporated within a MSS and about the functionality that technology allows to be incorporated.

In order to place this problem in its context, a brief introduction in MSSs is given in the next section.
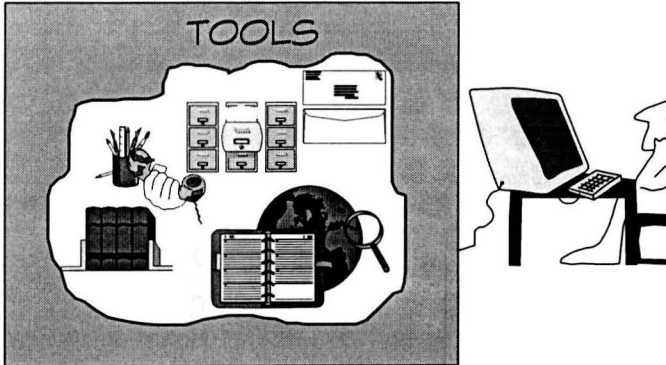
1.3 Introduction in Management Support Systems 📖 1

Many different names are given to all kinds of Management Support Systems. Three letter words are made from a random combination of words like Operational, Management, Decision, Executive, Enterprise, Support, Information and System (Koers, 1993). This has lead to a large collection of abbreviations like OIS, MIS, DSS, EIS and MSS. At the moment even more abbreviations are added to this collection like NGSS (Next Generation Support System) and ESS (Enterprise Support System).
Being aware that there is a lot of confusion about the meaning of these terms, it is important to emphasise that within this paper the word Management Support System (MSS) is referred to as

an information technology based tool or set of tools that supports a manager or a group of managers in doing their work.

This definition covers all of the systems that are indicated by the abbreviations mentioned before and more. A telephone for example, that has additional functionality because of the use of Information Technology (IT), can be considered a tool of the MSS. A Rolodex, however, does not make use of IT and is therefore not a part of the MSS. The abbreviations mentioned before will not be discussed in this paper, except for three (MIS, DSS and EIS). These three refer to systems that represent three different generations of MSSs with their own distinct backgrounds.

Figure 1-1 MSS as a set of IT based tools that support a manager in doing his work

1.3.1 History of MSSs 📖 2

Several different views about organisations and their management have been adopted by our society. They can be seen as paradigms that had their impact on the types of MSSs that were developed over the years. Two main paradigm shifts lead to the development of different generations of MSSs.

MIS (1969)	DSS (1979)	EIS (1989)
'what was?' routine report	'what if?' analysis	'what is?' intelligence
function orientated	specialised	integrating
department orientated	group orientated	individual
passive	interactive	communicative
read	model	activate
table	calculation	associative

Figure 1-2 A comparison between MIS, DSS and EIS
Source: Bedrijfskunde, 1994; Nr. 1, page 76

In the late sixties, the traditional view of the Administrative Organisation was the basis for the Management Information System (MIS). Managers were assumed to need specific information about the past and status information about the present.

In the next decade, Operations Research, Management Science and Logistics were hot items. Control was the key word and system developers assumed that a manager's main task was taking long term and strategic decisions. The system that evolved from this view was the Decision Support System (DSS).

The systems based on the concepts of bureaucratics and control did not give adequate results and new models were introduced. New organisation structures tended towards network organisations and the ideas about a manager's task changed. Activation, communication and motivating, among others, were considered just as important as making decisions. A third generation of MSSs emerged, the Executive Information System (EIS). The concept behind EIS is based on the belief that the tasks of an executive are complex and diverse. The support that an IT based system must give, has to be just as diverse, but not just as complex. Through an easy to use interface, the manager must be given access to various sources of information (internal and external sources). Graphs need to be used to show aggregated data from which trends and exceptions can be destilled, but the detailed data behind the graphs must also be available for in depth analysis. Besides information presentation, the EIS must also enable the manager to communicate to all persons of relevance and to organise his[2] own activities.

In other words, an EIS must support a manager in building an integrated view on all relevant aspects that are taking place within the company and its market. This will enable him to carry out his integrating task within the company. A task that is not compatible with the traditional functional and hierarchical organisation concepts.

1.3.2 Missing functionality 📖 3

The concepts behind EIS, as described before, seem to be very promising. In real life, however, not all the systems that are developed under the name EIS live up to this concept. The functionality of generating graphs that give information about the core processes of the company can be found in almost every system. The possibilities to access the under lying data for further analysis is also common. Complaints exist about support in the areas of communication, external data sources and soft information.

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[2] In this paper, the manager is referred to as a male person. This choice is made only to improve readability. A manager can of course be male or female.

Communication

Within the concept of EIS, communication is a very important factor. A manager that makes people work together, initiates activities and co-ordinates activities, is dependent on clear and efficient communication.

Today's EISs have either no communication support or have support that is limited to simple email facilities. This is not a firm basis to support a manager in his needs for clear and efficient communication.

External data

To effectively run a company, a manager does not only need data from within his company, but also relevant information about the environment it is operating in. Think of information concerning competitors, market developments, political issues, etc. Most EISs do not support the acquisition of this kind of information in a way that suits the manager.

Soft information

Within most EISs 'hard' information like standard reports, key performance indicators, budgets, stocks and resources are presented to the manager. Soft information like information on employees, meetings and long term developments can not be found. This information, however, is very important to a manager as it helps him to build his intuitive feeling about the company's performance. This is of course important to determine a strategy and to make choices.

1.3.3 Dynamic environment 📖 4

As seen in section 1.3.1, the way we think about organisations and its management is of influence to the way we think about MSSs. This view on organisations and management has changed over the years. Figure 1.2 depicts the general trends of this change, which leads to the network organisation. This type of organisation should be able to operate in a complex and dynamic environment.

Apart from organisational and managerial changes, a second factor causes changes in MSSs. This factor is information technology (IT).

The developments around IT take place at a tremendous pace. In general IT gets more powerful witch leads to better performance and enhanced functionality.
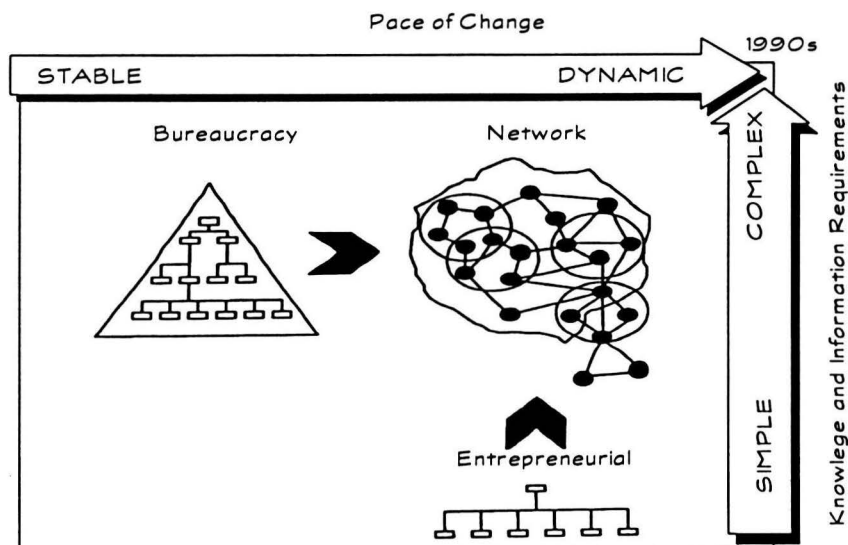
Figure 1-3 Organisation forms and environmental demands
Source: Fifth Generation Management, C.M. Savage, 1990

4

2 Assignment and Approach

Now that the problem is introduced and put into its context, we can state the exact contents of the graduation project assignment. From this assignment, it is possible to make choices about the approach of this project.

2.1 Assignment

On the basis of the problem definition and expectations of the tutors, we agreed on a graduation assignment.
The literal text of the assignment is shown in the following text box.

> Examine how advanced information and communication technology offers new functionality, that can support an international manager in doing his tasks. Elaborate the technologies that are very promising in such a way that the use of them within a Management Support System, can be better understood.

The word *international manager* in the assignment text is merely used to limit the scope of the assignment. The international manager is chosen because communication is an important area of interest. An international manager is assumed to be involved in communication a lot. Nevertheless, communication is the main issue, the fact that a manager can be described as an international manager is of minor importance.

2.2 Approach 📖 5

Now that the assignment is agreed on and understood, it is possible to determine the approach of the project.

2.2.1 Formulation of research questions

The original assignment text is too general to be used in a research project, so more specific research questions need to be formulated. These questions need to be formulated in such a way that they are of practical use within the project and help to solve the main problem.
The following questions were formulated:

1. *What developments are taking place in the field of IT and what are the implications of these developments on the functionality of information systems?*
2. *What has been the influence of organisational changes on the support requirements of a manager?*
3. *What are important issues when matching technological possibilities and user requirements in a real existing situation?*

The first two questions are made on the basis of the two factors that create dynamics in the environment of MSSs (technology and organisational concepts). The last question is asked to step down from a pure theoretical level and look at a situation in its real context.

2.2.2 Type of research

In general, there are three basic types of research (Baarda & de Goede, 1990). These types are descriptive, explorative and experimental research.

Descriptive research is used to find an answer to a question like "How many television sets are there in Finland?". In this type of research, the researcher has no idea about a possible outcome of the research.

Explorative research is used to answer a typical 'How come', 'What if' or 'Why is' question. The researcher wants to develop some hypothesis from the outcome of his research.

Experimental research is used if a clear hypothesis exists, and the researcher wants to now whether this hypothesis is true or false.

In this project the most appropriate type of research seems to be *explorative research*. The reason for this choice is based on the fact that we want to learn more about an unknown situation. We have some ideas about what is important or not, but real hypotheses can only be made after we have learned more about the situation. Explorative research seems to be most suitable for this purpose.

2.2.3 An important provisional expectation

When doing explorative research, some provisional expectations may exist. In this project, there exists an important expectation about the outcome of research question two. Considering the trend towards the networking organisation, the internationalisation of organisations and the trend of 'reaching double the results in half the time with half the people', it is expected that communication will be a main issue. The trends mentioned before demands from the members of an organisation good co-ordination, flexibility and skill. Communication in its broadest sense (direct, indirect, correspondence, conversation, formal informal, etc.) is essential for good co-ordination. It will also help to create more flexibility since good communication allows you to get a complete picture about what is going on in your organisation. This makes it possible to anticipate to new developments that make you more flexible. The skills of organisation members are also improved by good communication, since it enables people to share their experience and learn from each other.

2.2.4 Data acquisition

The information needed to answer the three research questions will be acquired through three different methods: existing information, interviews and a case experiment.

Existing information
Throughout this project, various sources of information are used. Especially for the answer of research question one, magazines, television, research papers and newspapers can be very useful. The advise of experienced third persons will also be used

Interviews
To get an answer to research question two, it seems logical to ask the managers themselves about their opinion. Interviews will be used to do this.

Case study
For an answer to the third research question, a case study will be used. Some sort of IT support will be examined for use within a MSS. A real user with real support requirements will be part of this case.

2.3 Project deliverables

At the end of the project a report (this report) is delivered that contains:

- A survey of developments in the field of IT *chapter 4*
- A survey of developments in organisational structures *chapter 5*
- Results of interviews with managers concerning their support requirements *chapter 6*
- In depth analysis of a specific IT support tool *chapter 7*
- General conclusions of this project *chapter 9*
- A description of the processes through which these outcomes were achieved *throughout report*

The theoretical considerations that are used to make choices and draw conclusions must be mentioned whenever this is appropriate.

3 Planning of the Project

After the main problem and the goals of the project have been determined, it's possible to make choices about the approach that will be used to deal with the problems and to reach the goals.

3.1 Initial planning *(not executed!)*

The initial planning of this project existed out of eight phases:

1. *Formulating the assignment and planning of the project*
   Self explaining

2. *Survey of the developments in the field of information and communication technology. Survey of organisational changes and its consequences on user requirements, according to literature*
   By using various information sources available, a survey of developments in IT will be made. This is necessary to get an answer to research question one.

