MASTER

Transferring knowledge

the design of a handbook for the benchmarking methodology of ENAPS

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Award date:
1997

Transferring Knowledge

The Design of a Handbook for the Benchmarking Methodology of

ENAPS

AS YOU REQUESTED, I BENCHMARKED OUR COMPANY AGAINST FIVE WORLD-CLASS COMPANIES.

THE COMPARISONS ARE IRRELEVANT BECAUSE WE'RE IN DIFFERENT INDUSTRIES. BUT THAT DIDN'T STOP ME.

WHY CAN THEY MAKE A POTATO CHIP IN ONE SECOND BUT IT TAKES US MONTHS TO DEVELOP SOFTWARE?

I THINK THEY OIL THE CHIPS.

S. Adams

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4 July 1997

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Abstract

This thesis creates a framework for the design of a handbook for the benchmarking methodology of the ENAPS project. This is done by identifying the learning types of the target groups and matching them with suitable instruction methods and media.

Summary

ENAPS stands for European Network of Advanced Performance Studies. ENAPS is a European project, that means it is funded by the European Committee. The objective of the project is to collect and transfer knowledge about 'best practices' within European industry. To enable this, a network is established of academic partners, industrial partners and agents (consultants). Technical University Eindhoven (TUE) is an academic partner in the project.

The goal is to develop a benchmarking methodology to collect the 'best practices'. Benchmarking is: measuring the own performance and then compare that with the performance of others. In this way possibilities for improvement can be detected. The agents in the project are the end-users of the product. They will sell the benchmarking methodology. In the project, a handbook for the methodology has to be created. The handbook will contain learning materials for the target groups. The target groups are agents that are going to use the ENAPS benchmarking model in practice and have to learn to use it. The other target group is managers that want their performance measured with the methodology and start in this way an improvement process.

Emphasis of this thesis was to set a framework for creating the handbook. The handbook is a collection of all those materials needed to train consultants in the usage of the benchmarking methodology that is developed in the ENAPS project. The materials can be created on paper, in software, in multi-media, etc. The framework specifies the contents of the handbook, as well as what materials or products will be produced and in what media.

The design of the handbook identifies two target groups, the agents (consultants) and managers. The contents of the handbook aims at fulfilling some learning objectives, that is, a specified outcome of a part of the handbook. These learning objectives are specified for each target group. Every individual in a target group has some specific learning objectives. It can be assumed that individuals in a target group have some common characteristics.

Learning in every person finds place through learning processes, these are very similar to learning processes. The learning processes that individuals follow are dependent on the individual learning characteristics of that person. By teaching or instruction, those learning processes are influenced. There are several instruction methods that can be used to influence the learning processes. Also the design of the instruction (by using different media), influences the effectiveness of learning.

The characteristics of the contents of the handbook, the learning characteristics of the target groups, the learning processes and the characteristics of instruction methods should decide which methods of instruction will be used and in what media to create them.

So, in the thesis three independent variables are identified:

- the contents of the handbook (the subjects);

- the learning style of the users;

- instruction methods/media to choose for the handbook.

The contents of the handbook was specified with the use of learning objectives. Learning objectives were stated for the two target groups of the handbook: agents (consultants) and managers. In a normal situation one would do a task analysis to identify training needs. Since this is a new methodology, such a training analysis could not be performed. Therefore the basis was to describe the desired working method and then derive learning objectives from that.

To make the next step to a selection of suitable instruction methods for the target groups, learning and learning processes in those target groups are researched. Kolb (1984) identifies four learning styles in which every person can be classified. The assumption was made that every person in a target group fits into one learning style. This is of course not the case. But it is likely that a majority of the target group fits into a learning style. Therefore, the classification was not used strictly, but the assumption was taken that both consultants and managers were a combination of two learning styles. The consultant appears to be a combination of converger and accommodator.

Ten different instruction methods were identified. With a subjective comparison of the characteristics of the learning styles and characteristics of the instruction methods, a selection of suitable instruction methods was made. For the consultant these are:

- games/simulation;
- role playing;
- case studies - group;
- videotape;
- one-on-one instruction.

For the manager these are:

- games/simulation;
- videotape;
- one-on-one instruction;
- case studies - individual.

A final selection of the instruction methods to choose and in what media to produce them, was dependent on some criteria, or restrictions in the project. These were minimalise costs for production, minimalise time for production and maximalise effectiveness for learning. These restrictions/criteria were weighed and then a final selection of instruction methods was made, which lays out the framework of the handbook:

A paper handbook shall be created. It will consist of separate documents. Every document has a reader's guide to allow users to choose if they have enough foreknowledge on the subject to skip the document. This task resulted in a preliminary handbook, which enables the agents to use the methodology in an early stage. This is necessary because already before the project had ended, the agents have to start measuring enterprises to collect material for comparison.

All documents will also be created in HTML. This gives an interactive touch to the documents. The user can click on subjects and skip other parts. This again to let the user skip parts of the documents if he already has foreknowledge on some subjects.

A handbook homepage is going to be created on internet. The user can download the handbook documents himself. This allows the ENAPS consortium to keep documents up to date since the contents is still changing as the project progresses. Other options like a user-discussion group are also possible.

In the next ENAPS meeting in October, a course will be developed to give further education to the agents. The contents will be decided in the next coming months. Right now agents are going out to use the methodology and will encounter problems or difficulties. The plan is to inventarise these problems and give education for those needs.

To support the agent in informing clients about ENAPS, a presentation package has been created. It consists of an information document and a presentation that they can use. Also the plan is to produce an ENAPS-flyer (an information brochure).

Contents

Preface

With this thesis I will conclude my academic study. Fortunately I do not have to leave the project that I have been working on for the last nine months, since IPL-TNO offered me to continue to work for them and conclude the ENAPS project. Working in the ENAPS project has given me a chance to meet a lot of new (international) people and see something of Europe.

I would like to thank Peter Gijben and Henk-Jan Pels who gave me the opportunity to do a thesis on the ENAPS project.

Further I would like to thank Paddy Jordan and Attracta Brennan of CIMRU Ireland who helped me a lot on the subject of learning processes.

1. Introduction

Benchmarking is an increasing activity all over industry now. Enterprises more and more feel the need to compare their performance with that of other companies. Several trends and developments, like the shortening life-cycle of products, the transition from a 'sellers' to a 'buyers' market, has put the customer in a more central position and increased the importance of performance measurement. In this way, enterprises know where they stand in the market and enables them to learn from 'best practices'.

The goal of the ENAPS project is to collect and distribute knowledge of 'best practices' within European industry. For this, a network is formed of academic partners and leaders in different industries. The network covers almost all members of the European Community. To obtain 'best practices', a benchmarking methodology is developed. With this, performance of European enterprises is measured and stored in a central database.

University of Technology Eindhoven (TUE) is involved in the ENAPS project as an academic partner. IPL-TNO is involved in ENAPS as an agent. The agents (mostly consultant agencies) will eventually apply the methodology and 'sell' it. TUE is responsible for two workpackages; creating the handbook for the ENAPS methodology and execute demonstrators (experimentation with the methodology).

For this thesis, the choice had been made to create a framework to design the handbook. The handbook is in fact a collection of educative and promotional materials to train the agents in the ENAPS methodology and all the materials they need to introduce the method in the enterprises that want to benchmark. The materials can be produced in paper, software, courses, multi media materials, etc. The assignment is to create a framework within which the handbook is specified, according to contents, but also in what media to do this.

The structure of this thesis is the following:

- Background;
- Problem statement and problem analysis;
- Research on the research variables;
- Design of the handbook;
- Conclusions and Evaluation.

Background		
Problem Statement & Analysis		
Research Variables		
Contents Specification	Learning	Instruction Methods/Media
Design of the Handbook		
Conclusions and Evaluation		

Background

First some background information is given about the ENAPS project and the project structure. Information is given about benchmarking and the business model which is the basis for the performance indicators. Since all subjects discussed are already give in the project, where possible a reflection on the results will be given.

Problem statement and problem analysis

The problem statement clearly defines what will be included in the thesis and what will not. It identifies the research variables that will be researched in this thesis. It also gives a planning for the thesis.

Research on the research variables

In this part, the handbook will be specified by using learning objectives. Further, learning processes will be researched in the target groups that the handbook has to serve. The most suitable instruction methods will be selected according to the learner characteristics and finally a choice will be made on the media in which to produce the handbook. A last subject of discussion is foreknowledge that the target groups may have on different subjects and how to deal with this in the handbook. The research on the three variables results in the design of the handbook.

Design of the handbook

On the basis of the research, the framework of the handbook will be designed. The contents and the products of the handbook will be defined. Also in what media to create them will be stated.

Conclusions and Evaluation

This handles the evaluation of the work in the project and the conclusions that are drawn for the design of the handbook.

The appendices are separated from this report. This is done to limit the thickness of this report.

2. The ENAPS Project

Background
Problem Statement & Analysis
Research Variables

Contents Specification	Learning	Instruction Methods/Media

Design of the Handbook
Conclusions and Evaluation

This section gives some general information about the ENAPS project and about benchmarking. This to give the reader an idea what the whole project is about. Some 'products' of the project are discussed, like the business model and the framework that is the basis for the performance indicators. It must be stated that the information stated in this chapter is given in the project, therefore, where possible a reflection on this work is given. This, because it is the core of the project. It is the basis for success, or for failure.

2.1. What is ENAPS

ENAPS stands for European Network of Advanced Performance Studies. ENAPS is an Esprit research project. The Esprit programme is initiated by the European Community to provide European industry with a competitive advantage by means of information technology. The EC funds the research projects that contribute to this. The ENAPS project started in December 1995 and will last for 30 months.

The objective of ENAPS is to collect and transfer knowledge about 'best practices' within European industry. To enable this, a network is established by leading industry and academic partners covering almost all of the countries in the European Union and the European Economic Area. The nodes of the network in the countries are referred to as agents.

The academic partners are: SINTEF (Norway), CIMRU (Ireland), BIBA (Germany), GRAI/LAP (France) and TUE (The Netherlands). These are also some industrial partners. The agents (mostly consultants) play an important role within ENAPS. They are the intermediates between ENAPS and the organisations who want to participate in benchmarking.

In Figure 1, the relationships between the EC, European industry and partners in ENAPS are visualised. The European Committee plays a role in the project by means of funding. But they also have requirements for management. Also conditions and law influence the possibilities and outcome of the project. The overall aim is to improve European industry by supplying methods and tools (like performance indicators, benchmarks, etc.). Feedback comes from industry when these tools are tested (by means of performance data, knowledge transfer, best practices, etc.).
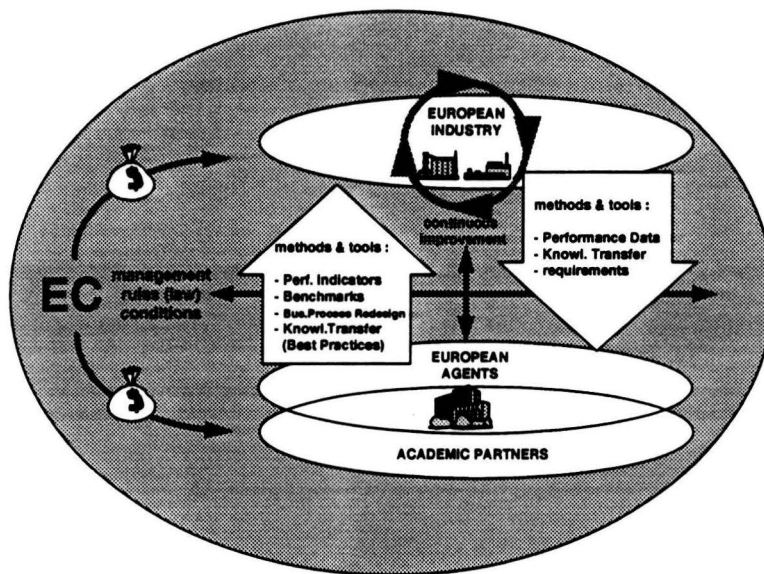
Figure 1 The relationships between the EC, European industry and partners in ENAPS

By means of a benchmark model, competence's and 'best practices' of European industry are collected. The network consists also of larger organisations but aims at knowledge transfer to small and medium sized enterprises (SME's). By means of the benchmark model performances of participating enterprises are measured and put into a central database. This offers organisations the possibility to compare their own performance with that of others and learn from the 'best' practices.

2.2. What is Benchmarking

ENAPS wants to initiate a continuous improvement process in the enterprises. To do this, it is necessary to compare the own performance with others on a regular basis. ENAPS has defined its areas of performance measurement. A definition of benchmarking is given by Camp (1989):

> *Benchmarking is the continuous process of measuring products, services and practices against the company's toughest competitors or those companies renowned as industry leaders.*

Benchmarking is the continuous use of a collection of performance indicators that measure the performance of several activities of the enterprise. A performance indicator is a variable that gives the performance of a process, system or a part of that, by comparison with a given norm (Fortuin, 1994). The goal of this performance measurement is to improve the organisation on the areas that do not perform as well as they should. By continuously measuring and comparing the performance, a process of continuous improvement is initiated. Also by continuously measuring performance, trends in internal and external developments can be recognised. By better understanding of the world surrounding the enterprise, the enterprise is able to anticipate to developments taking place.

No company is identical to another company, not even in the same sector. Differences in market approach and differences in products cause this. So how should benchmarking find place? It is of course possible to identify similarities between enterprises. On the basis of these similarities a business model is developed through which useful comparison can find place. This could also mean that a comparison is done between companies that operate in totally different sectors, but have one or more processes in common.

2.3. Definitions of the Performance Indicators

Depending on the level of detail in the measurements, they can be used for somewhat different purposes. At a too low level of detail, the measures are generally publicly available and often known by the actors in an industry (sales, products, market share, number of employees, etc.). Such measures, though important, can really only be used for making rankings of enterprises within and between industrial sectors. If, on the other hand, the level of detail is too high, the data will often be difficult to obtain (detailed cost analysis, detailed throughput time analysis, etc.), as the companies might be unwilling to disclose such detailed information. It is also doubtful that such measures, even if obtainable, could be used for conducting comparison and benchmarking indirectly through the use of a database. Both since the measures would often not be comparable from enterprise to enterprise and because only the measures would not be able to convey a complete picture of the best practices resulting in the measures.

Thus, a conclusion was that the performance measures should be of a medium level of detail, i.e., at a main business process level. Such measures can both be used for comparing performance across enterprises, industrial sectors, and national borders. Furthermore, a database of these measures can in turn be used for identifying relevant benchmarking partners in specific benchmarking studies. Therefore three levels of measurement are defined in ENAPS: *Business level*, *Process level* and *Function level*. Above the level of the business and secondary processes there is a business level which requires a set of measurements. The process and function levels require a set of generic measures which may be applied to any enterprise.

1. **Business Level Measures**: Financial and other high level measures;

2. **Process Level Measures**: Measures of such processes as Customer Order Fulfilment, and Product Development;

3. **Function Level Measures**: Measures of the functions which comprise the processes, for example a measurement of the production planning and control function within the customer order fulfilment process.

It should be pointed out that it is possible to distinguish between the database being built in ENAPS and the consultant methodology to be used by the agents. The agents can add value to their clients in a number of ways, including acting as an identification service for benchmarking partners, enabler of performance comparison, and conducting detailed performance measurement in the enterprises for internal use as a self assessment and monitoring of improvement.

2.3.1.Measurement Dimensions

Each process and function will have several measures associated with it. To assist in the development of these measures a set of measurement dimensions is used. These are:

- Time;

- Cost;

- Quality;

- Volume;

- Flexibility;

- Environment.

Although more dimensions could be specified (like productivity or efficiency), the project partners felt that these six were sufficient. They are used to view the enterprise from different perspectives. If one would only take financial measures (cost), one can think of a financially very efficient factory, but would this be the best practice (long throughput times, low quality, etc.). The dimensions are used as guidelines, not as a rigid framework.

All performance indicators used in ENAPS are of a quantitative nature. The outcome of the performance indicator is therefore a number, measured in a process. Qualitative measures which require the opinion of those answering will be avoided since they are not useful for the purpose of comparison. Opinions are never objective and even if a structured way of judging performance can be developed, there might be national differences (culture) that cause differences in judgement in each country.

The performance indicators are defined in three dimensions. They can be visualised in a measurement cube (Figure 2).
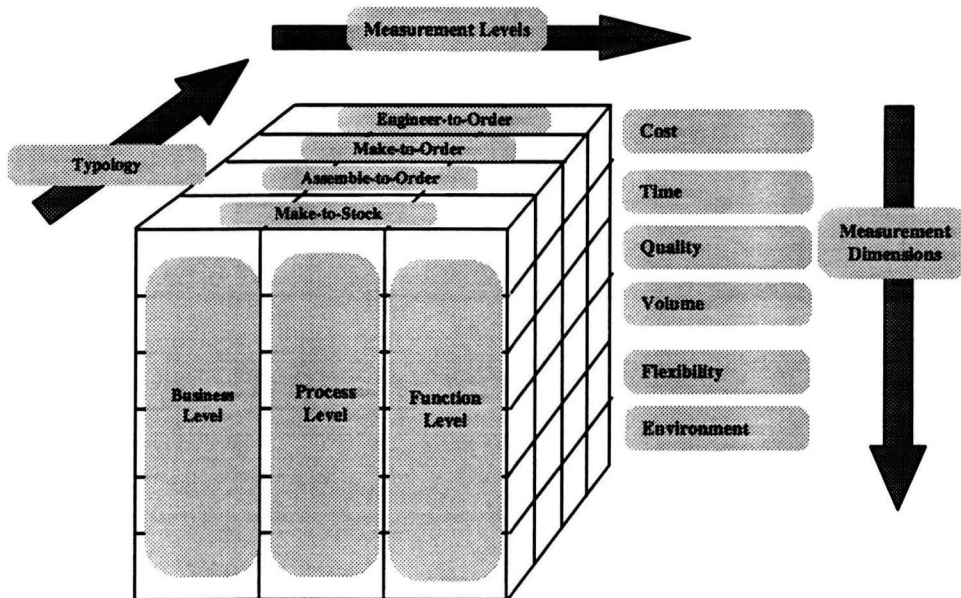
Figure 2 The Measurement Cube

Two dimensions are already described, the level of detail (business, process, function) and the measurement dimension (cost, time, quality, etc.). The last dimension is the typology of the production system. The typology of the production system depends on the position of the Customer Order Decoupling Point in the system. Than one can distinguish Make-to-Stock, Assemble-to-Order, Make-to-Order and Engineer-to-Order.

Here, one can argue if the choice of this typology is the correct one to use. There are several other typologies for enterprises. Bertrand, Wortmann, Wijngaard (1990), use another typology. They distinguish between the dimensions, complexity, uncertainty and dynamics and flexibility of resources. They use this characterisation to distinguish different production situations (one-time and small series production, process production, big series and mass-assembly, project production and series production). ENAPS wants to measure more than just the production department of an enterprise. It is therefore much harder to use a typology that is fully suitable, since most companies are mixtures of the different types. Therefore the use of the higher level Customer Order Decoupling Point typology seams to be justified.

2.4. The ENAPS Business Model

Within the ENAPS project, a Business Model is developed that indicates on which process performance measurement should find place. The Business Model was defined at a project meeting, by the project partners. A basic version of the business model is shown in Figure 3. This basic model identifies the various functions in a manufacturing system and its links to the customer and supplier. This basic model does not incorporate a recycling focus.
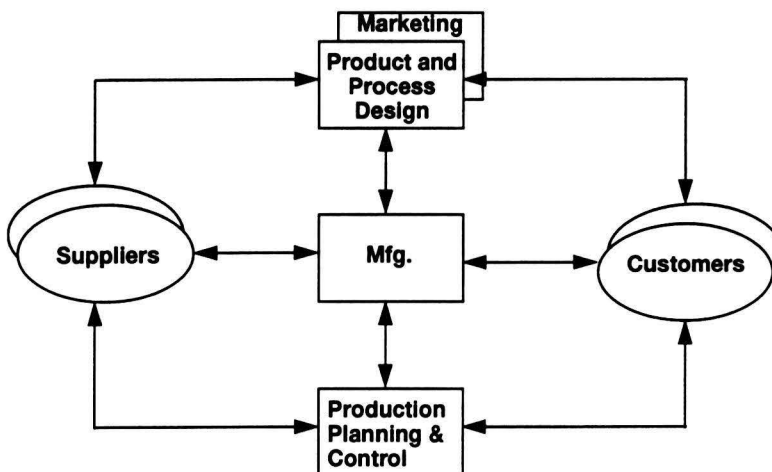
Figure 3 Basic ENAPS Business Model

The ENAPS business model is intended as a means of identifying the various functions within a manufacturing system and then showing how business processes can be mapped to these functions. The business model also incorporates a link to the customers and suppliers. In the following sections, the business processes identified using the ENAPS business model are described.

ENAPS processes are described using the Generic Enterprise Framework. Again, this framework was developed by the project partners. The generic framework consists of two types of processes: Business processes and secondary processes. Each of these levels consists of a collection of processes and each of these processes consists of a range or sequence of functions.

The generic enterprise framework is shown in Figure 4.

ENAPS - GENERIC - FRAMEWORK

BUSINESS PROCESSES

PRODUCT DEVELOPMENT
- Product Research *
- Product Engineering and design
- Process Engineering and design
- Co-engineering

OBTAINING CUSTOMER COMMITMENT
- Market Development (Analysis?)
- Marketing and Sales
- Tendering

ORDER FULFILMENT
- Procurement and inbound logistics
- Production planning & control
- Manufacturing and assembly
- Distribution and outbound logistics
- Order processing

CUSTOMER SERVICE
- After sales-service
- Product take back

SECONDARY PROCESSES

SUPPORT
- Financial management
- Human resource management
- Information management
- Maintenance
- Internal control of health, environment and safety

EVOLUTION
- Continuous business process improvement
- Product research *
- Production technology research
- Human resource development
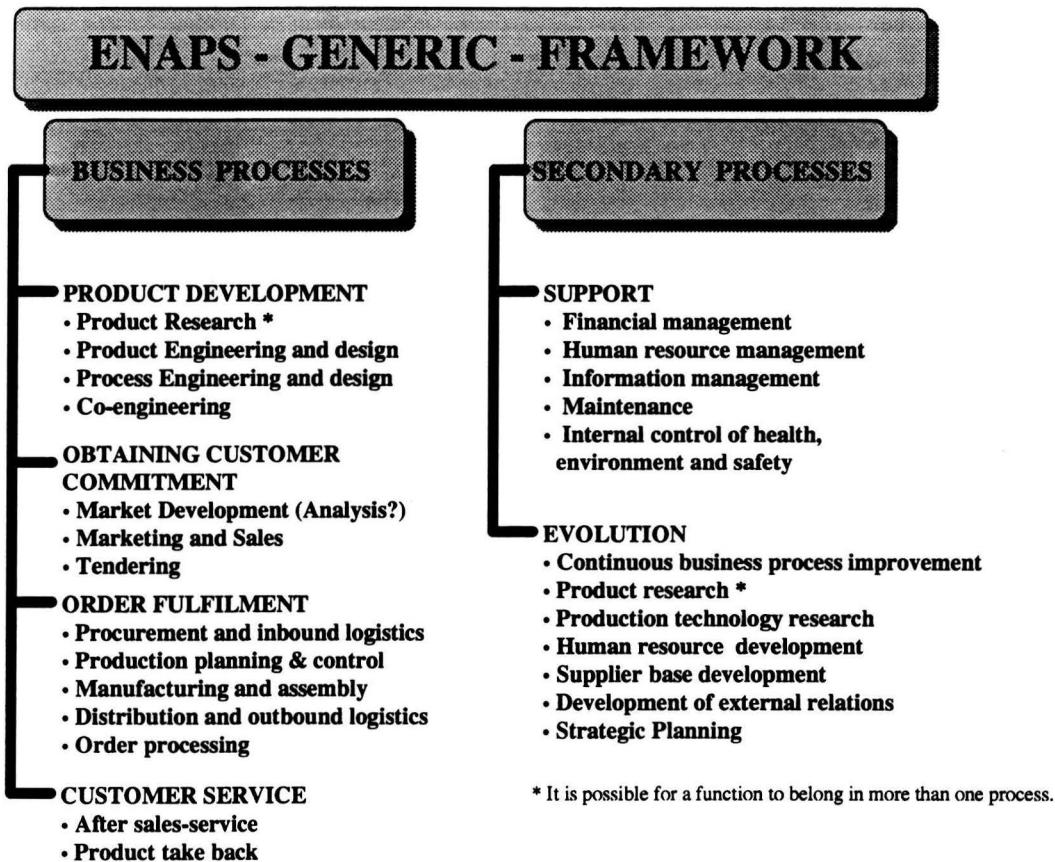- Supplier base development
- Development of external relations
- Strategic Planning

* It is possible for a function to belong in more than one process.