3. *Familiarisation with the Philips Display Components Organisation. Interviews with PDC managers concerning user requirements*
   In order to determine what support tool is suitable for in depth analysis, it is important to know what requirements a manager has. Interviews will be used to realise this.

4. *Determination of promising support tool*
   After it is known what technology can offer and what a manager requires, it is possible to choose a technology that provides support concerning an important requirement. In the next phase this support tool will be the subject of a more in depth analysis.

5. *In depth analysis of support tool*
   During this phase the previously chosen support tool will be studied for use in an existing situation.

6. *Interviews with managers outside PDC*
   To obtain more general results, managers outside PDC will be interviewed concerning their support requirements. The results from these interviews can be compared with the results from the internal interviews

7. *Deduction of conclusions*
   The results from all previous phases are aggregated. When appropriate, existing theory will be used to discuss the conclusions.
   The answers to all tree research questions will be used to deal with the main problem.

8. *Preparation of graduation paper and presentation*
   Self explaining

In general, the different phases are carried out in sequential order, although some overlap may exist. A time schedule (Initial Time Schedule) can be found in appendix A (top of page)

3.2 Revised planning

Due to circumstances the planning mentioned above could not be carried out. The interviews with managers of PDC (phase 3) could not be arranged in time. As seen in the initial time schedule in appendix A, a delay would result in a delay of the whole project, which was not acceptable.

Three changes were made to the initial planning;

- The interviews with managers of PDC were cancelled
- The choice of a promising support tool was made by mutual agreement
- The time schedule was changed

3.2.1 Consequences of revised planning

The changes in the initial planning have had consequences for both the time schedule and the activities.

Activities
Phase three in the planning has been removed, so leading to the planning presented in the text box below

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FINAL PLANNING

1. Formulating the assignment and planning of the project
2. Survey of the developments in the field of information and communication technology. Survey of organisational changes and its consequences on user requirements, according to literature.
3. Determination of promising support tool
4. In depth analysis of support tool
5. Interviews with managers outside PDC
6. Deduction of conclusions
7. Preparation of graduation paper and presentation

Time
A revised time schedule has been drawn up, in which more activities are carried out at the same time. This choice was made to introduce more flexibility. If one activity is delayed, you can always continue working on the other activity.
Another important change was a shift toward more focus on interviews and less on the in depth analysis. This change was made because the internal interviews were cancelled, so more attention on external interviews was needed.
The final time schedule of this planning can be found in appendix A (bottom).

4 Technology Survey

In this chapter new trends in the development of information and communication technology will be discussed. The trends and technologies have been found by consulting professional information technology consultants, reading magazines and through my own experience. The technologies have been selected by the following criteria:

- they must be new or enhanced
- they must be suitable for use by a manager
- they must offer functionality that can be used by a manager
- they must be related to computers or their environment

This chapter does not mention every available technology for three reasons.
The first reason is the pace at which technologies change and develop. This is too high to make it possible to write down a complete list. By the time you get to the end of the list the beginning is already outdated.
The second reason is very practical. A complete list of every available technology would make this report look like a telephone book.
The third reason is that such a list would not add more value to this section. The goal is to get more insight in trends and developments. A global picture with a sample of technologies is sufficient for this.

4.1 The main trends

By consulting the various sources mentioned in the introduction, six main trends in technology development have been found. These six trends are:

1. Information technology gets more powerful
2. More computers are connected to networks
3. Information technology is becoming more user friendly
4. Security is getting better
5. Information technology becomes portable
6. Microprocessor controlled devices are integrated and interconnected to deliver extra functionality

Many developments that are part of these trends take place by combining existing and new technologies. This combining generates synergetic effects that create new functionality.
The six trends will be briefly explained, followed by examples of new technologies that are related to these trends.

4.1.1 Information technology gets more powerful

The first digital computer ever build was the ENIAC, finished in the end of 1945. Since then the information technology has developed at a tremendous rate. Computers have become faster, smaller and cheaper. The personal computer, developed by IBM, set the start for the

introduction of information technology in the manager's office and even family homes. Not only better hardware, but also new developments in software have made IT more powerful.

More powerful computers
Faster and cheaper, as always

Over the past few years, computers have become more powerful and cheaper. There is no reason to assume this will change over the coming years.

Powerful computers enable the use of graphical user interfaces, video playback and other power consuming functions. In other words, a powerful computer offers more possibilities.

To get a feeling of how computers are changing, look at the figure beside. The vertical scale is logarithmic and even in this scale the power of the first PC (0.1 MIPS) is not visible.
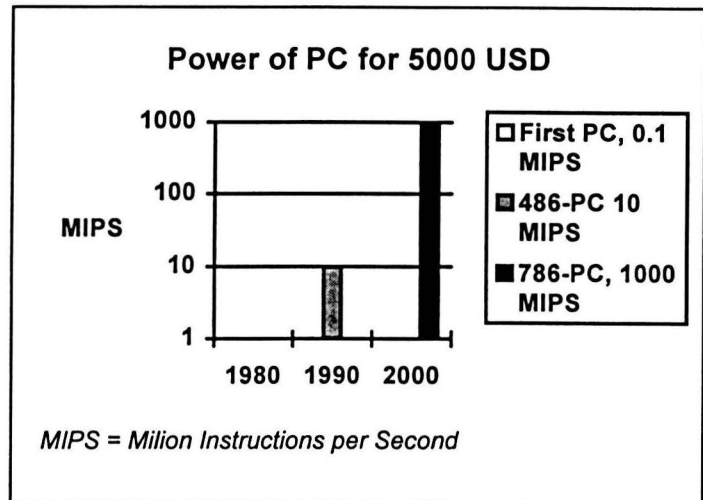
Figure 4-1 The growth of PC power
Source: reader handed out during course 1K106, Capita Selecta automatiseren van technische productiesystemen.

Optical data storage
Is used on a wide scale and still evolving

Optical data storage makes it possible to store large amounts of data in a small space in a relative cheap way. The CD-ROM is an example of optical data storage.

At the moment, most people can only read data from optical media, but there are devices available that can also write data on optical media. As the prizes of these devices drop everybody will be able to make their own CD-ROM's.

The amount of data that can be stored on one CD can rise significantly in the future by the use of a new standard. This standard makes it possible to store 3.7 gigabytes on one CD. Using multiple layers on a CD will even double this amount per layer (7.4 Gb for two layers, 11.1 Gb for three layers, etc.).

Data compression
GIF is out, JPEG is in, or is it JPEG is out and Fractal is in? If only there would be a lasting standard!

There are two approaches in dealing with the problem of overloaded networks and hard disks. One is enlarging the capacity, the other is reducing the capacity requirements. Data compression is part of the second approach.

There are many different standards for data compression. For pictures you have GIF and JPEG among others. For video there is MJPEG and MPEG.

Compression technologies can be devided into lossless and lossy methods. A lossless method always produces decompressed data that is identical to the original data. The problem with these methods is that the attainable compression ratios are very small (typically 2 to 1). Lossy

compression methods can achieve a much higher compression ratio (100 to 1), but with higher compression ratios the decompressed data differs more and more from the original data.
There are efforts to agree on a world wide standard, but since new and better methods are being developed at a fast rate, a genuine, lasting standard does not exist yet.
It is not expected that one standard will be set for all kinds of data. There will be a standard for video, one for audio, etc.
One of the latest new compression methods for images is fractal compression. It gives better quality than JPEG compression, but undoubtedly another even better compression method will be invented in the future.

Multitasking
Every serious operating system of the future should support *true* multitasking

Multitasking means that a computer runs more programs simultaneously. This makes it possible to let several people work on the same computer at the same time or that one person has more programs running at the same time. Not every operating system or environment offers *true* multitasking. Some of them offer the functionality to run more than one application at the same time, but only one of them can show activity while the others are in a sort of sleeping state.
True multitasking is offered by the operating system UNIX for several years now. This determined the success of UNIX in network environments, where multitasking is essential. On office computers (or home computers) multitasking is not common yet.

Enhanced email protocols
Offers great potential

Most people who use email can only send text files. Enhanced email protocols such as MIME (Multipurpose Internet Mail Extensions) enable the user to send text, audio, video and photo's via email.

Neural-networks
Are used on a small scale for very specific purposes

Neural-networks are designed to deal with uncertainty. They can be used to recognise patterns or deviations from patterns.
The technology is based on how many cognitive scientists think our brain works. This does not mean a neural-network can think, it is nothing more than computer technology.
Neural-networks are not new, but only recently computers have become powerful enough to make use of it. This means the use is still developing and not very widely implemented yet.

4.1.2 More computers are connected to networks
Five years ago, computer networks were only used by large companies or institutions.
Affordable and easy to use hardware and software has brought networks within the reach of smaller companies. Nowadays, computer networks are common in almost every company.

Data highways
Some people say they already exist, others disagree

A data highway is not a technology, but a concept. It points to a world-wide computer network operating at wide bandwidths. This makes it possible to send/receive data-intensive information such as Digital Video over large distances.
A clear definition of a data highway does not exist. Some people will say the existing fast networks are data highways while others say a data highway has to be build yet.

The Internet
Some people call this the datahighway

The Internet exists of thousands of small networks, linked together to form a world-wide computer network. It is very large (estimated 20 to 30 million users) and the amount of information that is available in it is equally large. The Internet is still growing rapidly and begins to play a more important role in our society.
The network is used to communicate and to extract information and software from computers linked to the network.
Internet is not owned by someone. Everybody can use it to do whatever he or she wants and there is no form of legislation. The only form of punishment is that of being treated like an outcast by the other network users. Up to now this method has worked out very well.
The users of the Internet are mostly people working at companies, government institutions and universities, but normal households are also beginning to use the Internet.
Every computer connected to the Internet has a unique address, comparable with the unique telephone number of every connected telephone. The fast growth of the Internet will make it necessary to use a new Internet standard   probably by the end of 1996. This because the available addresses of the present standard are running out. This new standard will also deal with one of the main drawbacks of the Internet, the lack of security.
The speed at which the Internet operates depends on the connection you make because Internet exists out of many linked networks. The slowest network determines the speed of the connection. So some companies have created their own infrastructure to bypass bottlenecks such as busy intercontinental connections.
In general the data on Internet is available at no costs, but there are signs that this is changing. New methods of payment will start the commercialisation of the Internet.

CompuServe
Number one in commercial network services

Like Internet, CompuServe is also a large computer network that provides the users with all sorts of information. A big difference is that you have to pay for the use of it. This is because someone (an organisation) owns CompuServe.

Their business is to provide computer network services to their customers and, like every sane company, they want to be paid for that. This situation has a few advantages.

- There is someone responsible to which you can turn with problems or complaints
- The information is of a high quality. The network provider will see to this because he is running a business in which quality is an important factor to survive.
- There is a real standard. One organisation determines how the network is organised, this means the user needs to learn only one set of instructions and software developers can invest money into the development of special programs for this environment.

A disadvantage is of course that this costs you money.

ISDN (Integrated Services Digital Network)
Is ready for use, but does not have much users yet

ISDN is a digital telephone network. It is supposed to cover the whole world just like the existing telephone networks, but not al countries have developed the infrastructure yet.
The bandwidth of this network is determined by the number of 'channels' you want (3 or 30). A normal user can use two 64 Kb/s channels and one 16 Kb/s channel. This is wide enough to send video, audio and computer data at the same time through one connection. A heavy user may use a connection with 30 64 Kb/s channels.
A connection has to be bought from a telephone company.
The costs of ISDN are higher than the costs of a normal telephone connection, but the benefits are large. You could use ISDN for a fast Internet connection for example. Despite this there are only a few isolated users (mainly companies).

4.1.3 Information technology is becoming more user friendly

Until recently people had to be experts to use computers. This is changing rapidly. Information technology is now designed to be used by people. This is necessary because information technology performs such a vital role in our society, that almost everybody is confronted with it. Even an old grandmother when she withdraws money from an automated teller machine.