Figure 4 ENAPS Generic enterprise framework

It is recognised that at the business process level and the secondary process level the processes are generic. Below that the functions contained within a process is dependent on the typology of the enterprise. The functions listed in Figure 4 represent a listing. The sequence and the range of functions will need to be defined for each enterprise category according to the ENAPS typologies.

In the project, differences in structure depending on the enterprise typology are defined. It goes beyond the scope of this thesis to describe all the differences that are recognised. But a statement can be made that it is a good thing to recognise differences in existing functions for different production situations.

2.4.1.Business Processes

The business processes are defined by their scope, i.e. when they start and when they finish, rather than their content since content may change with differing manufacturing typologies. So the product development process is defined from concept until launch of a new product. The customer-commitment process is defined from market analysis until sales of products. The order fulfilment process is defined from intake of a customer order until the payment of that order from the customer. Finally, the customer service process is defined from delivery of the product until the product is out of use, including take-back of the product if appropriate.

As was stated in the previous sections, four business processes are identified. A business process is not the same as a function (or department) that may exist within a company. A business process runs through several departments. For instance, the order fulfilment process starts with the sales department where a customer order is taken in. The order has to be planned in production. Then production of the order finds place, the order is shipped and delivered to the customers. So several departments are involved.

ENAPS uses these business processes for benchmarking. It is the performance of these processes and activities that are important, because they recognise the interactions between departments.

2.5. The Philosophical Goal of ENAPS

The European Committee wants to establish co-operations between European academic institutions. It also wants to improve the competitive advantage of European industry, by transferring knowledge from academic institutions to industry. It therefore subsidises projects that can achieve that goals. The ENAPS project wants to involve industry. It has created a network that includes agents (consultants) who have close relationships with European enterprises.

The network gives an opportunity to exchange knowledge between academic institutions and industry in the form of (benchmarking, improvement methods, performance indicators). But this also enables a knowledge transfer from industry to academic institutions ('best practices', performance data, cases). So there is a two-way knowledge transfer.

Benchmarking also enables enterprises to learn from each other. By performing a benchmarking study, one enterprise can adopt the 'best practice' from another enterprise.

In the ideal situation, the company performs benchmarking, that is, it first measures its own performance by using the performance indicators, with the help of the agent. This data is fed into the database. The agents queries the database and identifies a performance gap in the company. The database gives automatically a description of the 'best practice' in the database. In a knowledge base then, a suitable improvement technique is chosen automatically on the basis of stored experiences with different techniques in comparable other situations.

2.6. Conclusion

ENAPS is still a long way from the ideal situation. First of all, the performance indicators are not structured enough. When they were developed, a framework was created consisting of the measurement dimensions, the measurement levels and the enterprise-typology. This framework was supposed to be the base on which to define the performance indicators. But in practice, they were created by using a brainstorming session. The result was a set of performance indicators and measures that did not fit the framework very well. Later it was tried to fit the resulting indicators into the framework. This resulted in another session where all the performance indicators and measures were revised and some redefined. But still they do not fit the model very well. So either the model is wrong, or the procedure that was used was not executed correctly. The last is probably the case.

Second, there are no 'best practice' descriptions in the ENAPS database. When an agent does queries in the database, he can find enterprises that perform quantitatively better than his client. But why this company or these companies are performing better can not be retrieved because this information is not stored. In the ideal situation, one would like to retrieve a description of the 'best practice' in a similar company as the client. Some other ESPRIT projects concentrate on retrieving 'best practices' and storing them in a database. A solution for ENAPS could be a co-operation with such other projects. This is currently discussed within ENAPS.

Third, there is no structured means for knowledge transfer. ENAPS concentrates on retrieving data, storing this data in a database and comparing this data with other data. 'Best practices' are not stored and neither how they were accomplished in that company. So even if one has a description of the best practice, what is then the best way of redesigning the current process to the 'best practice' process. A solution could be a linkage with a knowledge base where experiences with improvement techniques in similar situations are stored. Then according to the situation, the best improvement technique can be selected.

Fourth, for true benchmarking and knowledge transfer, open data is needed. The best situation would be that all enterprises give away performance information and descriptions of their processes. But enterprises hesitate to give away this sensitive information. They want to stay anonymous. Therefore security measures have been taken to ensure anonymity and that no data can be retrieved if a query results in data on only three or less enterprises. This makes the comparison process more difficult. Still this is a trade-off that has to be made. If companies are not willing to give away information, the database will stay empty and benchmarking (in this way) will not be possible.

Finally, there is a chicken and egg problem. Right now, agents have nothing to offer their clients, since the database is empty. But they have to go out and measure to fill up the database. They have to invest now to fill the database, on which they can earn money later. It appears that there is a mentality problem. The agents do their work for which they are funded, but there is no extra effort. If there is no extra effort from the agents, the project will fail.

3. Problem Statement and Analysis

Background
Problem Statement & Analysis
Research Variables
Contents Specification / Learning / Instruction Methods/Media
Design of the Handbook
Conclusions and Evaluation

Now the background of the ENAPS project is clear, the problem statement and problem analysis for the thesis will be discussed. First, the problem statement (the assignment) is formulated which makes clear what the purpose of this thesis study is. The analysis will reveal the different subjects (research variables) that will have to be researched to fulfil the problem statement

3.1.Problem Statement

The ENAPS project is divided into workpackages. Together with IPL-TNO and TUE an agreement is made that one of the workpackages that TUE is responsible for, will be completed in this thesis study. TUE is responsible for workpackage 6: development of the ENAPS handbook and workpackage 7: development of demonstrators. Because workpackage 7 was due to start in January 1997 and workpackage 6 was starting of at the moment, the decision was made to work on workpackage 6.

Workpackage 6 was planned to start at September 1996 and end in May 1998. So the complete workpackage can not be finished within this thesis study. Therefore the decision has been made to end the thesis study at task 4: deliver a preliminary handbook.

The Handbook

The handbook consists of a collection of materials that is designed to introduce and use the ENAPS benchmarking model. This can vary from courses in the ENAPS methodology until manuals for the usage of the software that is developed. It can be seen as a *learning package*. The handbook has to serve two target groups:

- Agents (consultants) that are going to use the ENAPS benchmarking model in practice and have to learn to use it;

- Enterprises (managers) that want their performance to be measured with the ENAPS methodology and start in this way an improvement process.

Problem Statement

Within a timescale of 9 months, starting at September 2 1996, a framework for a handbook has to be developed for the ENAPS project. The handbook will contain learning materials for the target groups. The framework will specify the contents, or the intended outcome of the handbook. The framework shall tell what instruction methods are to be used in the handbook. It will also tell in what media these instruction methods will be visualised.

In the next section, the problem analysis, it will be clarified how this goal will be achieved.

3.2.*Problem Analysis*

The design and development of the handbook over the whole project is the following:
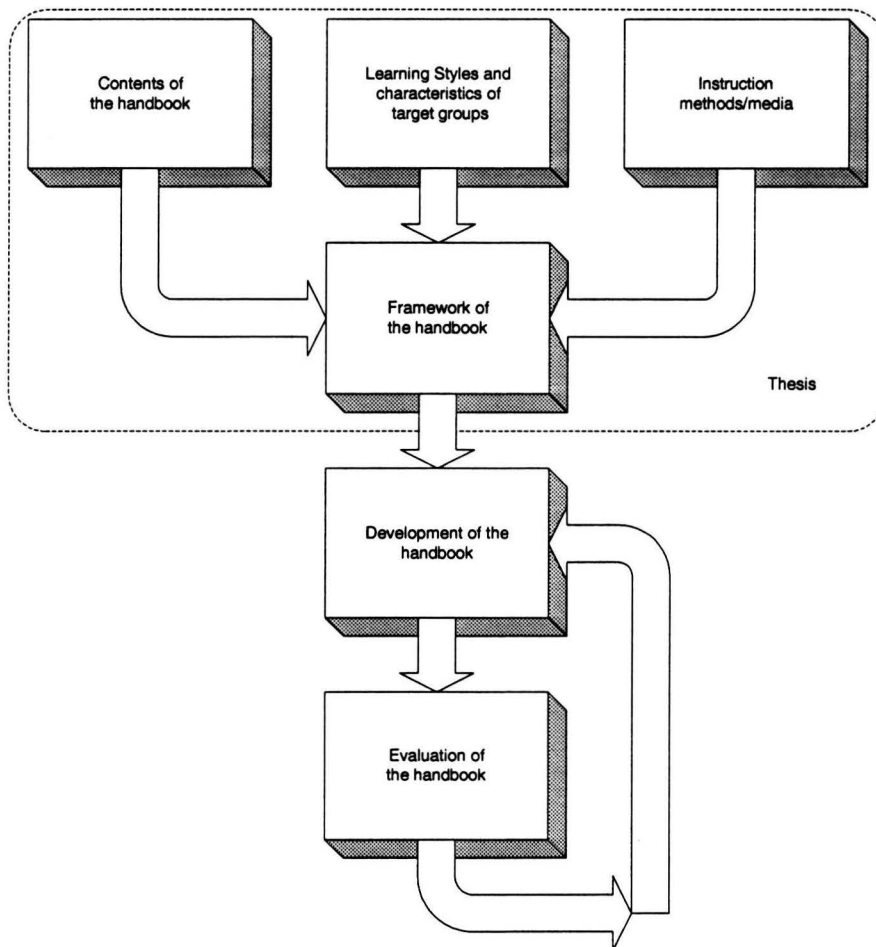
Figure 5 Development of the handbook in the ENAPS project

The design of the handbook identifies two target groups, the agents (consultants) and managers. The contents of the handbook aims at fulfilling some learning objectives, that is, a specified outcome of a part of the handbook. These learning objectives are specified for each target group. Every individual in a target group has some specific learning objectives. It can be assumed that individuals in a target group have some common characteristics.

Learning in every person finds place through learning processes, these are very similar to learning processes. The learning processes that individuals follow are dependent on the individual learning characteristics of that person.

By teaching or instruction, those learning processes are influenced. There are several instruction methods that can be used to influence the learning processes. Also the design of the instruction (by using different media), influences the effectiveness of learning.

The characteristics of the contents of the handbook, the learning characteristics of the target groups, the learning processes and the characteristics of instruction methods should decide which methods of instruction will be used and in what media to create them.

So, in the research, three independent variables can be identified. These are:

- The contents of the handbook; the matters that have to be educated;

- The individual learning styles and characteristics of the target groups;

- The instruction methods and media to use for the handbook.

These variables can be subdivided into several sub-variables that all influence the design of the handbook (Figure 6).

The actual implementation and evaluation of the handbook will not be part of the thesis. This, due to the time schedule of the project. The delivery of the handbook is planned for the end of May 1998. This would be too late for a thesis study. Therefore it is chosen to deliver the framework of the handbook as a result of this thesis. The handbook in this phase will still be growing, because the project still continues. Therefore the contents is not yet stable. A more detailed description on how to come to the framework is described in the next section.

3.2.1.Setting the Framework for the Handbook

The ENAPS project develops a tool that can be used to measure the performance of an enterprise. The performance is then compared with the performance of other companies. It can be viewed as an instrument. As with any (complicated) instrument, you need a manual to work with it. The handbook serves this purpose. It is actually a learning package for the consultant who has to work with it. It should also include materials that the consultant can use to inform or learn the manager about the instrument. Therefore, the handbook identifies two target groups: consultants and managers.
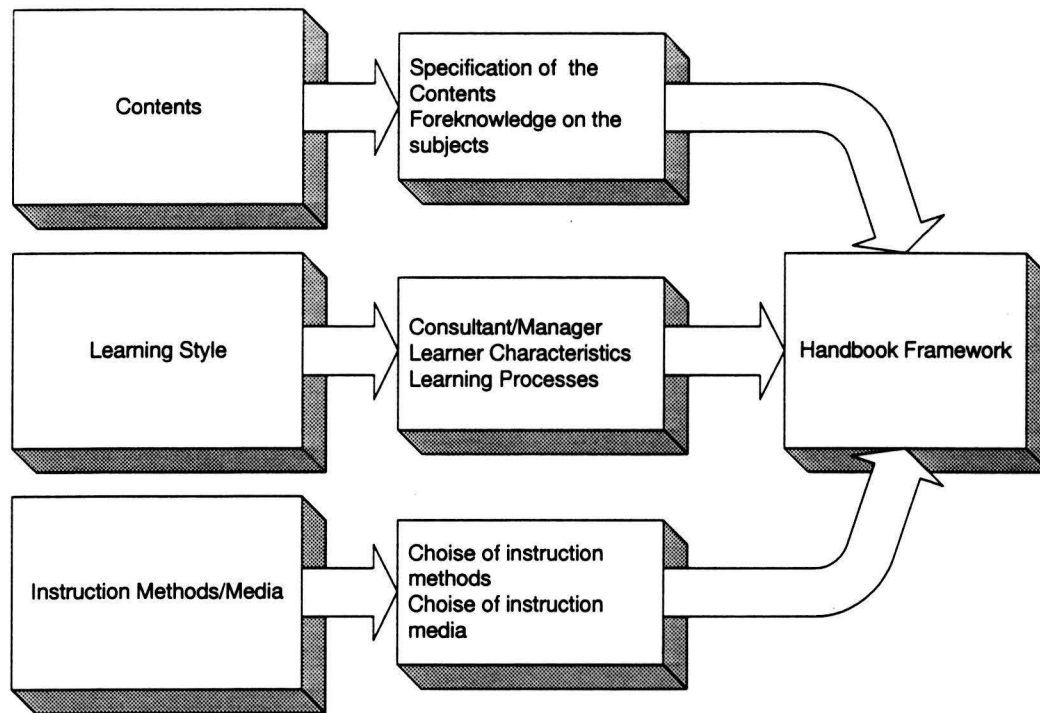
Figure 6 The Conceptual Scheme for Designing the Handbook

The sub-variables in Figure 6 consist of the different subjects that will be researched in this thesis. These are called research objects. Next, these research objects will be explained, with their relation to the handbook.

Specification of the Contents

The contents of the handbook can be specified by means of learning objectives. The handbook is a collection of materials with which the target groups will be served. By examining the contents of the benchmark model and the objective of the model, the learning objectives can be specified. A distinction must be made between the two different target groups. Learning objectives will have to be specified for each target group separately. Literature can be used to search for methods to formulate learning objectives

Foreknowledge on the Subjects

Users of the handbook will have different fore-knowledge. Some users that have been participating in the project from start to end will have a much greater fore-knowledge that beginning junior-consultants that have to do a benchmarking study for the first time. Therefore the user must have some freedom in what to read en control the order in which to read different subjects.

Target Groups (Consultant / Manager)

As mentioned with the learning objectives, the target groups of the handbook have to be specified. The target groups have to be identified as well as the task that they have in the benchmarkmodel. This research object has a great coherence with the specification of the learning objectives.

Learner characteristics

Every individual in a target group has several learning characteristics. Examples are: dominant learning style, level of education, age, etc. It is to be assumed that individuals in a certain target group have a number of learner characteristics in common. To design learning materials for a target group, it is necessary to examine the learner characteristics and design the materials according to that. In literature, there are descriptions of learner characteristics that can be used.

Learning processes

To design optimal learning materials, it is necessary to know how people learn in general. These are so-called learning processes that are closely related to thinking processes. It should be examined what learning process(es) fit the earlier identified learner characteristics. Also, the relationship between different instruction methods and how they influence the learning processes must be researched.

Instruction methods

This research object is closely related to the previous one. What methods of instruction can be identified and how do they influence the learning processes. Examples of different instruction methods are: case-study, reading a book, watching a video, etc.

Choice of instruction methods

According to the learner characteristics of each target group, the learning processes, the characteristics of the different instruction methods and the contents of the handbook, a choice has to be made what instruction methods to use for each target group.

Choice of instruction media

When the instruction methods are selected, then the instruction media have to be chosen. This means how the materials will be implemented in the handbook. Several aspects play a role here: the effectiveness for learning, costs of development, but also time of development.

Of course more variables can be thought of. For example, learning environment, motivation, national differences. These all affect learning. But the above mentioned variables are the ones most commonly used in literature on education (Loweyk and Verloop 1995, Goldstein 1993). Therefore it is chosen to limit the thesis to these research objects.

3.3.Planning

The ENAPS project is subdivided into workpackages. These workpackages are again subdivided into tasks. For every task a so-called deliverable has to be delivered. This is a document describing the outcome of the task. The dates that these deliverables are due have been agreed upon by all project-partners. The planning of this thesis is in line with that planning. In the project, there are interdependencies from other workpackages and tasks on which the planning is based. So there was limited freedom in shifting with the planning.

The dates that the deliverables are due have been used for this planning of the thesis.

Planning of the thesis

Start	*2 September 1996*
Orientation and problem analysis	*end of October*
Specification of the handbook	*end of December*
Specification of target groups, learning processes and instruction methods	*end of January*
Specification of the materials and media for the handbook	*end of March*
Deliver an intermediate (paper) handbook	*end of May 1997*

4. Contents Specification: Learning Objectives

Background
Problem Statement & Analysis

Research Variables

Contents Specification	Learning	Instruction Methods/Media

Design of the Handbook
Conclusions and Evaluation

In the problem analysis, the different research variables were described. The first variable is the specification of the contents. The handbook has to be specified. Already in an early stage of the project, the contents had to be specified, according to the technical annex (project definition). A means to specify the contents of learning materials is by using learning objectives In this section, some information about learning objectives is given. This is done to clarify why learning objectives are chosen to specify the handbook. In curriculum design and in organisational training design, the use of learning objectives is very common. From available literature, this method of specification is chosen and applied to the handbook.

4.1.Learning Objectives

The benchmarking model which is under development in ENAPS, is in fact an *instrument* to do benchmarking. As with any (complicated) instrument, you need a manual to work with it. You might even have to follow a course for it. The handbook should provide such a manual. It should include all the necessary materials to educate the target groups that have to use the benchmarking tool (agents and enterprises). The materials may consist of paperwork, software, multimedia, etc. Which media are most appropriate will be examined later. First the contents of the handbook has to be specified. This will be done in this document.

Kessels and Smit (1989) identify *goals* and *objectives*. A goal is according to them: a general description of the qualifications that a course-member can obtain by following that course. For instance: *The course aims at supporting the manager with the design and implementation of radical changes in the organisation.*

A learning objective is a tangible, clear and unambiguous description of the behaviour that the course-member has to show as a proof for achieving the intended learning result. For instance: *The course member (manager) is able to choose an appropriate model of conversation, in a given situation, and lead the conversation with the employee in such a way that the phases described in the syllabus 'Conversation Techniques' can be clearly distinguished.*

Davies (1976) and Prat (1980) distinguish *aims*, *goals* and *objectives*. *Aims* reflect ideals, inspiration. Aims reflect the vision of the course designer. When developing a curriculum, a set of courses, they can be used to create a coherent set of individual courses. The goals and objectives function in the same way as in Kessels and Smit (1989).

The classification that will be used in this study is that of goals and objectives. Davies, Prat and others take the specification of curricula as a basis for their choice of classification. If done so, *aims* can be used to ensure a coherence between the different courses that form the curriculum. The handbook will not be as extensive as a curriculum, therefore a classification in two levels will be enough. In the rest of this research, learning objectives are viewed as sub-goals of learning goals.

4.1.1.The Function of Learning Objectives

Kessels and Smith (1989) identify several functions of learning objectives:

- Learning objectives as an aid for the specification of the content of a training;

- Learning objectives can be used to evaluate the intended outcome of a training;

- Learning objectives as an aid to choose the right instruction methods and the right instruction media;

- Learning objectives can be used as a means of communication (between developers of the courses and between the educator and the course-member).

Specification of the Content of a Training

A general goal of training in organisations can be: help employees to attribute to the process of realisation of the organisational goals, by means of learning processes. By means of task-analysis of the individual jobs, the content of the training can be specified.

In case of ENAPS, an analysis of the required knowledge to work with the benchmarking model and the abilities to use the software and interpret the results can be used to specify the handbook. The ENAPS methodology will be specified and then learning objectives will be derived.

Specifying learning objectives ensure a markation of the handbook design in an early stadium. This will prevent deviations in the design process from the intended outcome of the handbook, because the intended outcome has been made clear.

Intended Outcome of a Training

To be able to evaluate the outcome of a training, the outcome had to be specified in advance. This can be done with learning objectives. After the training one can measure if the training achieved the intended results. In ENAPS the handbook will have to be tested in practice. This could be done by evaluating the results in practice and the experiences of the agents.

To make measurement possible, the learning objectives have to meet some conditions. A learning objective has to (1) describe an observable behaviour, (2) give the conditions under which that behaviour has to be shown and (3) give a criterion to determine if the course-member has reached a sufficient level of learning result.

An example:

The course-member (quality controller) is able to sort 60 randomly selected printed circuit boards with a magnifying-glass on soldering errors within 20 minutes. Only one sorting mistake is allowed.

- *Observable behaviour: Sorting printed circuit boards resulting in two piles, one with and one without soldering mistakes;*

- *Conditions: randomly selected printed circuit boards, using a magnifying-glass;*

- *Criterion: 60 printed circuit boards within 20 minutes, maximal one sorting mistake.*

Learning objectives cannot always be formulated in this way. For simple tasks, where the quality aspect can be quantified easily, the problem of formulating a learning objective is easy. The handbook to be used in ENAPS will consist of more complicated learning objectives. An example of such a complicated learning objective:

The course aims at supporting the manager with the design and implementation of radical changes in the organisation.

- *Observable behaviour: making a written design of a radical change in an organisation;*

However, if a manager is able to make an analysis of the change process on paper, this does not mean that he will act strategically in a real situation. In that case it is hard to specify the intended learning result. This will lead to a more general description of the conditions than in the printed circuit board example.

Evaluation by a criterion is also more difficult. When is the manager able to design an organisational change strategy and start the change process?

Not specifying the learning outcomes brings the danger that any learning result will be seen as an intended learning result. So one should keep in mind that this is the first specification of the handbook. There is not yet any experience with the ENAPS methodology. The stated objectives can not all lead to observable behaviour and not all learning results can be measured. The objectives serve as a guide during the development of the handbook in the future.

Choosing Instruction Methods and Instruction Media

With the development of the handbook the methods and tools have to be chosen to give the user the right skills, knowledge and insights to use the benchmarking model. The concept knowledge will be discussed later. The learning objectives can assist the developer in choosing the right instruction methods and instruction media. To teach a child how to ride a bicycle one chooses different instruction methods than for the manager in the change process.

The problem of riding a bicycle is easier than that of the manager. That is because of the complexity of the problem. The developer has to use his creativity and knowledge to create effective learning situations. The process of this design is a sequence of a number decisions. In these decisions, the following variables play a role:

- knowledge of the designer of the learners and their characteristics;

- his insight into learning processes, how they take place, which learning environments and learning methods support or hamper the learning processes;

- the experience that the developer has with courses he followed and experiences that he had with courses and learning materials that he developed before;

- the available training time and training and development budget;

- the different kinds of abilities, attitudes, insights and knowledge that the learners have to acquire, assuming that every kind is acquired in a different way.

Learning Objectives as a Communication Means

A long list with stated learning objectives is not a good means of communication. It could only serve the developer as a checklist when designing the training. An explanation with the objectives, can serve the course-member by clarifying the goals of the course at the beginning.

The learning objectives are of course a means of communication for all people involved in the development of the ENAPS benchmarking method.

4.1.2.Classification of Learning Objectives

In Davies (1976), different kind of learning objectives are distinguished. A main classification that is used in general is:

- a cognitive area, concerning rational functioning;

- an affective area, concerning attitudes, interests, motivation and values;

- a motor area, concerning controlled and uncontrolled muscle movements.

The importance of distinguishing different kinds of learning objectives is that for each ability, different instruction methods are more ore less suitable.

Cognitive Learning Goals

Davies (1976) describes the taxonomy of Bloom (1956). According to Bloom cognitive goals consist of *evaluation* (being able to value or judge), *synthesis* (combining elements into a whole), *analysis* (split up into smaller elements), *apply* (use an ability in a specific way), *understanding* (insight, interpretation) and *knowledge* (being able to remember specific information or experiences en being able to think in abstracts). In fact, this is the learning process. The learning process will be discussed in more detail later, as will the concept of knowledge.

According to Kessels and Smit cognitive goals can be established by:

- collect information and apply it;

- collecting information can be done by self-study, exploration or by listening or looking at a teacher. Applying information requires practice.