User friendly interfaces
Are closing the gap between man and computer

New user-interfaces are becoming more and more graphical user-interfaces (GUI). An example of a GUI is Microsoft Windows, the most commonly used graphical interface on PC's.
Apart from the screen, some of the new developments in user-interfaces are handwriting recognition and touch-screens. Speech recognition systems are becoming better capable to recognise *natural* speech. This means you can write documents simply by reading them to the computer just as you would read them to another person.
User-interfaces like Virtual Reality (VR) helmets are still in their initial stage. They are not expected to break through on a large scale in the near future.

World Wide Web (WWW)
Is becoming the major part of the Internet and the number of users and providers is growing exponentially

WWW is a navigational aid of the Internet. It handles the user-friendly access of information within the Internet and also enables information providers to present text, audio, video, pictures and other types of information without extensive programming and in a consistent way.
Working with the WWW (or short, "The Web") is like browsing through an immense hypermedia[3] document. The user does not need to know anything about computers. Connections with computers all over the world are made completely transparent.
The concepts of WWW can also be used on closed networks. A Local Area Network (LAN) for example.

Directory services
Are operational at the moment

Directory services are databases that contain information on what is available in large networks. A user can enter key words to search for information on a certain subject he is interested in. The database will provide him with a list of directories and files in which the information can probably be found.
The quality of the various directory services differs a lot. Not all of them are completely up-to-date.

Intelligent agents
The technology exists, but for use on a large scale it has to be supported by network providers. This will take a while.

Intelligent agents are programs sent across networks. In the programs are instructions encapsulated that perform all kinds of tasks in places on agent-enabled networks or places such as electronic mailboxes, markets or gathering points. One could instruct such a program to search for the cheapest available flight from A to B and report back to the user.
An agent is written in a specific language. The network servers must also understand that language. An example is Telescript, made by General Magic. For the Internet there is Safe-Tcl as a language.

Multimedia, hypertext and hypermedia
These new form of media have reached a mature state and have become a multimilion business

The term multimedia is used for a combination of sound, graphics, (moving) image, data and text. This all has to be in digital form and interactively usable. Multimedia is implemented most commonly via CD-ROM or CD-i.
Hypertext means the presentation of text in which words are linked with other text documents. In such a document one can click with a mouse on a word to 'jump' to another document related to that word.

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[3] see Multimedia, hypertext and hypermedia, page 15

Hypermedia is a combination of hypertext and multimedia. Documents no longer contain only text, but also photo's, video, audio, etc. Links can exist between any combination of media (e.g. a photo with a video or a word with audio). The WWW as mentioned before is a form of hypermedia.

Computer telephony
Is still in its development stage

As the word says, computer telephony means using a computer to handle telephone calls. The use of a computer in telephony offers more functions than simply one of "a thousand short-dial numbers". The computer can start up a specific application when you dial a certain person and in combination with caller ID information, even when that person calls you. There is no general standard for computer telephony yet. Intel and Microsoft are fighting with their standard (TAPI) against the standard from AT&T/Novell (TSAPI).
Both standards focus on call control. Call control enables a computer the control of dialling, answering, transferring and conferencing.

4.1.4 Security is getting better

As mentioned earlier, information technology plays a vital role in our society. This means that a lack of security creates a great risk. Sensitive information can go into the hands of the wrong persons or information can be altered without the possibility to check this afterwards.
To make sure these risks will not form a threat for the use of information technology, technology is used to ensure more security. Some of these technologies are listed below.

Smart-cards
Have been introduced silently, but are now probably in everybody's wallet (look at your telephone-card)

A smart-card (also called chip-cards) is a credit-card sized card with a build in micro processor. The processor performs functions such as data management, security-control and card-specific functions. The cards used today have about 64 Kb of memory. New cards that use optical data storage techniques can store much more data and are available now. Hybrid-cards are smart-cards with both a build in micro processor and a magnetic strip for compatibility with old card systems.
At this moment smart-cards are often used as bank-cards or telephone-cards, but there are many other uses such as security-control.

Data encryption
Modern encryption is virtually impossible to crack

This technology has been used for centuries. New developments from the past few years, however, have made encryption technologies almost impossible to crack. The development of an encryption program that was distributed freely over the Internet has caused some trouble because the program was so good that even the government agencies could not crack it.

4.1.5 Information technology becomes portable

In the beginning of the information era computers were large enough to fill a whole room. The computers of today are small enough to fit on a desk and are often small enough to carry in a suitcase. Computers, however, are just a part of information technology. There is also networks, printers, monitors, etc. The trend is that also these elements of IT are getting portable.

Handheld computers
There are a lot of manufacturers who make them, but not many people buy them

Handheld computers are, as the name says, computers that are small enough to fit in your hand. They are also called Personal Digital Assistants (PDA's).
Handheld computers can perform agenda functions, have communication capabilities and can be programmed with software like project-management software, spreadsheets or databases. Some of them have a user interface that uses hand-writing recognition.
Just like desk-top computers, handheld computers are getting more powerful with every model. The latest models are able to use PCMCIA cards. These are credit-card sized add-on cards for computers. When inserted into a slot, they make it possible to send faxes or connect the computer to a network for example.
Real benefits (and the real breakthrough) of handheld computers can be the support of wireless communication, which will be the subject of the next paragraph.

Wireless communication
Short range communication works well, long range still has problems

Wireless communication means communicating via a computer network without being physically linked to this network. This gives the user the benefits of being hooked on a network without being limited in mobility (on the condition the equipment is mobile). Technically, wireless communication from anywhere in the world is possible via satellites and radio. Practically this does not work as it should. It is not expected it will in the near future. On the office grounds or on a campus it is much easier to use wireless communication.

4.1.6 Microprocessor controlled devices are integrated or interconnected to deliver extra functionality

Information technology can not only be found in computers. Other devises such as televisions, video cameras, pocket telephones, etc. are also controlled by microprocessors. In other words, they make use of IT.

Telecommunication
Not shocking news, but still quite handy

Fax, phone and answering machine are integrated into one single device. The biggest benefit of this is that the equipment needs less space and is cheaper than all three devices separately.

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Set-top boxes
2000 different TV channels, interactively, home shopping; with the right box this all is possible

These devices are connected between a television and a satellite dish or cable connection and can be used for different purposes. There are set-top boxes that enable you to use video on demand, a system that lets you decide what movie you want to see on cable television. In the ideal situation every individual can choose whatever movie on any time.
Another type of set top boxes provides you the functionality to make use of WWW (see page 15) on your television. The network connection is realised through the cable network.

4.2 Functions

IT by itself cannot do much for a manager. The technology needs to be utilised to perform a function. Often in combination with other technologies.
The functions listed below are focused on the use by a manager and are in some way new (completely new or enabled through the use of new technologies).
As mentioned in the section before, a combination of technologies creates new or enhanced functionality through synergetic effects.
Sometimes you will find the same description for both a function and technology (such as with multimedia for example). This emphasises the tight relationship between technology and functionality.
In this section, main functionalities are mentioned, followed by technologies that can be combined to deliver this functionality (small sized font). For every main functionality, more specific functions are described.

4.2.1 Electronic Communication
More powerful computers, Computer networks[4], Data compression, Enhanced email protocols, ISDN, Multimedia, Data encryption, Handheld computers, Wireless communication

Electronic brainstorming
Via computer networks it is possible to 'talk' with others via your screen. This process is at the moment text oriented, but technology allows also video, sound or graphics to be part of electronic brainstorming. You could use this technology to brainstorm with a group of people about a problem. These people can be anywhere in the world. One person can take part in several sessions and because everything that is said is automatically recorded, it is less difficult to take part in more than one session.

Electronic correspondence
There are several advantages in electronic correspondence over normal (paper) correspondence. Perhaps most important is the advantage that it is very fast (±10 sec. around the world). You can also address several persons at the same time. There is the possibility to have your messages forwarded to another person and in many cases you can read and reply your post from everywhere in the world. Another big benefit is that electronic post can be directly processed by a computer (storing, selecting, retrieving, etc.). Adding intelligence to a message makes it possible to instruct a message to go to another person if the first addressee does not read the message within a specified time.

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[4]Computer networks are not mentioned as a specific technology in chapter one. In the above context, topics related to computer networks mentioned in chapter one are Data Highways, The Internet and CompuServe. These are just three (important) examples of computer networks, but there are many others.

Until recently it was only possible to send text via electronic mail. New standards in electronic mail allow the user to send text, photos, animation's, videos, etc. via email.

Place independent (wireless) access to computer networks
By using wireless technology, people can have access to a LAN from everywhere in and around the office building without being physically connected to the network. This means you can have access to all the data in your desktop computer via a wireless connected laptop, which can be useful in meetings.
Several organisations offer nation-wide or even world-wide, wireless access to global networks. Via these networks you can access your LAN and read your email for example.
A problem with the last mentioned service is the reliability and speed of the connections. Also the world-wide access cannot be guaranteed.

Video conferencing
Video conferencing means having a conference where your partners are not in the same room with you, but somewhere else in the world. The contact between the participants is made via screens (television or monitor) on which you can see each other. The biggest advantages are that you can show things and that non-verbal communication is also possible. The last advantage only counts to a certain degree. The quality of the moving image is not good enough to notice all the signals that you would notice when having a face-to-face conversation. This will probably never be the case, but future technology can improve the image quality still a lot.
Video conferencing is not new, but up till now you had to go to a specialised studio to make use of it. Fast networks such as ISDN make it possible to do this from behind your office computer.
At the moment there is the limitation that you can only 'talk' with one person. New hardware that supports conferencing with three persons has already been announced by manufacturers. There are also organisations that make conferencing with more people possible by having one-on-one links with every participant. The incoming images are compiled in a mosaic screen, which is sent to the participants.
During a video conferencing session it is possible to share a computer screen. This means all participants can see the same computer screen on which an application runs. The participants can use this application, even if it is not installed on their own computer.

Shared whiteboards (Softboard)
A softboard is a special whiteboard. It is special because it automatically digitises whatever is written on it. A drawing appears on a computer screen exactly as is looks on the whiteboard.
In combination with a special modem you can speak to someone on the telephone (hands free) and write or draw something on the whiteboard. This drawing will be visible on the computer screen of the person you are talking to. Colours are recognised. The drawings on the whiteboard can be saved on a floppy or hard disk for processing or archiving purposes.
A softboard is of course very suitable to explain things to your telephone partner by using the whiteboard in your office.

4.2.2 Information Gathering and Dissemination

Data compression, Computer networks, ISDN, World Wide Web, Directory services, Intelligent agents, Hypermedia/Hypertext

Information searching

The search for information can be a very time consuming activity. World-wide computer networks can help in this situation. By typing in a keyword, databases all over world can be searched. The information available is of all kinds, but specially scientific, technical and recreational information is found a lot. The quality of freely available information differs a lot. Most information is ill suitable for business use, but sometimes you can find very useful and valuable information at no costs at all.

Information that has to be paid for is in general better structured and maintained. An example of this is marketing research information or news services.

Even with the help of computers, the search of information can take a while because there is so much information available, that selecting the information you need takes time. Intelligent agents can help in this situation because they do their work automatically. The user only has to browse though the returned information to check if it is what he or she wants.

Once the desired information has been found, it has to be accessed and sent to the user's computer. This can be done fast and easy through user-friendly interfaces. The information is available 24 hours a day.

As mentioned above, searching for information can take a lot of time. Accessing the information after it has been found can be done very fast. It is possible to think that someone from the manager's staff searches for information and gives the results to the manager, who can access it directly from behind his desk.

Automated up-to-date news service

There are services on networks like CompuServe and Internet that have the latest press-releases from Reuters, etc. If you subscribe to such a system you can let it send you automatically the news you are interested in. In this way you can read the news customised for you 24 hours a day. The news also gets to you sooner than it would via television or the newspapers.

Automatic monitoring

With automatic monitoring I mean watching events and take action according to what happens. As an example you could think of an intelligent agent that is staying in the computer of your airline company. It can watch the schedules and alert you if your flight has a delay of one or more hours

Market monitoring

There are many news groups on the Internet that discuss specific products or techniques. This allows a manager to monitor the acceptance of his products in the market. The discussions are mostly between users themselves. This means the remarks are sincere and the advantages and disadvantages of the competitors' products are also mentioned.