Affective Learning Goals

Being affected by or confronted with information that brings out an affective or emotional involvement of the learner. Davies (1976) describes for affective goals the taxonomy of Krathwohl (1964). He makes a distinction between *receiving* (of information, controlled or selective attention), *valuing* (accepting a value judgement, preference for a value judgement), *reacting* (willingness to react, satisfaction with reacting), *organising* (organise a value-system) and *distinguishing* characteristics of a value-system.

These learning goals can be accomplished by discussions, role-play, (sensitivity) training, an intrusive film or theatre show and in a practical training in a working environment.

Motoric Learning Goals

This category is about handling conscious or unconscious muscle movement. Suitable learning activities are:

- demonstration, practice and practical training;

- for practice and practical training, models, simulation and reality are suitable instruction means.

The ENAPS handbook will not consist of motoric learning goals.

4.2.Knowledge

What is knowledge? How does it differ from information? We all have some notion about what knowledge and information is. Terms that are understood without being exactly defined are called primitive terms. Knowledge and information are primitive terms, Weggeman (1996). Other examples of primitive terms are art, love and organisation.

Another approach is to think of knowledge as source of aid (comparable with money or capital in an organisation). As with money, knowledge can devaluate and the amount of knowledge available is endless, it is not consumed.

By distinguishing between data, information and knowledge we can find a more direct answer to the question what knowledge is. *Data* is the symbolic representation of numbers, amounts, dimensions, or facts (Weggeman, 1996). Examples are: 20 degrees Celsius, 100 ECU. *Information* results from comparing data that is structured situationally, to create a message that has a value in the given context. Examples: today there are 20 people more than yesterday, the weather forecast. *Knowledge* is that what enables someone to fulfil a certain task, by selecting what is context-dependant, interpret and value information. To do this one has to be familiar with the domain or the processes that are important for executing the task. So the main difference between information and knowledge is that knowledge is connected with acting or doing (Nonaka, Takeuchi, 1996). A definition of knowledge is given by Weggeman (1996): *knowledge is the ability of a person to execute a certain task.*

The question then can be asked, can information be used to create knowledge. It does, according to Zijderveld (1995). He states that in courses, presentations, books, television and radio debates, pieces of information are ordered, structured and explained in coherence. In this way, information becomes knowledge.

Tacit knowledge and explicit knowledge

Nonaka and Takeuchi (1996) describe the distinction that Michael Polanyi (1966) made, between *tacit* knowledge and *explicit* knowledge.

Tacit knowledge is dependent on a person. It is personal, context specific and therefore is hard to formalise and communicate. Explicit knowledge (or codified knowledge) is knowledge that can be formalised and can be transferred to others. Below, some examples of tacit and explicit knowledge are given (Weggeman, 1996):

Explicit Knowledge	Tacit Knowledge
task-information in theories, formula's, procedures, handbooks	experiences, abilities and attitude
transfer by education	transfer by demonstration
adoption by studying	adoption by copying and imitating

How is knowledge created? According to Weggeman (1996), it is the product of the two knowledge parts:

- Task-information, (explicit, encyclopaedian or codified knowledge). This refers to knowledge that can be written down or knowledge that has already been formalised in some language, then obtained and internalised.

- Experiences, abilities and attitude (tacit knowledge).

With this information, a learning process will be described further in this thesis.

4.2.1.Compromising Foreknowledge

What is foreknowledge? It is knowledge that a person already has on a subject. We can view it as knowledge. But how do we know what foreknowledge a certain person has. Nonaka and Takeuchi (1995) distinguish between tacit knowledge and explicit knowledge. Foreknowledge can also be tacit or explicit. The explicit knowledge is the knowledge that someone can describe. A consultant may tell you: 'I know how to conduct an interview'. And he then explains the steps or procedure that he usually follows. But there may be some things that he can not describe but that he does unknowingly. This can be the way he looks at the person he interviews, reads their face and their body- language, the way he listens and interprets their voice.

Ideally, the handbook is customised to every individual. That is, it should be adapted to the learning profile of the individual, should use the most appropriate instruction methods and teach the learner only the things he does not know yet.

However, this is not possible. The handbook is written for a number of people greater than one. Within that group, there are people that have a lot of foreknowledge, tacit or explicit, and people that have hardly any foreknowledge (beginning consultants). So in the handbook, a compromise has to be found. All the information needed to work without any foreknowledge on the subject should be available and the handbook should provide easy access to advanced information to users that do have foreknowledge on some areas.

4.3. Using Learning Objectives for the Handbook

In chapter 7, learning objectives are used to specify the contents of the handbook. The method that is to be used, is first stating the desired methodology, then learning objectives are stated. At the moment of the contents specification (December 1996), a number of things were still under development.

It was decided that the handbook would be written for people with little foreknowledge, since beginning consultants, that have never done such a benchmarking study, should be able to do it by using the handbook. This means that some facilities for people that do have foreknowledge on the subjects, have to be created. This, to lead them through the parts of the handbook that are relevant for them. More information about this will be given in chapter 7.

5. Learning

Background
Problem Statement & Analysis
Research Variables
Contents Specification	Learning	Instruction Methods/Media
Design of the Handbook
Conclusions and Evaluation

This section describes the learning process. Every person has his own preference for a certain way of learning. Kolb calls this learning types. Kolb has identified four different learning types. It is to be assumed that different persons in a target group of the handbook have some learning characteristics in common. It might be possible to identify a learning type for each of the target groups (consultants and managers).

Myers-Briggs used the psychological types of Jung to create a test that fits ones personality into one of 16 different possible types. In this chapter the psychological types of the consultant and manager will be described. Kolb has identified a relationship between these personality types and his four learning types. So in this way it is possible to identify the learning types of the manager and the consultant.

It is to be assumed that persons in a certain learning type have some preference for certain instruction methods. This relationship will be described in the next chapter. Then the handbook can be specified and the best (most effective for learning) instruction methods and media can be selected.

5.1. The Learning Process

There are several theories of learning. In this research, two theories are examined, the experiential learning theory of Kolb (1984) and the four ways of learning that Nonaka and Takeuchi (1996) describe.

Kolb (1984) combines three different learning models, that of Lewin, Dewey and Piaget. These different models have a number of characteristics in common that have been fit into one model by Kolb. The model will be explained by a description of the learning process, in the next section.

On the basis of different models and insights, Kolb comes to a working definition of learning:

> *Learning is the process whereby knowledge is created through the transformation of experience.*

In this definition, emphasis is the process of learning, not on the contents or result. Knowledge is seen as a transformation process that uses information of experiences.

The learning process is a cyclic process with four learning stages:

- concrete experiences;

- reflective observation;

- abstract conceptualisation;

- active experimentation.

In this model, *concrete experiences* and *abstract conceptualisation* are two opposite orientations, just as *reflective observation* and *active experimentation*. The basis of the model lies in the shifts between the four extremes.
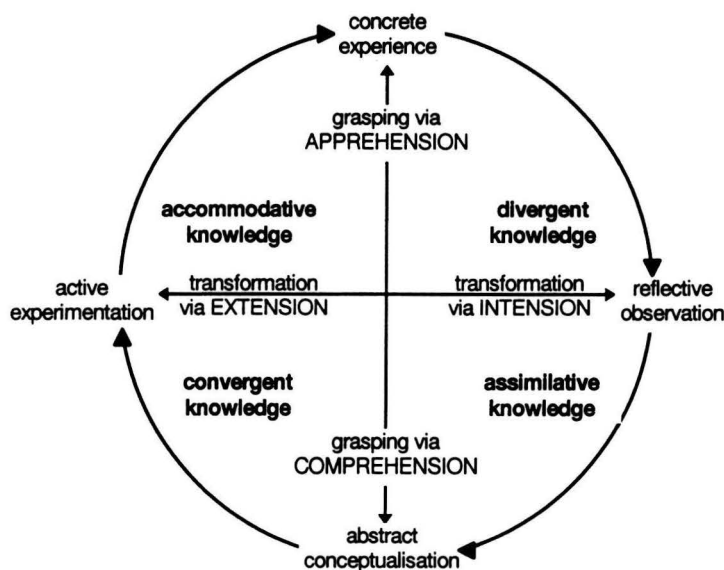

Figure 7 The experiential learning model

For effective learning, the learner has to have four different abilities. He or she must be able to involve him / herself fully, openly and without bias in new experiences (*concrete experience*). He or she must be able to observe and reflect on these experiences from many perspectives (*reflective observations*). He or she must be able to create concepts that integrate their observations into logically sound theories (*abstract conceptualisation*). He or she must be able to use these theories to make decisions and solve problems (*active experimentation*).

Yet no person is highly skilled in all these abilities. The model shows that the learning abilities are polar opposites (*concrete experience - abstract conceptualisation* and *reflective observation - active experimentation*). This suggests that in the process of learning one moves from actor to observer in varying degrees. People always tend to be dominant in one of the opposites. Therefore four learning styles can be discriminated; convergent, divergent, assimilative and accommodative learning styles.

Kolb makes a distinction between two opposite processes:

- *Prehension*; conceptual (or symbolic) interpretation of reality (*comprehension*) or experiencing the world around us (*apprehension*);

- *Transformation*; internal processing of information by reflection, forming an opinion (*intention*) or external applying of information in the world surrounding us (*extension*).

As mentioned before, *learning* is the process of creating knowledge by the transformation of experiences. Knowledge is created by the combination of grasping experiences and transforming them. Because there are two opposite forms of *prehension*, and also two forms of *transformation*, this results into four categories of *knowledge* (Figure 7):

- Divergent knowledge;

- Assimilative knowledge;

- Convergent knowledge;

- Accommodative knowledge.

These different kinds of knowledge and the creation of it, will be explained in the remainder of this chapter.

The central idea of Kolb is that for *learning*, and with that *knowing*, it is necessary that experiences should be comprehended but also transformed (into actions or behaviour). Just being aware of an experience is not enough for learning. One has to act according to what is learned. Reversibly, transformations can only find place if one is aware of a situation or experience.

Nonaka and Takeuchi

Nonaka and Takeuchi (1996) identify four different ways of learning. These will be explained with the following figure:

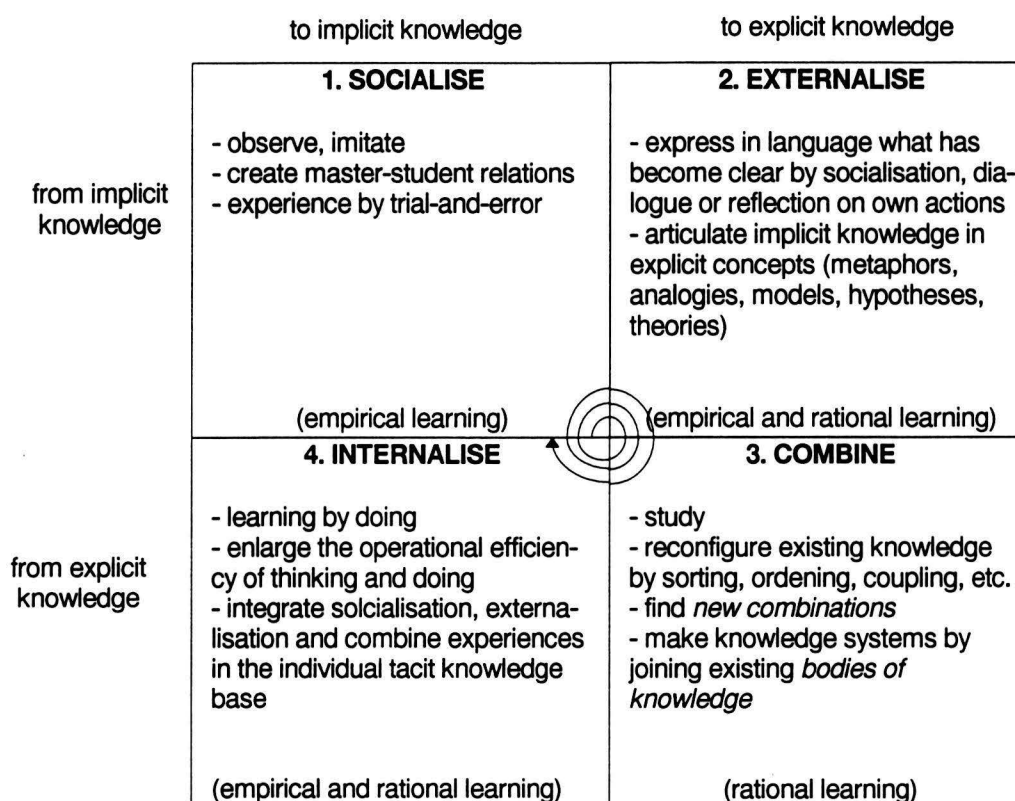|	to implicit knowledge	to explicit knowledge
from implicit knowledge	**1. SOCIALISE** - observe, imitate - create master-student relations - experience by trial-and-error (empirical learning)	**2. EXTERNALISE** - express in language what has become clear by socialisation, dialogue or reflection on own actions - articulate implicit knowledge in explicit concepts (metaphors, analogies, models, hypotheses, theories) (empirical and rational learning)
from explicit knowledge	**4. INTERNALISE** - learning by doing - enlarge the operational efficiency of thinking and doing - integrate solcialisation, externalisation and combine experiences in the individual tacit knowledge base (empirical and rational learning)	**3. COMBINE** - study - reconfigure existing knowledge by sorting, ordening, coupling, etc. - find *new combinations* - make knowledge systems by joining existing *bodies of knowledge* (rational learning)

Figure 8 Four ways of learning

Socialisation is the process of exchanging experiences, where person-bounded knowledge is created in the form of mental models and technical skills. This is learning without using language, learning by observing, experimenting. Externalisation is the process where person-bounded knowledge is expresses in explicit representations. This is done by using metaphors, analogies, concepts, hypotheses and models.

In combining, concepts will be synthesised into a knowledge system. People exchange information in the form of documents, meetings, telephone conversations, computer networks. Restructuring existing information by sorting, combining, adding and categorising can create new knowledge. Internalisation is the process where explicit knowledge is becoming part of the person-bounded knowledge.

Real learning is the interaction between the different knowledge parts. This interaction originates in the transitions between the four quadrants (the drawn spiral). First, socialisation starts with building an interaction-field. This field accommodates the exchange of experiences en the mental models of people. Second, by externalisation, a useful discussion or collective reflection is started. Third, the combining mode is started by 'networking' the newly created and existing knowledge is reviewed from different angles. All this 'learning-by-doing' results finally to internalisation.

Reflection on the theory of Kolb and that of Nonaka and Takeuchi

If we compare the learning process of Kolb with that of Nonaka and Takeuchi, we identify some similarities.

Kolb's *accommodative knowledge* can be compared with Nonaka and Takeuchi's *socialising*. It originates in active experimentation, doing things, getting involved in new experiences. *Divergent knowledge* can be compared to *externalisation*. It is reflecting on the gained experiences and formalising it in ideas, models and theories. *Assimilative knowledge* can be compared with *combining*. Here one tries to combine all existing knowledge and try to create new knowledge, by inductive reasoning. Finally, *convergent knowledge* can be compared with *internalisation*. Knowledge is organised within a person and internalised by using it in practice.

Kolb identifies different individual learning styles in his model. In the remainder of this section, the Kolb model is used to identify the learning style of the consultant and of the manager, who are the target groups of the handbook. As stated, Kolb says that for learning, a person has to move over two axes, prehension and comprehension.

Prehension: Apprehension versus Comprehension

One form of comprehension that Kolb mentions is *apprehension*. This concept can be best explained with an example.

Stop reading this thesis for a minute to become aware of your environment. Whatever you see, hear and feel around you are the colours, shapes and sounds that are so normal to us that we do not even think about them any more. The feeling of sitting in a chair, while it supports your body, the lay-out of this thesis, the sounds of the environment around you. We know all these things. We do not need to analyse them rationally. Still we find it hard to describe the elements. They are just present in our environment.

Concepts and the related form of knowledge is called *comprehension* by Kolb. By comprehension, we bring order in the constant flow of information (and experiences) that come to us every day. To do this, we shape the information and thereby change it. This will be explained with an example.

If you would stop again with reading this thesis and leave the room that you are in, the experience of the room will disappear immediately (*apprehension*). The knowledge that you have of the room that you were in, allows you to describe it to others. You have made a model for yourself that you can communicate. Small details and nuances will be lost with this, but still others can visualise your description.

Transformation: Intention versus Extension

In semiotics, there are two different movements. One is syntaxis (describing) and the other is semantics (signs and symbols).

This concept is about describing. With the description of a rose, one can distinguish characteristics like shape and colour.

Descriptions are not attached to one single object or person. We can make up fictive persons by creating a description. We can also merge different descriptions until they represent one single entity. Or we can split a description to distinguish between two differences. Fantasy plays an important role here.

By smelling a rose, you can bring up feelings and images. This aspect is called *extension*.

It is not descriptions, but feelings that are being brought up. They represent one single entity. They are attached to real events or things. In these case there is no fantasy involved.

5.2.Individual Learning Styles

Different people learn in different ways. People also have different preferences as to ways of learning and subjects to learn. By our experiences, our personal development and demands of our present environment, we develop learning styles that emphasise some learning abilities over others. Some people have a strongly developed ability to create new models and theories, while they have more trouble in practical application of theoretical models and theories. Other people are strong in logical reasoning, yet they do not commit themselves fully to new experiences.

As mentioned before, Kolb identifies two opposite orientations; *active - reflective* and *concrete - abstract*. With these extremes, he identifies four different learning styles that can be classified according to the dimensions *active - reflective* and *concrete - abstract*. He calls these learning styles *converger*, *diverger*, *assimilator* and *accommodator*

Convergent learning style

The convergent learning style relies on the abilities of conceptualisation and active experimentation. The strength of this approach lies in problem solving, decision making, and the practical application of ideas. This style is called convergent because a converger performs well on tests where there is only one correct answer to a question or problem. Knowledge is organised in such a way that by hypothetical, deductive reasoning, they can focus themselves to specific problems.

Convergent people are controlled in their expression of emotion. They prefer dealing with technical tasks and problems rather than social and interpersonal issues. They have little interests and are usually specialised in exact sciences.

Divergent learning style

The divergent learning style has the opposite learning strengths from convergence, emphasising concrete experience and reflective observation. The strength of this approach lies in imaginative abilities and awareness of meaning and values. Divergent learners view concrete situations from many perspectives. This orientation is based on adaptation and observation rather than action. this style is called divergent because a person of this type performs better in situations that call for generation of alternative ideas and implications.

This type of people are interested in others and tend to be imaginative and feeling-oriented. They are interested in culture and can specialise themselves in art.

Assimilative learning style

The dominant learning abilities in this case are conceptualisation and reflective observation. The strength of this orientation lies in inductive reasoning and the ability to create theoretical models, in assimilating disparate observations into an integrated explanation. This orientation is less oriented towards people and more concerned with ideas and abstract concepts. Ideas however are judged less in this orientation by their practical value.

Accommodative learning style

This style has the opposite strengths from assimilation, emphasising concrete experience and active experimentation. The greatest strength lies in doing things, carrying out plans and tasks and getting involved in new experiences. The emphasis of this orientation is on opportunity seeking, risk taking and action. The style is called accommodative because it is best suited for those situations where one must adapt oneself to changing immediate circumstances. In situations where theory or facts do not fit the tasks, those with an accommodative style will most likely discard the plan or theory. People with an accommodative orientation tend to solve problems in an intuitive trial-and-error manner, relying heavily on other people for information rather than on their own analytic ability.

Those with accommodative learning styles are at ease with people, but are sometimes seen as impatient and pushy. His or her educational background is one of a technical or practical kind, like management and business.

5.3.Psychological Types of Jung

Now the general idea of learning has been described, the psychological types of Jung will be used to identify the psychological types of the consultant and manager. First the general idea behind Jung's types will be given, then the types of the consultant and manager will be described.

Carl Jung (1988) developed a framework that distinguishes several psychological types. He identifies four different dimensions to sort peoples psychological profile.

- Opposite ways of finding out: sensing or intuition;

- Opposite ways of deciding: thinking or feeling;

- Opposite ways of dealing with the world: introvert or extravert;

- Opposite attitudes toward the outer world: perceiving or judging.

Isabel Myers-Briggs developed a method to categorise people among these four dimensions. Every person tends to prefer one of the opposites of each dimension. Since there are four dimensions, 16 different categories can be distinguished. First, the dimensions will be described in more detail.

Ways of Finding Out

One way of finding out, is using the senses (*sensing, S*). The senses tell what is going on in reality, so what is present and what is happening. The senses are important for retrieving facts in a certain situation.

An other way of finding out is by *intuition (N)*. This means trying to see relationships and possibilities that go beyond the reach of the senses. Intuition is important when trying to act according to a situation or event.

People of course use both senses and intuition, but never at the same time and often there is a preference for one.

Ways of Deciding

Decisions can be taken by *thinking* (*T*). By thinking, a logical prediction is made of the outcome of a certain action that one wants to undertake. An impersonal decision is then taken on the basis of cause-effect relationships.

An other way of deciding is by using feelings (*feeling, F*). By feeling, everything is taken into account that may be important to the decision taker or to others (whether this is logical or not). A decision is taken according to personal values.

Ways of Dealing With the World

The external environment or the internal environment. Some people enjoy it more to act with people and things in the external world (*extravert, E*), while others prefer to occupy themselves with their internal word of concepts and ideas (*introvert, I*).

Attitudes Toward the Outer World

This aspect refers to the usage of judgement or perception in behaviour toward the environment. People that use their judgement (*judging, J*) live in a planned, orderly way, they want to control and regulate their lives.

People that prefer *perception* (*P*) live in a more flexible and spontaneous way. They want to understand live and adapt to it.

5.4. Myers-Briggs Type Indicator

With the preferences on the four dimensions of Jung, 16 different personality types can be identified. They can be represented with the four letters that were stated in the preceding section, between brackets.

The 16 different personality types are described in appendix 1.

5.4.1. The Learning Profile of the Consultant

In Kolb (1984), Hurst (1989) and Myers-Briggs (1980), several learning styles have already been identified for different professions. In this section a description is given of the learning styles of the consultant and the manager. A small test is done on consultants in Ireland and The Netherlands to verify the descriptions in literature. No hard conclusions can be drawn from this test since the sample size is too small. The intention of the test was to get an indication of the learning style and take literature as a basis. The test can be found in appendix 2.

The following sections describe the outcome of the test taken on 21 consultants. Of which 8 were from AMT Ireland and 13 from IPL-TNO in The Netherlands. The test characterises ones personality on four scales. On each scale, one has to choose one of the opposite characteristic. In this way 16 different types of personalities are discriminated. These types can be fitted to the learning styles which were previously described.

First of all the average personality type of the consultant is described. The test was used to verify the information that was already available in literature. The test confirmed what was found in the literature.

5.4.2.The Briggs Myers Type Indicator test

The Briggs Myers test is a test to characterise someone's personality. It is a test in which people have to judge their own personality according to four subjects; *ways of finding out, ways of deciding, outer world or inner world* and *attitude towards the outer world*.

The test was taken 21 consultants in total.

	Extravert	Introvert	Thinking	Feeling	Sensing	Intuitive	Judging	Perceptive
	E	I	T	F	S	N	J	P
AMT	7	1	5	3	3	5	3	5
IPL	12	1	4	9	4	9	3	10
total	*19*	*2*	*9*	*12*	*7*	*14*	*6*	*15*

Table 1 Results of the Myers-Briggs Type Indicator test under consultants

Ways of finding out

From the test taken, it appears that consultants have a *intuition* preference in ways of finding out (instead of a *sensing* preference). Hurst also states: "Consultants prefer to gather information more broadly and look for whole relationships (intuition preference)."

Intuition searches for meaning and relationships and possibilities that are beyond the reach of the senses. People that use their intuition more than their senses, grow expert at seeing a new possibility or solution. They value imagination and inspirations, and become good at developing new ideas, projects and problem solving.

Ways of deciding

In making decisions, consultants appear to be equally *thinkers* as *feelers*. The outcome of this confirms statements in literature. Remarkable is the difference between the Irish and the Dutch consultants. The Irish seem to be more *thinkers* and the Dutch seem to be more *feelers*. Still no hard conclusions may be drawn because of the small sample size.

The *thinker* will be more skilled in dealing with that part of the world that behaves logically, with no unpredictable human interaction. The person tends to become more logical, objective and consistent. They make their decisions by analysing and weighing the facts, including the unpleasant ones.

The *feeler* is skilful in dealing with people. They tend to become sympathetic, appreciative and tactful and give great weight, when making any decisions, to the personal values that are involved, including those of other people.

Since decision making for consultants often deals with their clients, they should find a balance between thinking and feeling.