4.2.3 Presentation
More powerful computers, Optical data storage, Multimedia

Multimedia
Multimedia can be very useful in presenting information to visitors or employees. Through the use of animation and video things can be much better presented. In this way you could demonstrate your visitors how your production process is organised or train your sales force by simulating special situations in interactive video sequences.

4.2.4 Data Analysis
Neural networks, More powerful computers

Prediction of developments and recognising patterns
New technologies like neural networks can help in recognising patterns, unexpected developments, etc. They can help to predict the effect of marketing actions. Especially in complex environments where normal model building techniques and statistics cannot help.

4.2.5 Personal management functions
Multimedia, Computer telephony, handheld computers

Computer supported telephony
Normal company telephones offer a lot of functions. The use off these functions however is difficult because they have to be operated via unmeaningful codes (e.g. *#00+number). The words "If I lose you.." before a transaction will be familiar in this respect. A GUI can help to present these functions. Other more advanced functions are the access of email via a telephone. The computer will read out loud your email to you via speech synthesis. These functions will not be common in the near future.

Company encyclopaedia/filofax
Companies are dynamic organisations. The product line changes, the personnel changes, the clients change. Through the use of multimedia for example it is possible to build an encyclopaedia with photos of the products, personnel, stockholders and clients, films about the production process and more. Such an encyclopaedia could be maintained and updated at a central location.

Electronic agenda
Handheld computers (PDA's) are often used as electronic agenda's. Specific advantages over normal agenda's are things like alarm functions, planning functions. It is also possible to search for appointments or phone numbers via different indexes.
The functions described above are offered by most PDA's. New devices offer extra functions such as (wireless) communication functions.

4.2.6 General functions
Smart cards, Data encryption, User friendly interfaces, Computer networks

Security control
As organisations are becoming more dependent on computer information, the importance of security is also rising significantly. It is important to make sure that only authorised people have access to information via a reliable user identification.
User identification is not new, but new technology it making it more reliable.
An example could be a smart-card with the owner's fingerprint digitised on it. A scanner can scan the users fingerprint and compare it with the one stored on the card. Only if the two match, a positive identification is made.

Intelligent user interfaces
The modern user interfaces are graphical user interfaces (GUIs). The are designed to have a natural, intuitive feel. New interfaces also have a certain intelligence. This can mean it predicts what the user wants. If the user enters a name in a database and starts to type in the name BSO as a company name, the computer automatically enters the address if another person working at BSO is already in the database. An intelligent user interface will also prevent the user from making mistakes.

Teamwork support
For team support functionality it is possible to use groupware. Groupware is special software that helps a group of people to share information and communicate with each other. This enables a group to work more efficient and make better use of resources in reaching a common goal.
The success of groupware relies extensively on the people's willingness to share information.

4.3 Summary of technology survey

More powerful IT
The overall trend of more powerful IT has made it possible to use the standard PC more efficiently. The biggest change is improvement of user friendliness. Software like word processors, databases and spreadsheets have been used for more than 15 years now, but only recently powerful PC's have made it possible to use these programs in such a user friendly way that many people can work with this software.
The aspect of user friendliness is not only restricted to an application from a stand-alone point of view, but also the combined use of these applications is greatly improved.

Networking technology
Networking technology makes it possible to share resources on the office floor and it offers new means of communication. These new means of communication incorporate several advantages:

- Communication to a group of people is not more complex than communication towards one person
- Duplication of printed messages is not necessary

- Communication can take place faster. If you want the whole office to know something, it's just a matter of two minutes.
- Automatic logging of communications saves administrative overhead.

The growth of networking technology does not only take place in the office, the whole world is connected through Global Area Networks. This means that distance and time are no longer restrictions in a number of areas. Communication with people all around the world is no longer restricted to voice and printings only (telephone and fax), but video's or whatever information in digital form can be at any place within seconds.

Security
The implication of improved security is not often visible to the average user, but with good security, automated teller machines, telephone cards or office networks would not exist.

Portability
The trend towards portability has lead to cellular phones, laptop computers, pagers, PDA's, etc. People are no longer restricted to a specific place to communicate or to use computers. In the near future, access to your office network can be realised from your home or almost anywhere in the world. This can be done 24 hours a day.

4.4 Points learned from technology survey

- The power of IT (hardware, software and peripheral devices) has risen significantly
- Improved user friendliness has brought IT within the range of non specialists
- Networking technology is breaking through on a large scale
- This can improve the efficiency of communication
- And it removes the boundaries of time and place when exchanging digital information
- Portability of IT equipment and wireless communication increases these effects

5 Organisational Survey

As time changes, organisations change. The management styles of the industrial era are inadequate for the knowledge era, so new management styles and techniques will be needed to manage the new organisation. This also means that the manager's support requirements will change. In order to get an insight in these changes, you have to know what the organisation of the future will look like.

5.1 The New Organisation, growing the culture of organisational networking 📖 6

The following text is derived from *The New Organization, growing the culture of organisational networking,* written by COLIN HASTINGS in 1993.

5.1.1 Boundaries

Organisations as we have known them over the years are not adequate anymore to deal with the problems we face today. Organisations are unable to adapt fast enough. Decision making is slow and communication processes up and down the hierarchy are seen to be inefficient. Non-communication between departments, functions and specialisms is more rule than exception.

All types of organisations have struggled to overcome these problems, with mixed results. Gradually managers are realising that no initiative can solve the problems alone without changing the very organisational context in which they sit.

This change of the organisational context means breaking boundaries. These are boundaries with respect to:

- the free flow of communication (visible: geographical distance, invisible: culture differences)
- the boundaries between hierarchical levels, departments and specialisms
- psychological boundaries (someone from the work floor would not dream of walking into the Managing Director's office for a chat about production issues)

5.1.2 The hallmarks of the New Organisation

The change towards the New Organisation has already begun in some companies (Digital, Asea & Brown Bovery, BP, Benetton). The organisations that are developing now, have characteristics that Hastings calls hallmarks. These are:

Radical decentralisation
This development is focused on the decentralisation of tasks, power and responsibility. Combined with the belief in "small is beautiful" the organisation is split up into many types of small, autonomous and accountable elements. The smallest element is the individual.

Intense interdependence

Many of an organisation's tasks are achieved by assembling coalitions and project teams to purchase common goals. Both individuals and the organisation itself realise that in order to compete they have to co-operate.

Demanding expectations

The New Organisation sets strong, simple goals and has a clear sense of its purpose and mission. This is demanded by the people throughout the organisation both from their leaders and themselves. Each person has the right to ask for the co-operation of others

Transparent performance standards

An organisation sets demanding performance standards for everyone and measures and communicates these in a transparent way so that all are aware how they are doing in relation to other elements.

Distributed leadership

In the New Organisation the responsibility is very widespread among people. This requires considerable maturity and leadership from these people. Leadership moves beyond the boundaries of senior management into new networking roles.

Boundary busting

The New Organisation needs to be flexible and adaptive. A systematic awareness and elimination of physical, personal, hierarchical, functional, cultural, psychological and practical boundaries and barriers is needed to ensure this flexibility

Networking and reciprocity

The New Organisation thrives on direct relationships and information sharing between individuals. The organisation has to invest into the facilitation of intense communications between people.

5.2 Fifth Generation Management, integrating enterprises through human networking

CHARLES M. SAVAGE 📖4

The New Organisation as described by Hastings resembles very much what Savage calls the *human networking* organisation.
Managing this type of organisation generates a whole new kind of management challenges.

These challenges are:

- How do we move beyond the extreme fragmentation of companies formed in the industrial era?
- How do we maintain accountability in flat, dynamic network organisations?
- How do we support the focusing and co-ordination of multiple cross-functional task teams?
- How do we build into the very structure of the organisation the capacity for continual learning?

The solution to these problems can according to both Savage and Hastings be found in networking. This does not only mean connecting computers via wires, but the word networking is used here as a concept that will be explained in the next section.

5.3 Networking

As mentioned before networking is not just connecting computers to each other. It is a part of it, but is referred to by organisation theorists as *ways in which different organisations become interdependent on each other*.

To describe the meaning of networking Hastings uses "The Radar Screen model" depicted in Figure 5-1.
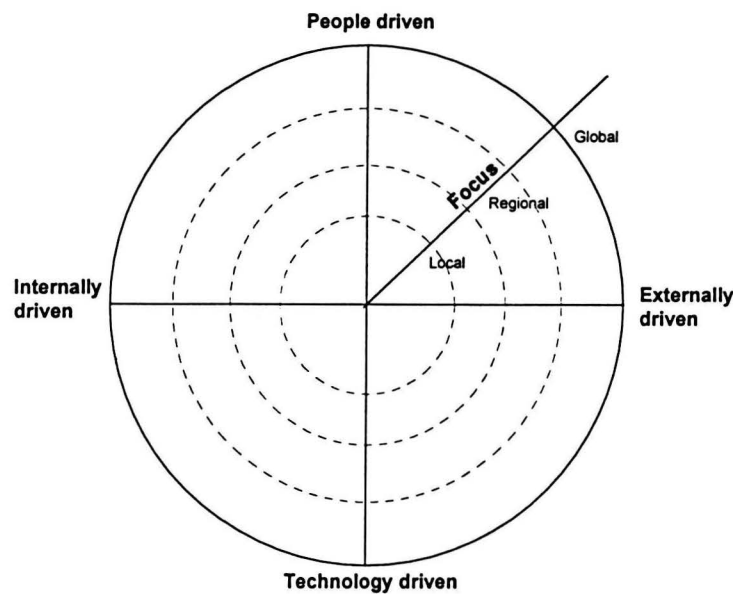
Figure 5-1 Dimensions of the New Organisation: the Radar Screen model.
© *Colin Hastings, New organisation Consulting*

As the figure shows, there are four strategic logics that lead organisations to move towards one pattern or another. Each logic has its own core networking process and purpose.

Strategic logic	Core networking process	Purpose
Internally driven	Networking within the organisation	Boundary busting
Externally driven	Networking between organisations	Successful partnerships
Technology driven	Hard networks	Connecting computers
People driven	Soft networks	Connecting people

Organisational networking refers to these four processes collectively.

Networking within the organisation

This is a strategy that sets a style and culture for an organisation. The purpose is to break down boundaries and create person-to-person communications. The constraints of traditional hierarchical and functional rules of communications must be lifted to free the organisation. Internal networks are branded in some way, usually by the topic of interest that network members share.

Many networks of this nature can be most easily 'seen' in the form of ongoing computer conferences within the organisation or through network newsletters, meetings and conferences.

Networking between organisations

The costs of developing new products and strategies have escalated in an exponential fashion. This means even a very large organisation can not take the risk to develop new technologies by itself. The cost and complexity of servicing increasingly global markets are also forcing organisations to collaborate with their clients, suppliers and competitors. To deal with this problem, organisations can form strategic alliances like "dynamic networks". The advantages of this are scale efficiency and market visibility while also being able to respond to local requirements. To make use of this the organisations have to share control of their resources, a tough boundary to break trough.

Hard networks

In this respect, networks is referred to as the electronics and software that connect computers. They are used to share information and to support communications.

The commitment to hard, high-tech networks involves major strategic decisions and huge capital investments in a field were technology is changing rapidly. These decisions consume large amounts of management time in an area where many of them feel both impelled to act, but, simultaneously, ignorant and fearful. The IT industry is not making this decision easier because of the lack of agreed international standards.

Hastings emphasises that it is a myth that installing electronic communications will, of itself, create the New Organisation. It is only a part of the wider organisational networking solution.

Soft networking

This term is used for all the different ways in which people make, and are helped to make, connection with each other through the systematic use of a wide range of soft technologies, such as conferencing, mobility policies and travel, for example.

Soft technologies need to come first, to form the infrastructure of personal contact throughout and between organisations. The hard technologies follow to support and enable those personal connections to expand and flourish.

Soft networking resembles what we see as the informal organisation within hierarchies. It is an important part of building individual's confidence and sense of positive power, the ability to make things happen.

5.4 The managers' requirements

Now we have gained an insight in the way organisations are heading, it is possible to predict what support managers require. Important in this case is that the manager of the New

Organisation is every member of it. If everybody is responsible for their work, everybody needs support in managing it.