Outer world or inner world

Consultants almost all seem to be *extraverts*. This means that they like to use their favourite process in the outer world of people and things instead of their inner world of concepts and ideas, as introverts would. Extraverts tend to be more interested and comfortable when working actively with people and things.

Attitude toward the outer world

The consultants seem to be more *perceptive* than *judgmental*. Perceptive people rely on their perceptive process for dealing with the outer world. They live in a flexible and spontaneous way, wanting to understand live and adapt to it.

5.4.3.Summarising the Results

The typical consultant seems to be *intuitive, thinking/feeling, extravert* and *perceptive (ENT/FP)*. A brief description of their personality would be:

Extraverted intuitive types

They are enthusiastic innovators. They are always seeing new possibilities. They have a lot of imagination and initiatives for originating projects and a lot of energy to carry them out. They get so interested in the current project that they think of little else.

They get other people interested too. They try to understand people rather than judge them. They adapt to other people in the way they present their objective, but never to the point of giving it up. Their faith in their intuition makes them too independent and individualistic to be conformists, but they keep a lively circle of contacts as a consequence of their versatility and their easy interest in almost everything.

Their trouble is that they hate uninspired routine and find it hard to apply themselves to details unconnected with any major interest. Even their projects seem routine and loose attraction as the main problems are solved and the rest seems clear sailing. They may discipline themselves to carry through, but they are happiest and more effective in jobs that permit one project after another, with someone else taking over as soon as the situation is well in hand.

5.4.4.Matching the Learning Style of the Consultant

Kolb has fitted the Briggs Myers Type Indicator to the learning model and the learning styles. It appears that each type can be fitted to a learning style. This way the learning style of the consultant can be determined.
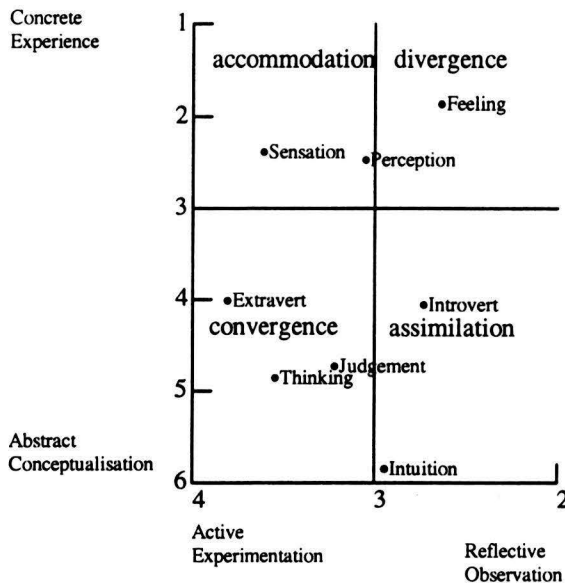
Figure 9 Matching personality types with learning styles

According to the Briggs Myers Type Indicator, consultants are *extrovert, intuitive, perceptive* and both *thinking* and *feeling*. In Figure 9, this leads to a learning style that is somewhat a combination of convergent and accommodative. If consultants were not *feeling*-types, they would be *convergers*. But since they are both *feeling* and *thinking* types, they also have some characteristics of the *accommodative* learning style.

This is understandable because in their consultancy, they have to be able to concentrate on the subject and not be influenced to much by other people. The have to be aware of different trends and theories. They have to be able to work independently. On the other hand, they have to make sure that others accept their solutions which must also be practical. This is the trial-and-error side where the consultant is dependent on others in the execution of their solution.

Further on in this document we will try to identify the best instruction methods for this learning style, to ensure that the handbook that has to be developed will deliver effective educational materials.

5.4.5.Insights into Consultant Types and Roles

Greiner and Metzger (1983) identify different types and roles that a consultant can adopt. They state that consultants can not be all things to all people and therefore have make a choice, which should depend on the assessment of (1) what the person (consultant) feels most comfortable with in terms of personality, knowledge and experience; (2) the client's preference for an approach that matches its working style; (3) the nature of the client problem.

The roles that Greiner and Metzger distinguish are pairs of opposites.

Generalist Versus Specialist Consulting

Generalists are diagnosticians. They sell and accept assignments on the assumption that there are certain management fundamentals required to run any business successfully. Such fundamentals include strategic planning, organisation, marketing, production, financial control, compensation and communications. Generalists posses knowledge about all these functional business areas. Specialists believe that no consultant can know everything about a specific topic unless they are expert in it. Generalists are most effective on complex problems, when an extensive analysis is needed. But generalists can only go so far, then they must call in a specialist.

Process Versus Content Consulting

Process consultants are the 'psychiatrists' of the consulting trade. Content consultants are 'specialist surgeons'. Process consultants believe that only the client can help himself. The client is led through a self-examination and self-healing process. An assumption here is, that the client has a far greater knowledge of the problem than the consultant. The content consultant tells the client what is wrong and then advises a strategic move.

Diagnostic Versus Implementation Consultant

Diagnosticians are adept at producing an 'X-ray' of the problem. They penetrate beneath symptoms and recommend a course of action. Then they often stop at this point by refusing to get their hands dirty. Implementation consultants go further and state that true consultancy is never done until the client has moved off the status quo permanently.

Custom Versus Packaged Solutions

Custom consultants give clients tailor-made solutions to solve each client's particular problem. Competing with the tailor-made approach is the recent growth of packaged programs. These standardised solutions are used for resolving generic types of problems across many clients.

Internal Consultant Versus External Consultants

External consultants state that they are more objective because internal consultants lose perspective out of loyalty and constant exposure to a single organisation. Insiders have rarely easy access to the CEO, since they are subject to the chain of command and politics that affect all full-time employees. Insiders have greater knowledge of the company, than can be obtained by an outside consultant. Insiders know the political terrain and the hidden problems.

5.4.6.The Learning Profile of the Manager

In the ENAPS methodology, the agent has to give some training or presentation in the enterprise to management. Therefore it is good to know what learning profile fits the manager. The handbook can then, just in case with the consultant, use the best instruction methods to develop educational materials.

According to Kolb (1984), the manager profile lies between *converger* and *assimilator*. So there is some compromise between the practical application of ideas and theoretical conceptualisation. This is understandable, because the modern manager has to follow new trends in production, information technology, human behaviour in organisations etc. But he has to be able to use these new ideas, concepts and theories in practice.

5.4.7.Managerial Psychology

According to Hurst (1989), cognitive styles by profession and by managerial position can be generally described as follows:

Managerial	Information gathering		Information evaluation		
	Intuition	Sensing	Thinking	Feeling	n
High level executives	43%	57%	90%	10%	136
Supervisors and managers	42%	58%	64%	36%	3678
Small business managers	14%	86%	81%	19%	150

Table 2 Cognitive style by profession and managerial position

Those with a preference for *intuition* are concerned with possibilities and patterns. They use metaphors and symbols. They are generally considered to be impractical, with little regard for practical details, whilst they describe with metaphors and symbols. *Sensing* people are concerned with activities and events. They tend to be adaptable and practical. Meanwhile their overall behaviour is characterised by attention to practical details, a need to make things work and to describe what has occurred in concrete terms. Results are their reward.

The *thinking* types are generally interested in the cause and effect of things. They tend to be reliable and orderly. Furthermore, they regularly desire that goals be matched to resources and subsequently to results. They feel a sense of reward when the outcome succeeds the plan. Those with a preference for *feeling* value people, and are generally enthusiastic and insightful. Whilst they inspire peers and subordinates, they reward with recognition and praise.

5.4.8.Insights into the Manager's Work

In this section, some characteristics of the typical manager are give. This is meant to 'get a feel' of the personality and their way of learning and receiving information.

In this section, the work of Henry Mintzberg, *The Nature of Managerial Work* (1973) is used. Some conclusions of his work are:

Much of the manager's work is challenging and non-programmed. Still every manager has a number of regular, ordinary duties to perform, particularly in moving information and maintaining a status system.

The manager is both a generalist and specialist. In his own organisation, he is a generalist, the focal point in the general flow of information and in the handling of general disturbances. But as a manager, he is a specialist. The job of managing involves specific roles and skills.

Much of the manager's power derives from his information. With access to many sources of information, the manager develops a database that enables him to make more effective decisions than his employees. Unfortunately, the manager receives much information verbally, and lacking effective means to disseminate it to others.

The prime occupational hazard of the manager is superficiality. Because of the open-ended nature of his job and because of his responsibility for information processing and strategy-making, the manager is induced to take on a heavy load of work, and to do much of it superficially. Hence, his work pace is unrelenting and his work activities are characterised by brevity, variety and fragmentation.

There is no science in managerial work. Managers work essentially as they always have, with verbal information and intuitive (non-explicit) processes.

The manager is in a kind of loop. The pressures of his job force him to adopt work characteristics that make it difficult for him to receive help from the management scientist and that lead to superficiality in his work.

Mintzberg's significant finding concerning media is that managers demonstrate very strong attraction to verbal media. Estimates say that the manager spends 57% to 89% of his time in verbal communication. This is an important conclusion that emphasises that most acquisition activities of consultants should be verbal presentations.

5.5. Conclusions

There are several theories of learning. Kolb describes the three learning cycles of Lewin, Dewey and Piaget. Nonaka and Takeuchi also describe a learning process. Kolb combines the learning cycles of Lewin, Dewey and Piaget and creates his experiential theory of learning. Comparing Kolb's theory with the four learning processes that Nonaka and Takeuchi describe, there are many similarities. A difference is that Kolb stated that for learning, one has to go to the whole cycle. While Nonaka and Takeuchi identify four different ways of learning, so in every state learning finds place. But they also recognise the cyclic character of learning.

Another difference is that Kolb recognises individual learning types. In this research, these learning types are used to identify the learning types of the consultant and the manager. Also the psychological types of Jung are used to get a feeling for the target groups. How do they gather information and how do they make decisions? Also some characteristics of the profession of consultant and manager are described.

This all leads to a description of the average learning style of the consultant and manager. Of course, the average consultant does not exist, just as the average manager does not exist. But individual handbooks can not be created. So some generalisation is needed. Still, there are differences in learning for people in different professions. Learning types give an indication of those differences. It is meant to give the designer a 'feel' for his target groups and reckon with that when specifying the instruction methods and media to be used in these learning materials.

6. Instruction Methods and Media

Background
Problem Statement & Analysis
Research Variables

Contents Specifica- tion	Learning	Instruction Methods/Media

Design of the Handbook
Conclusions and Evaluation

In the previous chapter, learning characteristics and personality characteristics of the consultant and the manager were described. It is to be assumed that according to chose characteristics, consultants and managers will have their own preferences for certain instruction methods and media. In this chapter, suitable instruction methods will be chosen for the consultant and the manager. This is done by matching the characteristics of several instruction methods with the characteristics of the different learning styles. In the selection of the instruction methods, there is no right or wrong, just a matter of good or better.

For the selection of instruction methods, a small questionnaire was given to the same consultants as in the Myers-Briggs test. The were asked for their preference as to different instruction methods when receiving training or education. The results will be compared with information from literature. The questionnaire can be found in appendix 3.

Frontczak and Higgins (1991) distinguish ten different instruction methods:

1. Videotape;
   Watching a videotape, with a group or alone, without a tutor
2. Lecture;
   Following a lecture with a group of persons
3. One-on-one instruction;
4. Role playing;
5. Slides;
   Looking at slides, without other (verbal) information
6. Computer-based training;
   Working alone on a computer program
7. Games/simulations
8. Case studies - group;
   Discussing a case with a group
9. Case studies - individual;
   Studying a case individually
10. Self assessment/self testing.

In appendix 4, some characteristics of these instruction methods are described.

6.1.Fitting Instruction Methods to Learning Styles

The characteristics of the learning profiles of the consultant and the manager can be compared with the characteristics of the instruction methods (appendix 4). Each learning profile will have preferences for some of the instruction methods. In this section, the most likely combinations of instruction methods and learning profile will be examined. The combinations are formed by comparing the characteristics of the learning profile with the characteristics of the instruction methods. This is a subjective process. Only a survey is held on 21 consultants in which they could indicate their preference in instruction, from the list of 10.

The Consultant

As already mentioned, the consultant lies between the *converger* and *accommodative* learning style. Some characteristics of these learning styles are recapitulated.

The learning style of the converger emphasises abstract conceptualisation and active experimentation. They like problem solving, decision making and the practical application of ideas and theories. Convergers prefer to deal with technical problems and 'figure things out' rather than social, interpersonal skills.