In my opinion, this chapter has shown that two aspects are essential for a manager in a modern organisation; good communication and good information. Before we will discuss these two issues, please note that the term communication is in this context used in its broadest sense. Direct conversation, correspondence, email, non verbal communication, etc. are all covered by the term communication.

Information is referred to as a collection of data that has more value that the pieces of data have apart from each other.

Communication

The people of the modern organisation are very dependable on another. They need to reach a common goal, but are often spread all over the world. In order to co-operate and co-ordinate their activities, the need to communicate extensively.
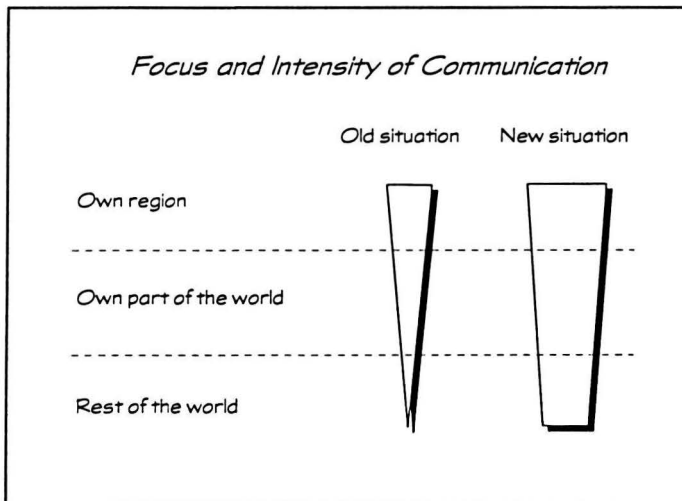
Figure 5-2 Changes in communication

Figure 5-2 shows the shift in focus of communication after the organisational changes towards the New Organisation. Not only does the focus shift towards more communication outside your own region, but also the intensity of communication rises.

Information

Just like communication, information is also essential for realising the New Organisation. Information is needed to co-ordinate the actions of the members of the organisation, the interaction with other organisations and interaction with the market. Figure 5-3 shows different aspects on which information is needed. Information about your own situation is still needed, but the emphasis shifts towards information about the rest of the organisation and its market. The world also becomes more important

5.4.1 Other support requirements

Communication and information are one of the most important aspects on which support is useful. Still, the description of the New Organisation
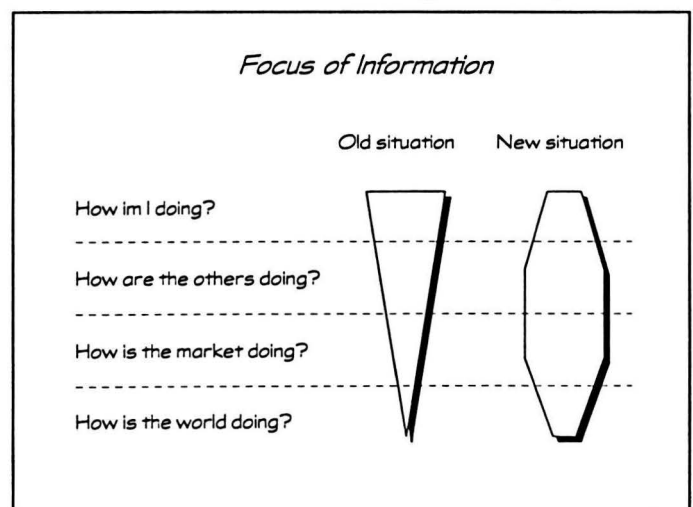
Figure 5-3 Changes in information requirements

and the manager's task within this organisation shows other aspects that may need extra support.
These aspects in which a manager could use support are summarised below:

- Mobility
- Presentation facilities
- Learning facilities
- Project co-ordination facilities
- Aids to share practice
- Strategy development aids
- Data analysis aids

5.5 Points learned from organisational survey

- The change towards the network organisation or New Organisation will have a significant impact on the manager's tasks
- The new organisation exists out of many, autonomous parts that interact in order to reach a common goal
- Communication and information will have an important role since it is essential for efficient co-operation and co-ordination between the different parts
- The manager of the New Organisation is every member of it. If everybody is responsible for their work, everybody needs support in managing it.
- The intensity of communication and information will therefore rise
- The scope of organisational communication and information is expected to shift towards a more external view

6 Interviews

In this chapter the preparation, execution and outcomes of the interviews are discussed. A separate report with a summary of every single interview also exists, but due to privacy reasons this report is only available for the tutors.

6.1 Type of interview

Basically there are three types of interviews; structured, semi-structured and unstructured. The first type refers to an interview in which all the questions are pre-fabricated and during the interview, no deviation from the initial schedule is allowed.

The second type makes use of pre-fabricated questions, but new questions may be introduced or questions may be skipped when necessary.

The last type refers to an interview in which the interviewer is free to ask whatever question is appropriate in his/her opinion. No pre-fabricated schedule is used.

Since there are many uncertainties concerning the support requirements a manager has, it is difficult to generate a list of questions in advance. In such a case, the unstructured interview can be a good approach, but for this type of interview the interviewer needs to be experienced and well grounded concerning the interview subjects. Since I am neither an experienced interviewer nor a veteran on the subject of management support, it seems better to use the semi-structured approach.

Within this project, a list of interview questions is generated in advance, but during the interviews it is possible that questions are skipped or that new questions are made.

6.2 Interview approach 📖 7

To make sure the results of an interview give the information that is needed to satisfy the main goal, it is necessary to have a good preparation.

The preparation and execution of the interviews is based on the approach described in the book *Interviewen, Theorie, techniek en training* by BEN EMANS, 1990.

Ben Eman's ten step approach is as follows.
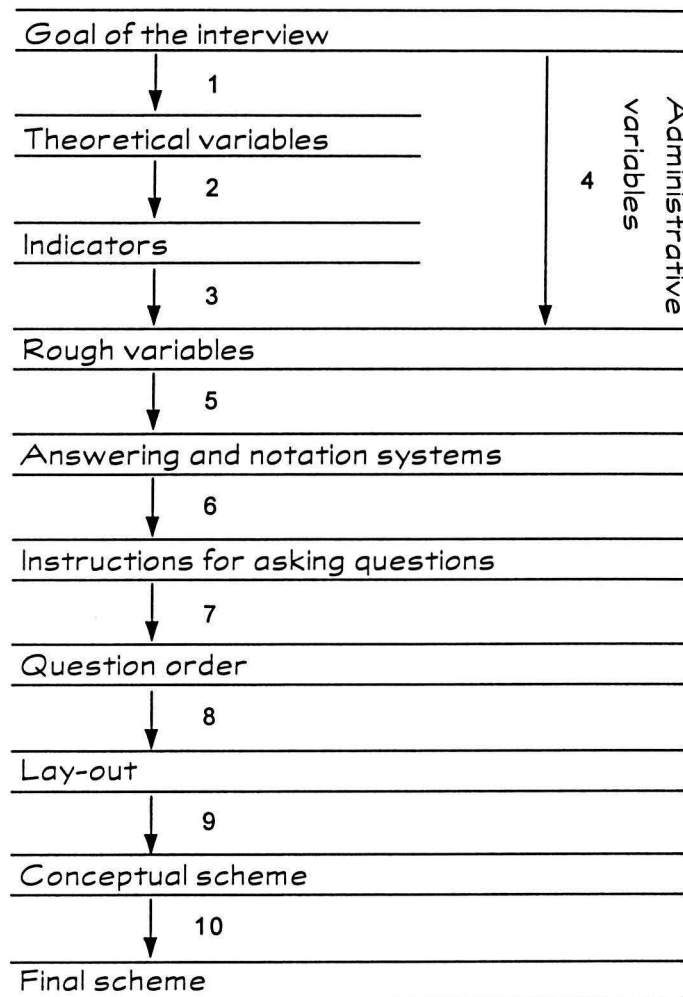
Figure 6-1 Ten steps in preparing an interview
Source: *Interviewen, Theorie techniek en training*, BEN EMANS, 1990

6.2.1 Goal of the interview

The main goal of the interviews is to get an answer to the following questions:

- What kind of support requirement does a manager have?
- What demands does he have concerning the quality of support?
- What is his attitude towards the use of new technologies?

6.2.2 Theoretical variables *step 1*

The first step in building an interview scheme is deducting theoretical variables from the goals of the interview. These variables are listed in the table below.

Collection A represents all objects that can have a value for the variable. Collection B represents all values a variable can have.

Table 6-1 Theoretical variables

No.	Name	Collection A	Collection B
1	Support requirement	All respondents	Every possible requirement for support
2	Quality demands	All respondents	Every possible combination of quality demands a respondent has towards support functions
3	Attitude	All respondents	Every possible attitude towards the use of information and communication technology

6.2.3 Indicators *step 2*

To determine what rough variables are needed, we have to know in what way we get an indication of the value of the theoretical variable. In the table below the indicator of every theoretical variable is shown.

Table 6-2 Indicators of theoretical variables

	Theoretical variable	Indicator
1	Support requirement	Respondent's description of support requirements
2	Quality demands	Respondent's description of quality demands
3	Attitude	Respondent's description of his attitude

6.2.4 Rough variables *step 3*

The list of indicators helps us to get an idea about the main issues we need to know in order to find values for the theoretical variables. These indicators are however not suitable as direct questions in an interview. Practically usable variables, called rough variables, need to be derived from the theoretical variables, by looking at their indicators.

Table 6-3 Step 1,2,3 and 5

Step 1	Step 2 and 3		Step 5		
Theoretical variable	Name of rough variable	Collection B	Answering system	Answering instruction	Notation instruction
Support requirement	Main problems experienced by the manager, caused by organisational changes	Every possible problem a manager may experience as a result of organisational change	Open question without field encoding		Write down
	Description of support requirements	Every possible requirement of support	Open question with partial field encoding	Name as many as you want	mark if on answer form, note if not on answer form
	Support ranking	Ranking of requirements from last question	Closed question	Choose your top three from the list	Note the ranks
Quality demands	Specific variables for each support type	DEPENDS ON SUPPORT TYPE [5]			
	Description of ideal support	Every possible description of ideal support	Open question		Write down
Attitude	Present use of IT	Every possible use of IT	Open question		Write down
	Opinion about IT	Every possible opinion	Open question		Write down

6.2.5 Administration *step 4*

The rough variables that have been found till now are derived from theoretical variables. Another set of rough variables (also called technical variables) needs to be introduced for administrative reasons. The name of the interviewee, the date of the interview and a task description of the manager's job are introduced to process the interview results afterwards.

6.2.6 Answering and notation systems *step 5*

In Table 6-3 you can see that the answering system mentions open and closed questions. In general open questions will be used.
Field encoding is used in some cases, but from the options that an interviewee can choose, there will always be one option that lets the respondent give a different answer (partial field encoding).

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[5] It is not known in advance what type of support a manager will mention. The most likely support types (communication, information gathering, data analysis, presentation and personal management) have been used to make questions, but mentioning them all would make the table excessively large.

6.2.7 Instructions for asking questions *step 6*

This step in the preparation of an interview is meant for interviews where the interviewers are not familiar with the preparation. This is not the case within this project, so this step will be skipped.

6.2.8 Question order *step 7*

The questions will be asked in an order that gradually focuses the attention to a specific subject.

First the main problems of organisational changes will be discussed. From these problems it is possible to determine what type of support can be helpful. After the support types have been identified, the two or three most important support types will be looked upon more closely.

6.2.9 Final Question list *step 8, 9 and 10*

With table 6.3 as basis, a questionnaire with interview questions has been made (see appendix B). The list is constructed in such a way that only a part of the questions will be asked. The choice of these questions depends on the support requirements the respondent is interested in.

As mentioned before, the interviews will be semi structured. The question list is only used to have a set of opening questions about important points, but the use of them depends on every single interview situation.

6.3 Interview Demonstration [6]

During the interviews, after it has been determined what IT support can be useful for the respondent, a demonstration of various IT support tools is given.

On a lap-top computer, a demonstration of several support tools is available through an easy to use interface (see Figure 6-2). This interface is developed to show that things that are considered difficult or complicated (e.g. Internet) can be used with a simple 'mouse click'.

The *DTV* button brings up a video fragment showing an actual Desktop Video Conferencing session that was taped at the BSO office. *PAS* stands for Professional Assistant System, a system that is being developed with the purpose to create a system that supports a technology manager especially on the unstructured tasks he has to deal with. These unstructured tasks are expected to be related to knowledge management.

The button *Netscape* will build a
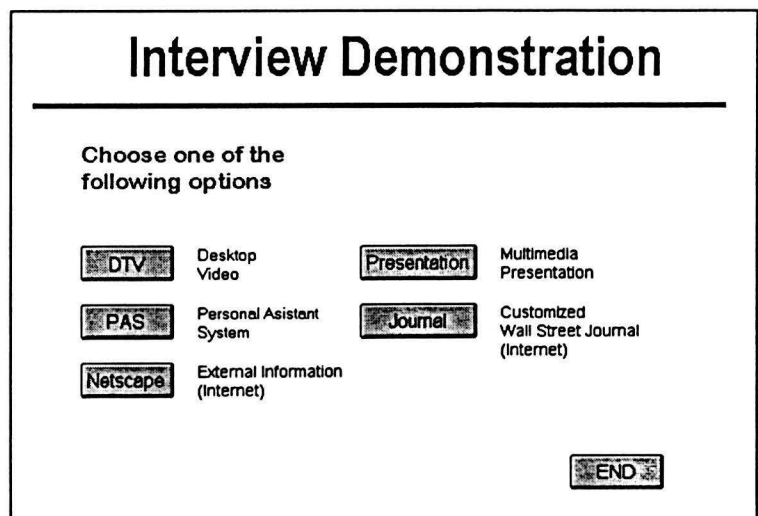
Figure 6-2 Opening screen of interview Demonstration

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[6] In this section technologies are mentioned that are not explained in the 'Definition of Terminology', in these cases they are explained in the chapter "Technology Survey"

connection with the Internet. After this, the application "Netscape" is started, an application that is used to access the World Wide Web.

The *Presentation* button shows a simple multimedia demonstration in which video fragments of a production facility are shown.

The *Journal* button starts an application that provides the user with the latest news from all over the world. The news comes from The Wall Street Journal, The New York Times and various news wires and is brought to the user through the Internet infrastructure. An important feature of the application is that only news to the user's interested is sent. A user defined filter is used for this.

Some support tools could not be demonstrated with the computer (e.g. Softboards, General Magic). In these cases photos and/or verbal explanation is used.

6.4 Execution of the interviews

Eight interviews were taken, all according to plan. Each interview was quite deep and took at least 1½ hours. Most took even longer, with extremes up to 4 hours.

After each interview, a summary was made and send back to the respondent with the request to provide feedback in the case some of the answers were misinterpreted by me.

6.4.1 Choice of respondents

In section 2.1 it is mentioned that we are interested in international managers, because of their expected need for communication support. It proved to be difficult to find enough international managers within a short time period. So we chose to select managers on other criteria.

The main criterion was to find managers that have functions in various parts of our society. In this way we hoped to get results that are applicable to managers in general. As a secondary criterion we kept on looking for international managers.

In total eight managers agreed to be interviewed. They came from various branches of our society, as listed below:

Type of industry	Size	Function/Responsibility
Animal corpses destruction and processing	Small	Head of Environmental and Technology Department
Hardware and software developer of interactive electronic media	Very large	Strategic Product Planning (*int.*)
Research and consulting in the health care branch	Small	President
Research laboratory	Very large	General information infrastructure (*int.*)
Education (University)	Medium	Member board of directors
National defence (army)	Large	Head of section automation (staff officer)
Financial service (Leasing and factoring)	Large	Co-ordination of international activities (*int.*)
Electronics (Communication Systems)	Very large	CEO (*int.*)

As you can see, the goal of diversity is certainly realised. The secondary criterion is realised to the extent that four out of eight managers, indicated by the word (*int.*) in the list, can be clearly marked as international managers.

6.5 General Results

The results summarised in this section have been found in eight interviews. This amount is not high enough to deduct statistical conclusions. It is however possible to compare the outcomes of every single interview and notice striking similarities or differences.

6.5.1 Main problems

During the interview, the respondent was asked to describe the main problems he experienced as a result of organisational changes over the past years. Every answer was one on its own, but I have tried to fit them in some basic categories. The results are summarised below.

Table 6-4 Main problems

Problem category	Times mentioned
co-operation	1x
control	4x
change in organisational culture	1x
Execution of tasks (travelling, information gathering, etc.)	1x
Practical usability of IT	1x

The categories co-operation, control and change in organisational culture are more or less related to co-ordination and co-operation. As expected in the organisational survey, these factors play an important role (mentioned by respondents 6 times).

6.5.2 Support requirements

Five different categories of support were given;

support on:

- communication
- presentation
- information gathering
- data analysis
- personal management

The respondents were asked whether they recognised these areas and if some category of support lacked. One respondent used this occasion to introduce the category *relational networking support.*

Other respondents used the occasion to emphasise that information gathering and data analysis can not be seen as two separate support types. If this occurred, the two categories were replaced by a combined category *information gathering and data analysis.*

The result of the support ranking of the three most important categories is summarised in the table below. If two categories were ranked equally, the numbers were devided. This explains the ½ numbers in the table.

Table 6-5 Ranking of support categories

Support category	Number 1	Number 2	Number 3	Weighted total[7]
Communication	2	1	2½	10½
Presentation		1	1	3
Information gathering	2	2		10
Data analysis			½	½
Personal management		2	1	5
Relational networking	1			3
Information gathering and data analysis	3			9

The numbers mentioned in the table should not be seen as 'hard data'. They are only mentioned to summarise the answers.
It is remarkable that communication and information gathering score high. Especially information gathering, when looking at both the separate and combined category, scores high (19). In comparison with the other scores, the difference is big.
There was no difference between the choices of international and national managers.

6.5.3 Reactions to demonstration

During the interviews, demonstrations of support tools were given (section 6.3). The reactions to these demonstrations are summarised below.

Table 6-6 Reaction to demonstration

Demonstration subject	Positive	Neutral	Negative
DTV	3	1	
WWW	5		2[8]
General Magic	1		
PAS	4	1	
Multimedia Mail	1	2	1
Wall Street Journal	4	1	
WWW (when used as local hypertext information exchange tool)	1		
Electronic brainstorming		1	

The classification mentioned above should not be seen as a very strict classification. The respondents had only a short look at the application and could not give a clear opinion about

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[7] Weight factor 3 for first rank, factor 2 for second rank and 1 for third rank
[8] The negative reaction resulted from the unstructuredness of WWW

the usefulness of the application. The choice of classification was made on the general feeling a manager had concerning the application.

6.5.4 General issues

It is remarkable that many (7) respondents emphasised the need for a well thought and well structured policy concerning the use of IT.

This was according to the respondents needed to assure an efficient information and communication structure. Not only technical issues like hardware and software, but also issues like, what kind of information should be available to who and how should this information be interpreted, need to be discussed. Without such a policy, the effectiveness of support tools is expected to be low.

With respect to the demonstration applications can be said that most respondents did not appreciate fancy functions on the application. Just start with the basic functionality and leave all the extras for later when the manager is familiar with the application.

6.5.5 Present use of IT

All respondents that work at either a large organisation or a geographically dispersed organisation had email facilities.

The high ranked executives used it intensively. Five out of six respondents who had access to email facilities, used it on a regular basis. Only one used it solely for reading incoming mail.

Seven out of eight respondents had a PC on their desk. Mostly, applications like word processors, spreadsheets or databases are used within a Windows environment.

All respondents realised that IT is very important to an organisation. In general they have a positive attitude towards the use and possibilities of IT.

6.6 Summary of interviews

The main problems that managers mentioned are often related to feeling that the manager is loosing control over the situation.

The support that is required to deal with these problems lies in roughly two main fields; communication and information gathering. Real benefits from support tools in these areas are not expected to exist unless they are part of an over-all policy on the organisation's information and communication structure.

Communication

The problems of communication not only incorporate the problem of reaching the people to which you want to communicate, but also the problem of 'getting the message across'. With getting the message across is meant that the message that is communicated is not correctly interpreted by the organisation members.

Even when there are problems with communication, the manager does not ask for more support tools. The combination of telephone, fax, email and postal services seems to be strong enough to provide in reasonably efficient communication support.

So a manager only accepts new support tools in this area if it works or functions unconditionally and in an easy way. If this is not the case, the tool will only make a delicate situation more confusing and is therefore not needed.

Information gathering

It seems to be difficult for a manager to get the information he wants. As an important cause for this problem it is mentioned that there is no policy concerning the information structure. The lack of policy causes a situation in which the information from various parts of the organisation is not stored in such a way that others can use it. Even if it is stored, there may be no good infrastructure to disseminate it.

Managers expect that IT can help in this area by delivering tools that help to deal with all kinds of information (internal, external, hard and soft). The main functionality of these tools must be found in clarifying the big picture that exist when linking all kinds of information sources.

Besides communication and information gathering, the other types of support that were suggested to the respondents, namely presentation, data analysis and personal management, were recognised as types of support that are sensible to suggest. It is interesting that one respondent added an extra type of support, relational networking support.

With respect to the IT support that was demonstrated to the managers can be said that a real opinion about these applications can not be given by simply looking at a demonstration. In general, applications that offered a clear structure, like PAS and Relevant, were received well by high placed managers. Other applications, like DTV, were received well by people who needed that type of support.

A general complaint was the user unfriendliness of IT. It is difficult to make things work together (if they work at all). There are too many unnecessary functions on machines and things are not logic. Real software and hardware standards do not exist where you would expect them.

At the moment, most managers have a computer on their desks. They use it for various applications like word processors, spreadsheets and databases. Office networks are available everywhere and email facilities are used by most managers.

6.7 Points learned from interviews

- The main problems are related to the feeling that there is a lack of control over the situation
- Communication and information gathering are both considered as very important in relation to these problems
- Extra or better support is mostly needed in the field of information gathering
- The existing tools that are available for communication (telephone, mail, fax and email) provide sufficient support.
- An information and communication structure is needed to effectively use support tools
- IT is still considered to be difficult and complicated in use. Especially on the area of software and hardware standards and compatibility.
- The general attitude towards IT is positive, most managers have a computer and use it for standard applications like word processors, spreadsheets, databases, etc.

7 In Depth Analysis of Support Tool

Within this graduation project, a support tool has been examined more closely. In this case the analysis was focused on Internet.

The field in which the analysis was placed is the Strategy and Planning Department of Philips Display Components. Two managers of this department had the feeling that Internet could be a promising source of external information, but were not sure if this could result in a useful tool to work with.

The complete analysis is described in the report *Internet as Source of External Information*, which was presented to Philips Display Components. By request of Philips, the report itself is not publicly available because there is company confidential information in it. The main aspects that are relevant for this graduation project are however all mentioned in this chapter. This chapter describes the background of the analysis and will summarise the conclusions from the previously mentioned report.

7.1 Choice of support tool

As mentioned in chapter 3, the initial planning incorporated an in depth analysis on a promising support tool that was chosen on the basis of the results from interviews with managers from Philips Display Components (PDC). After the planning changed (section 3.2), no interview results were available to make this choice. The revised planning dealt with this problem by making the choice based on mutual agreement.

Two possible subjects (support tools) came out of meetings between the involved parties; Desktop Video Conferencing and Internet.

The first subject was already part of other research carried out by BSO and PDC and was therefore not an option. Internet had the attention of several managers from PDC and questions about the usability of this phenomenon were already asked. With this information the choice for Internet as subject of the analysis was easily made. Meetings with two managers from PDC's Strategy and Planning Department, Mr. Munnikhof and Mr. Pelzers, specified the subject to Internet as source of external information. The focus of attention should be towards World Wide Web (WWW, section 4.1.3). WWW is very easy in use and therefore suitable for use by a manager, which is the reason for this limitation.

Whenever the word Internet is used in this chapter, it especially refers to its use in combination with WWW.

7.2 Execution of analysis

During several meetings with Mr. Munnikhof and Mr. Pelzers, the way in which they wanted to use Internet was determined. Based on a set on information requirements Internet was searched to find relevant information. The output of this process was fed back to the two gentlemen. Their reaction led to the conclusion that Internet can indeed be a useful source of information.

After this conclusion was made, the next step was to examine in what way Internet could be incorporated in a system that enabled the Strategy and Planning Department to use Internet as an information retrieval tool. Also the aspect of dissemination of the information throughout

the organisation was covered. A more detailed description of this process is found in the report mentioned before.

7.2.1 Demonstration Model

During the analysis, an important disadvantage of Internet was found in its chaotic nature. This makes it difficult and time consuming to find the information one is looking for. A solution to this problem was found in a menu structure that leads the user directly to main categories of information (e.g. business news). This limitation towards a specific information category has the advantage that the user is confronted with a *smaller amount* of *more relevant* information that can be handled better by the user.

To make this solution better understandable, a working demonstration model was made. Due to practical reasons, this demonstration model was made for one of my tutors, Mr. Grünwald, instead of for PDC, but still the principle remains the same. A picture of the main menu can be found in the figure below.
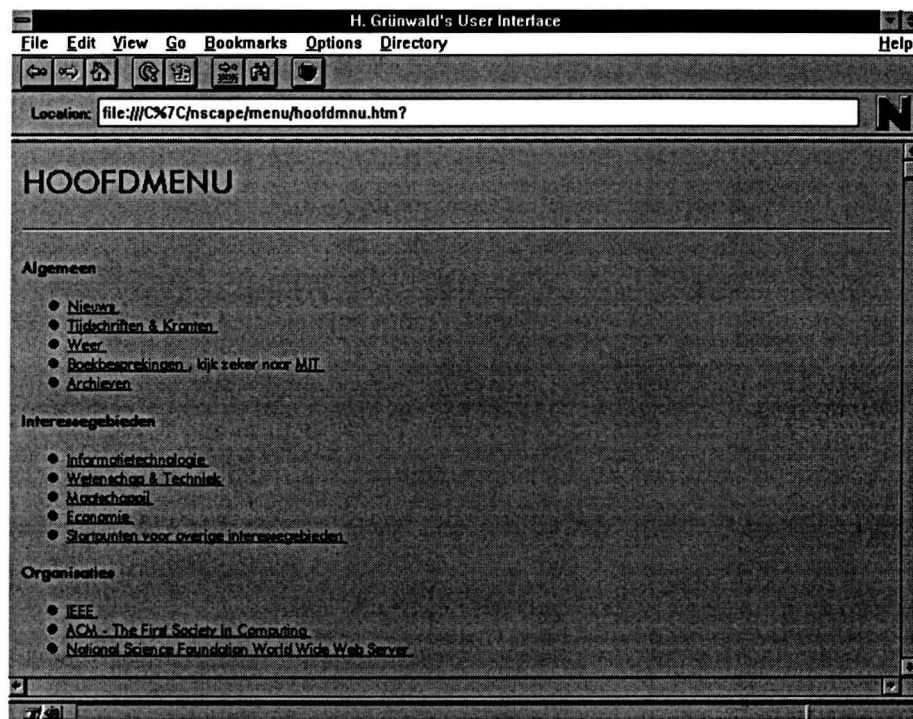
Figure 7-1 Main menu from demonstration model

The menus were presented to Mr. Munnikhof and Mr. Pelzers and were received with enthusiasm. They believe this solution comes close to the situation they desire, although they would like to see an extra function added to the menu solution. This function should enable the user to filter the information behind a menu entry with key words.

They ask for this function because a menu limits the possibilities of a user (you are restricted to the entries). A key word search functionality brings back some flexibility because the user can search the information fast with keywords he or she determines.

The complete solution brings up a situation where the user is restricted in his possibilities, which is desired to prevent an overload of information, but where enough flexibility is offered to effectively use the tool.

7.3 Summary of analysis results

The following text is the literal summary as found in the report "Internet as Source of External Information".

It is generally known that Internet provides access to a very large collection of information. A short analysis after the relevance of this information for use by Philips Display Components (PDC) has shown that relevant information can be found in the Internet.
A special 'part' of Internet is called World Wide Web, which provides in a very easy and user friendly access to the resources in Internet.
One major drawback of Internet is its chaotic structure in combination with the broad variety of subjects on which information can be found (from song lyrics to government information). This aspect of Internet makes it difficult and time consuming to find desired information.

Making a connection to Internet can be achieved by making use of an Internet connection provided by C&P[9] through the local area network. A solution for dealing with the drawback mentioned above, is offering the users a collection of Internet resources that contain relevant information for PDC employees. This saves the user the trouble of filtering out that kind of information from the complete Internet resources.
A practical implementation of this concept can be found in user defined menus, containing items that lead the user direct to information of relevance to this specific user.
The Strategy & Planning department of PDC can search for useful information resources on the entire Internet and use the results to create the user's menu in co-operation with the executive/manager. Sophisticated computer programs (intelligent agents, page 15) can help to automate a large part of this process, but this involves writing special code. Help of experienced Internet experts is needed to realise this.
To enhance the practical usability and flexibility of the menus, some sort of search functionality has to be build inside the menu structure. This makes it possible to search for special keywords, like "High Definition Television (HDTV)" in the information that can be found under a certain menu item.

The approach described above tries to comply to the users need of restriction (only relevant information) without having to give in on flexibility (search engines).

7.4 Points learned from in depth analysis

Not all the points mentioned below can be derived from this chapter, some of them can only be found in the original report.

- There is a real interest in the possibilities that IT offers to access external information sources
- The user wants to be restricted to relevant information without loosing flexibility
- Support that is customised to every individual, will probably improve the user's acceptance
- A policy concerning the information infrastructure, that is aimed at a dynamic environment, makes it possible to implement new solutions fast and easy.
- Internet in its present shape is not well fitted to the user requirements, but don't try to change Internet, try to use it in such a way that its limitations are suppressed by finding your own creative solutions. Internet eventually will change for the better

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[9] C&P (Philips Communication & Processing Services) is a division of Philips Electronics that provides services on the field of communicating and processing digital information.

8 Experience Gained during Project Execution

The benefits of this graduation project are not only found in the results that are on paper. The experiences gained during the project execution are also important outcomes.

8.1 Personal experience

The personal experience I gained in handling a project like this, is influenced by two main characteristics, namely *uncertainty* and *many involved parties*.

Dealing with uncertainty
In chapter 1 it is mentioned that the developments around MSSs are very dynamic. Since MSSs are the subject of this graduation project, some dynamics are also found in the execution of this project. It is not known in advance what to expect precisely when doing explorative research in a dynamic environment.

Many involved parties
During the project, many people from different organisations (BSO, TUE, Philips Display Components) were involved. The formulation of the assignment was directly influenced by seven people. Two extra persons were involved when choosing a subject for the in depth analysis.
Besides the people that were directly involved, the interview respondents had also their influence on the execution of the interviews.

The situation of many different involved parties caused extra uncertainty within the execution of this project. Reality learned that the realisation of plans is not always smooth, even when all parties are willing to co-operate with the best intentions. Adjustments of plans are needed to deal with this reality, as seen in chapter 3.

The whole situation described above forced me to be very flexible, but it also gave me a chance to put my own ideas in practice when looking for an approach to deal with unexpected occurrences.

8.2 Demonstration models

In this project a lot of demonstration models were used. During the interviews five different tools could be demonstrated and during the in depth analysis another demonstration application was made. The use of these models proved to be very constructive. The interview respondents found them interesting and it brought up new material to discuss. In a way they made the interviews more confrontational. They also seemed to help a potential respondent in agreeing to be interviewed, because the demonstration of new tools made them curious. The demonstration application of the in depth analysis, really made the involved persons understand what I meant. It caused enthusiasm.

9 Conclusions

Before the general conclusions are discussed, the points learned from every chapter in the project execution phase are repeated in the figure below.

Technology survey (chapter 4)

- The power of IT (hardware, software and peripheral devices) has risen significantly
- Improved user friendliness has brought IT within the range of non specialists
- Networking technology is breaking through on a large scale
- This can improve the efficiency of communication
- And it removes the boundaries of time and place when exchanging digital information
- Portability of IT equipment and wireless communication increases these effects

Organisational survey (chapter 5)

- The change towards the network organisation or New Organisation will have a significant impact on the manager's tasks
- The new organisation exists out of many, autonomous parts that interact in order to reach a common goal
- Communication and information will have an important role since it is essential for efficient co-operation and co-ordination between the different parts
- The manager of the New Organisation is every member of it. If everybody is responsible for their work, everybody needs support in managing it.
- The intensity of communication and information will therefore rise
- The scope of organisational communication and information is expected to shift towards a more external view

Interviews (chapter 6)

- The main problems are related to the feeling that there is a lack of control over the situation
- Communication and information gathering are both considered as very important in relation to these problems
- Extra or better support is mostly needed in the field of information gathering
- The existing tools that are available for communication (telephone, mail, fax and email) provide sufficient support.
- An information and communication structure is needed to effectively use support tools
- IT is still considered to be difficult and complicated in use. Especially on the area of software and hardware standards and compatibility
- The general attitude towards IT is positive, most managers have a computer and use it

In depth analysis of support tool (chapter 7)

- There is a real interest in the possibilities that IT offers to access external information sources
- The user wants to be restricted to relevant information without loosing flexibility
- Support that is customised to every individual, will probably improve the user's acceptance
- A policy concerning the information infrastructure, that is aimed at a dynamic environment, makes it possible to implement new solutions fast and easy
- Internet in its present shape is not well fitted to the user requirements, but don't try to change Internet, try to use it in such a way that it's limitations are suppressed by finding your own creative solutions. Internet eventually will change for the better

Figure 9-1 Points learned during execution phase

When looking at these points, three main conclusions can be derived. The points that contribute to one of these conclusions are marked by special bullets (conclusion 1, ◊; conclusion 2, ♦; conclusion three, *).

The **fist conclusion** is that *Communication* and *information gathering* are, as expected, both very important areas of interest to the manager. The support requirements of a manager are however mostly focused on information gathering and **not** on communication.
A possible reason for this difference can be the existence of traditional communication support tools, like the telephone, fax, post and nowadays also email. The combination of these tools seems to be powerful enough to deal with the most important communication support requirements. New tools, like Desktop Video Conferencing, can be useful, but are only accepted after they have proven themselves on the areas of performance and added value.

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Information gathering is probably the most important area in which new support tools can bring significant improvement. The manager needs more relevant information from sources that, with the present means of support, are hard to access. Networking technology can help in this situation.

The availability of information is not the only problem. The process of handling the information in order to get the big picture is also a problem. The cause of this problem can, according to many interview respondents, be found in the lack of an efficient *information policy*, which brings up the **second conclusion**. There is a need for a policy concerning information. Without this policy, too many blockades prevent an efficient flow of information and the interpretation of information is not the same throughout the organisation. Information technology must play an important role in this policy since it determines for a great deal what is possible and what is not.

The managers understand that the structure in which external information is stored, is out of their control. They do expect that computers can handle this information in such a way that it is presented in a clear structure. When handling internal information, this expectation is even stronger because internal information is within their organisation's control.

An organisation wide policy concerning every aspect of information, including the communication and information structure, can solve most of these problems, according to the interview respondents.

The **third conclusion** that there is still a lack of user friendliness when working with information technology. The way in which software is controlled is not logical in the respondent's opinion. What you would naturally expect an application to do when you give a certain command, is often not what really happens. Other complaints are about the problems that occur when making different IT based tools (both hardware and software) work together. A lack of standards is mentioned as one of the causes for this problem.

With respect to support tools we can say that simplicity is greatly appreciated. Exotic features only complicate the use of a tool and make it less interesting.

An **extra main conclusion**, that can be derived from the experiences gained during the execution of this project, is that demonstration models give a lot of additional value to interviews. It can change the interview from a *conversation* to a *confrontation*. This can bring up reactions that would never have been found in a normal interview.

9.1 Discussion of conclusions

Some of the points mentioned above need more discussion to get a better understanding of their context.

9.1.1 Information gathering 📖 3, 8, 9

Within this report, one main conclusion is that information gathering is the most important field in which support is needed. For this reason it is interesting to look what two highly respected authors have said about information and the manager.

Ackoff's information myths
In his book *Creating the corporate future*, Ackoff mentions five statements that he calls information myths. The statements can be found in figure 9-2 (next page), together with Ackoff's explanation about why these statements are myths.

Ackoff's information myths

1. **Managers have especially the need to get more relevant information**
   Managers do not at all have the need to get more information, they get too much information at the moment. What they really need is less irrelevant information and the remaining information should be presented in a more condensed form.

2. **Managers perform better when you give them the information they ask for**
   Managers want to know everything, so they ask (and get) more than they can handle

3. **Managers perform better when you give them the information they need**
   If we knew what information they need, someone else could solve the problem. A manager can not specify his information needs far enough in advance to develop a system for it.

4. **The more information is shared by managers, the better the organisation will do**
   The more information you have from each other, the more harm you can inflict on each other. Information is personal. Giving away your information requirements and information sources makes you vulnerable.

5. **Managers who use information systems, do not need to know how they work**
   If that was true, no reliable control on their reliability would be possible and it would be the system developers who manage the managers.

Figure 9-2 Ackoff's information myths

The outcomes of this project seem to be somewhat in conflict with Ackoff's statements. Let's look at the first statement. I believe this is certainly not a myth, but also Ackoff's explanation is in this case very weak. It is true that a manager wants to get less irrelevant information, but he wants this to get more time to handle more relevant information.

Ackoff's explanation of the second and third myth is conflicting. He says we do not know what information a manager needs in the explanation of third myth, but in his explanation of the second myth he claims that we should not listen to what they ask for. How will we than ever know what information is needed? Even if we know what a manager needs, does this mean that someone else can solve the problem? I don't think so.

With respect to the fourth myth. In 1980, when Ackoff's book was published, a lot of managers probably thought this way, but nowadays most managers see that this believe is self destructive for both a manager and his organisation on the long run.

The explanation of why the fifth statement is a myth does not give much credit to a manager's capabilities. If a system is not reliable, the manager will see this sooner or later and abandons the system. The interviews showed that managers are interested in IT, but their approach is somewhat conservative. The do not rely blindly on a system unless it has proven its reliability beyond a doubt.

In general, I think Ackoff's statements are very weak. It is true that managers are overloaded with information, but you can not blame that on the managers. In some way this is what Ackoff is doing.

View of Minzberg

In the article "The Manager's Job: Folklore and Fact" from Harvard Business Review, Henry Minzberg states that it is not true that senior managers need aggregated information like that produced by a Management Information System. He argues that they do not need abstracts

and stylised facts, instead they obtain and transmit information via all sorts of verbal media: face-to-face conversations, phone calls, travelling, meetings, spontaneous and impromptu discussions.

R. Cullen's book on his promotion project, "EIS, meer dan gegevens", confirms this belief. Some of these information sources, however, that were always considered to be only accessible through verbal contact, can be reached through computer networks. This often works faster, cheaper and more efficient. So even if verbal ways of information acquisition are inevitable in a lot of situations, new tools are available that provide information in a different (IT), efficient way. Why not use them?

9.1.2 Policy

As mentioned before, the information policy needs to get more attention. It should be made in such a way that it is flexible enough to deal with the dynamics in which organisations operate. Information technology must be part of the policy, but changes in the possibilities of IT must not lead to frustration of the information policy. The policy should be flexible enough to use these changes for the better.

When you hear managers complain about a lack of policy, you may ask yourself "are these managers not the persons that are responsible for making a policy?". Some of the managers I interviewed certainly were. The others have at least significant influence on the people who make policy.

In a Dutch magazine[10] a survey was discussed in which executive managers were asked about their knowledge of IT. The results of this survey were really bad, at least from the executive's perspective.

The general conclusion is that management has little or no knowledge of automation and IT, which is an essential part of the information policy. This can explain that management does not make a clear policy on these subjects.

Apart from these observations, it remains a question whether it is possible to make a clear policy on the use of IT. The dynamics in this field are so huge that it may not be possible to make a policy in the way we have policies on stock control or expenditure declaration. Still some sort of policy like using modular components or using prototyping for development can help to create the flexibility that is so much needed to deal with unexpected problems.

9.1.3 User friendliness

The complaint about the user friendliness of IT is often heard, and more or less justified. Still, a lot of effort is made to improve this situation and the user friendliness of IT has indeed risen significantly (chapter 4). This is why I think that some of the complaints are caused by organisations themselves. Managers sometimes have too high expectations.

Take a car for example. Most of us do not consider driving a car as extremely difficult. That is because we all have had extensive training in driving a car. A lot of organisations 'forget' to train their employees in the use of IT. Without training this use can be very difficult, just like driving a car is difficult without any training.

More realistic is the complaints about the inability of IT components to work together. This counts for both software, hardware and peripheral devices. Industry wide standards are needed to make tools work together. If two or more tools do not work *together*, the manager considers them non working *at all*. In my opinion, this attitude is more or less justified.

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[10] FEM, issue 9, 15 April 1995, page 54-55

9.2 Further research

This project is the execution of explorative research. A better view is created on the changing situation of the manager's support requirements and their implementation in MSSs. Most of the conclusions, however, are based on interviews with eight respondents, two surveys and an analysis. More research is needed to validate the outcomes of this project.

Interviews with significantly more respondents can be used for this. They need to be focused on getting better understanding on the main conclusions and also the questions that have risen during the execution of the project. Examples are: information gathering, external vs. internal information, training on IT use and information policy.

The experience gained during the execution of this project, like the advantages of demonstration models, can help to effectively carry out this further research.

A graduation project seems very suitable to do further research. In the next section, a proposal for such an graduation project is made.

9.2.1 Proposal

It is advised to interview more respondents on a specific area of interest. I think information gathering and dissemination is the best candidate as an area of interest. Within this area, aspects like internal and external information, the policy concerning information, existing infrastructure and information presentation can be examined.

The number of respondents should be one hundred or maybe even more to get results that have statistical value. The use of demonstration models is advised, since they proved to be very valuable in this project.

To interview one hundred or more respondents in an eight month period (standard graduation period), at least two students are needed. The eight interviews of this project took two months the carry out. At the same time, I also worked on the in depth analysis. If you take this into account, in combination with the fact that the processing of the interview results could be done more efficient, it must be possible to take 11 interviews a month (two working days per interview). In this case, fifty interviews will take a bit more that four and a half months, which makes it not a tight schedule.

Another approach can be the analysis of companies that have introduced advanced systems to deal with information, like companies that use Internet for communication and information exchange or companies that use Lotus Notes as a solution for their problems. Of course you need the co-operation of these companies to use this approach, but with some effort two or three companies can probably be found. Especially when they think they have a really good solution, they may be so proud of it that they love to explain it to an interested outstander.

The approach used for the in depth analysis can also be used in further research. Enough interesting tools are left to be analysed more closely.

A combination of all three approaches mentioned above will probably give the best results, but this takes a lot of effort and time to carry out.

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Definition of terminology

Cathode Ray Tube (CRT)	*Technical term for the glass picture tube that is used in televisions and monitors*
Closed question	*Question with a limited number of pre determined answering options*
Decision Support System	*Information system that supports the user in making decisions by offering functionalities like scenario calculations and trend analysis.*
Desktop Video Conferencing	*Communicating by use of a desktop PC on which the participants can see and hear each other in a moving image. The images are recorded by a small camera and transmitted over a telephone line or a computer network.*
Digital Video	*The technology of displaying digitally stored video sequences on a computer screen or television.*
Executive Information System (EIS)	*Information system that supports a manager in building an integrated view on all relevant aspects that are taking place within the company and its market. It must also support the manager in communication and task management. The interaction with the system goes through user friendly graphical interfaces.*
Field encoding	*Notation system that is used to match freely formulated answers within fixed categories.*
Global Area Network	*Computer network that connects computers over very large distances (think intercontinental).*
Internet	*Large collection of linked computer networks that offers public access to information sources all over the world. It can also be used to communicate with other network users.*

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Local Area Network	*Computer network that connects computers over short distances (think office building).*
Management Information System (MIS)	*Information system that presents the user hard, analytical information about the core processes of an organisation.*
Management Support System (MSS)	*An information technology based tool or set of tools that supports a manager or group of managers in doing their work.*
Network organisation	*Organisational form that exists out of many interconnected, small elements. The nature and behaviour of the elements and the connections can change to let the organisation adapt to its environment.*
Open question	*Type of question that allows the respondent to answer to his/her own likeness.*
Operating Systems	*Software application that co-ordinates the interaction between a computer's hardware, software and peripheral devices.*
Virtual Reality	*Artificial environment that is simulated by a computer in such a way that 'users' get the impression that this environment is reality.*
World Wide Web	*Computer system that gives a user access to information resources all over the world through an easy to use, graphical interface.*

INITIAL TIME SCHEDULE

ID	Task Name	ctober		November		December		January		February		March		April		May		June	
		10	24	7	21	5	19	2	16	30	13	27	13	27	10	24	8	22	5	19
1	Assignment formulation																			
2	Technology survey																			
3	Interviews PDC																			
4	Choice of promising tool																			
5	Deeper analysis																			
6	External interviews																			
7	Graduation report																			
8	Finishing activities																			

DELAY ON CRITICAL PATH

FINAL TIME SCHEDULE

ID	Task Name	October				November				December				January					February				March				April				May				June		
		9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	26	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25
1	Assignment formulation																																						
2	Technology survey																																						
3	Choise of promising tool																																						
4	Deeper analysis																																						
5	Preparation interviews																																						
6	Interviews																																						
7	Processing results																																						
8	Graduation report																																						
9	Finishing activities																																						

Two main tasks caried out at the same time. This creates flexibility.

Task		Summary	Rolled Up Progress
Progress		Rolled Up Task	
Milestone	◆	Rolled Up Milestone	◇

Interview questions

General questions

Name
Function
Number of subordinates

1. What are the most important problems that organisational changes have caused?

2. Which of these types of support can help to deal with these problems? (Communication, Presentation, Information gathering, Data analysis, Personal Management).

3. Are there any support types lacking from the ones mentioned?

4. Can you point out a top three of the most important support types?

Specific question for every support type

Communication:

- Can you point out in this figure what is the most common case of communication in your situation?

	Same place	Different place
Same time		
Different time		

- How important are the aspects you chose for successful communication?

- To what degree are the persons you communicate with geographically dispersed?

- In general, with how many persons do you communicate at the same time?

- What is your opinion on the following subjects?

	Not important	Sometimes important	Important	Mostly important	Extremely important
Eye contact					
Possibility to show things (e.g. letters, drawings)					
Security					

- How would you describe the ideal support on communication?

Presentation:

- Can you describe in which cases you are in contact with presentation?

- In the case you yourself are giving a presentation, are the always alike or very different?

- Which of the following factors are important at presentations?

	Unimportant	Neutral	Important
Pictures			
Sound			
Films, animation			

- How would you describe the ideal support on presentation?

Information gathering:

- What kind of information do you need for your work?

- Is this profile stable or unstable?

- What is the importance of speed when getting information?

- What is the importance of actuality when getting information?

- Do you search and sort your information yourself or do you delegate this task?

- How would you describe your ideal support on information gathering?

Data analysis:

- Can you describe your activities concerning data analysis?

- How would you describe your ideal support on data analysis?

Personal management:

- On which of these areas is support needed?
  Issue management
  Task planning
  Agenda functions
  Other (encyclopaedia, knowledge, etc.)

- How would you describe your ideal support on personal management?

After these questions, the interview demonstration is given. The respondent's opinion on this demonstration is asked.

<u>*General questions*</u>

5. Do you make use of information systems (e.g. EIS or email) when doing your work. If yes, on what occasions, how often and in what respect?

6. What is your general attitude towards the use of IT?

7. Do you have any comments to give before ending this interview?