The accommodate learning style emphasises concrete experience and active experimentation. They like doing thing and getting involved in new experiences. They seek opportunities, take risks, and learn more by trial and error. These individuals are more at ease with other people.

Frontczak and Higgins (1991) have tried to match instruction methods with learning styles. They have done this by considering logically different considerations for the use of different training techniques. The relationships are not empirically tested.

The converger likes to ask the question, 'How does it work?' They would enjoy video and films that have a dynamic nature. They might be bored by traditional lectures, since they like to gather information by hands-on experiences such as active computer based training techniques and games or simulations. Since they rather deal with technical tasks than social or interpersonal issues, individual assignments such as individual case analysis would be appropriate. They are however willing to work with others that are task-oriented.

The accommodator, as a risk-taker who likes new experiences, would not respond well to traditional lecture, videotape or film, but would enjoy unique creative computer-based training programs. Since they are at ease with people, they would enjoy one-on-one instruction, role-playing and group case studies. Since they like to imagine 'what would be', games and simulation would be appropriate.

Concluding, one can say that consultants, according to their learning profile, are likely to prefer the following instruction methods:

- *Games/simulation;*
- *Role playing;*
- *Case studies - group/individual;*
- *Videotape;*
- *One-on-one instruction.*

A survey held on 21 consultants shows that they agree with this list. So the handbook should use a combination of these five instruction methods.

The Manager

Earlier on, it was concluded that the learning profile of the manager lies between *converger* and *assimilator*. Some characteristics of these learning styles are mentioned below. The characteristics of the converger are already explained in the previous section, therefore only the assimilator's characteristics are explained.

The assimilator's dominant learning abilities are abstract conceptualisation and reflective observation. This orientation is less focused in people and more concerned with ideas and abstract concepts. Logical, sound theory, concrete, ordering, attention to detail, facts and figures are important to this person. They process information concretely.

The converger's preference for instruction methods is also explained in the previous section, therefore, the assimilator's preferences are explained here. Again, this information comes from Frontczak and Higgins (1991)

The assimilator is a concrete, spatial thinker, he would like traditional lectures, well organised videotapes, films and slides. Given the logical, structured nature of most computer-based-training techniques, assimilators would enjoy this method. They are less focused on people and less interested in ideas, so games and simulations and individual case studies would provide an opportunity to work independently.

Concluding, the handbook (or the consultants training the managers) should use one, or a combination, of the following instruction methods:

- *Games/simulation;*
- *Videotape;*
- *One-on-one instruction;*
- *Individual case studies.*

6.2. Selection of Instruction Media

In the previous chapters, the learning styles of the consultant and the manager were identified. According to those learning styles, appropriate instruction methods were selected. Now the media in which to create the instruction methods will be selected. The media will be selected according to several criteria (cost, time and effectiveness for learning).

6.2.1. Examination of Instruction Media

In this section, the previously selected instruction methods implemented in different media will be evaluated according to several criteria. These criteria are:

- Time (for development);

- Cost (costs of development);

- Effectiveness (for learning).

In weighing these criteria, one can take two views: that of the user and that of the producer. The effectiveness for learning counts for the user. Money and time of development more for the producer. The producer, in this case the ENAPS consortium, has to find an optimum in minimising the costs (due to limited budget) and development time (due to limited capacity). With this information the following table is created:

instruction method	medium	cost	time	effectiveness	total
Videotape	film	--	--	+	-
	video	--	--	+	-
	CD-ROM	--	--	+	-
Lecture	course	+	+	+	+
One-on-one instruction	course	+	+	++	+
Role playing	course	+	+	++	+
Slides	CD-ROM	--	--	+	-
	slides/projection	+	++	+	+
Computer-based training	CD-ROM	--	--	+	-
	internet	++	+	+	+
Games/simulations	CD-ROM	--	--	++	-
Case studies - group	course	+	+	++	+
Case studies - individual	CD-ROM	--	--	+	-
	documents	++	++	+	++
Self assessment/self testing	documents	++	++	+	++
	internet	++	+	+	+

-- = highly negative evaluation   + = positive evaluation
- = negative evaluation   ++ = highly positive evaluation

Table 3 Selecting instruction media for the consultant

The table is the result of a subjective process of weighing the criteria. They have not been empirically tested for effectiveness, nor was there extensive research on the costs of creating the instruction methods in the desired media. It was a judgmental process.

Instruction Media for the Consultant

According to the learning profile of the consultant, they prefer the following instruction methods: games/simulation, role playing, case studies (group), videotape and one-on-one instruction. In Table 3, these are printed in Italic.

Within the ENAPS project there are some restriction as to the education of the consultant. There are a limited number of agents (one, or two per country). They are already involved in the project. Further, they are geographically spread over Europe, so it would be expensive to create a course somewhere in Europe. They should be educated from their home-country, preferably from their office. So strong emphasis in the handbook design is on self-study or self assessment.

It is too expensive to create a course and let all the agents attend that course. But there is still a possibility to give such a course in a scheduled meeting of the project. These meetings are still funded. Then a one or full day seminar could be given. So in Table 3, the costs for courses are evaluated positively.

For the duration of the project, the handbook is still under development. As time goes by, experiences with the method will come free and therefore some elements in the handbook can still change. The handbook is a dynamic entity. It has to be developed in such a way that it can be updated.

With these restrictions in mind one comes to the following selection of media in which materials can be created (grey in Table 3):

- Courses;

- Slides/projection;

- Internet;

- Documents on paper.

Instruction Media for the Manager

The learning profile of the manager identified the following preferred instruction methods: games/simulation, videotape, one-on-one instruction and case studies - individual. In Table 3, these are underlined.

For instruction materials for the manager, there are some restrictions concerning the design of the handbook. The view has been taken that no courses will be designed for the managers of companies that might want to participate in the project or in benchmarking. The managers do not need to be trained, they need to be aware of the method and whether they can use it for their company. This is the responsibility of the consultant or agent. He or she has to inform the enterprises about ENAPS and benchmarking. The handbook should support this process by creating materials that the agents can use in this task. This is done by creating a presentation package that the agents can use to present ENAPS and benchmarking to the enterprises.

7. *Design of the Handbook*

Background
Problem Statement & Analysis
Research Variables

Contents Specification	Learning	Instruction Methods/Media

Design of the Handbook
Conclusions and Evaluation

All the Research variables are now described. In this chapter the results of that will be used to lay out the framework of the handbook. The contents will be specified by using learning objectives. The methods and media to use are chosen according to the learning characteristics of consultants and managers.

7.1. *Contents of the Handbook*

Learning objectives are used to specify the contents of the handbook. Learning objectives have the following advantages: they can help in specifying the contents of the handbook, they can be used to evaluate the outcome of the handbook, they serve as an aid in choosing the instruction methods and media and they can be used as a communication means. A disadvantage is that the contents of the handbook is not yet stable. Since the project is not finished yet, some things are still under development. So the handbook can not be fully specified. Therefore only the things that are certain are specified. The learning objectives are used as a framework for the contents of the handbook. It should not be used rigidly.

The learning objectives are derived by describing the ENAPS methodology to be used by the agent and participating company.

The Method

Designing organisational training is often preceded by a task analysis. The current working method is compared with the desired working method. The difference specifies the necessity for training.

In case of the ENAPS handbook there is no task that can be analysed. There is of course a desired working method. The desired situation is the methodology to be used by the agent and the organisation. The function of the handbook is to support the methodology as much as possible.

In the specification of the learning objectives, first the desired methodology used by the agents and organisations is stated. Then the objectives are derived from that.

The different instruction methods are identified and matched with the learning profiles of the target groups and requirements within the project.

The ENAPS Methodology

Within the handbook two target groups are identified. A target group is a group of persons that the handbook has to serve in any way. By specifying their task and role, it is possible to derive the goals of the handbook. The goals can then be divided into learning objectives.
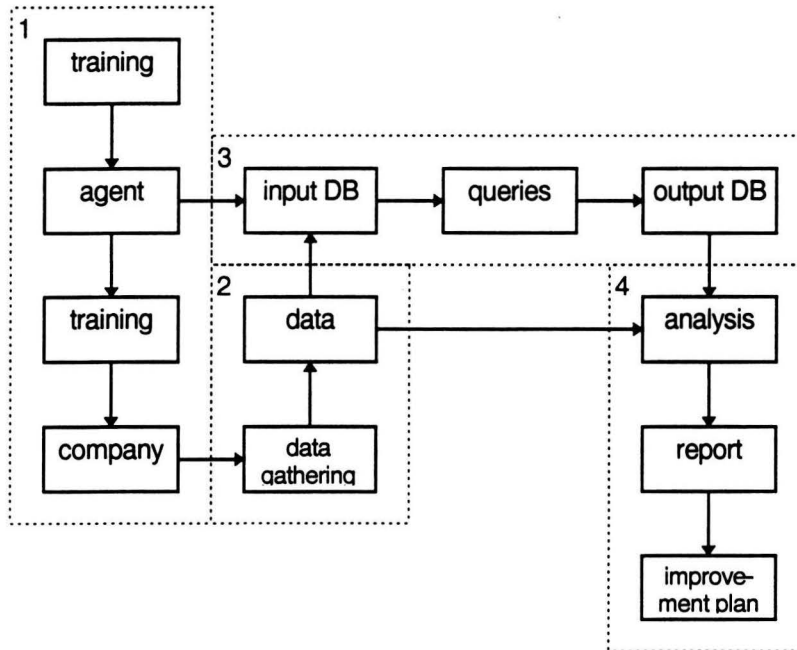
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1
  ┌─────────┐
  │ training │
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       ▼              3
  ┌─────────┐    ┌──────────┐   ┌─────────┐   ┌──────────┐
  │  agent  │───▶│ input DB │──▶│ queries │──▶│ output DB │
  └─────────┘    └──────────┘   └─────────┘   └──────────┘
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       ▼         2    │                         4
  ┌─────────┐    ┌─────────┐              ┌──────────┐
  │ training │   │  data   │─────────────▶│ analysis │
  └─────────┘    └─────────┘              └──────────┘
       │              ▲                         │
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  ┌─────────┐    ┌─────────┐              ┌──────────┐
  │ company │──▶ │  data   │              │  report  │
  └─────────┘    │gathering│              └──────────┘
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Figure 10 Procedure of the ENAPS methodology

In figure 10, the procedure of the ENAPS methodology is reflected. Four major parts can be discriminated:

1. A training part. This involves training of the agent, who has to introduce the ENAPS methodology to the participating companies. But also the training that has to be given by that agent in the company.

2. The second part involves the data gathering. In this part, the agent and the company will try to retrieve all the necessary information needed for the ENAPS benchmark. This involves issues like *what information*, in *what form* and *where* to retrieve it.

3. Then the communication with the ENAPS database follows. The agent is the only one who has access to the database. He has to input all the data by means of the electronic questionnaire. He can create the necessary queries en present the results to the enterprise.

4. The last block will be left as much as possible to the interpretation of the agent. In this phase the performance of the company is compared with the information in the ENAPS database. Guidelines will be given for the analysis. But due to the individual situation of the organisation, much is left to the experience and interpretation of the agent. Guidelines will be given for the lay-out and the contents of the report. The agent can write an improvement plan for the organisation.

From these blocks, the goals of the handbook are specified. These can then be divided into learning objectives. The results of this process can be found in appendix 5.

7.2.The Structure of the Handbook

In this section, the framework of the handbook will be laid out. The earlier described research on learning processes and instruction methods and media are used to choose the 'products' of the handbook.

Emphasis lays on supplying materials for the agent. But some materials are also produced for managers. The handbook will look as follows:

All materials are first created on paper. This paper-handbook contains several documents that describe the different subjects. This paper-handbook can be used as a reference. These documents will be downloadable from the internet. The user can print the document out himself. This gives the ENAPS consortium a chance to keep the documents up to date as the project progresses. If a document changes, the user can download it and replace it with the new version. Also, new documents can be easily added.

The documents shall also be created in HTML. This is the language in which internet pages are written. The user can download these scripts and read them locally with an internet-browser. In this way, some interactivity and easy access to different parts of the document can be supplied to the user, to make reading more convenient. This is also done to deal with possible foreknowledge that the agent may have (see also chapter 4).

There will be a handbook-homepage on the internet. Here the users can download documents and scripts, but will also be able to view summaries of these documents on-line. There would also be a possibility to exchange experiences via the internet, a discussion forum can be used for that. The homepage will keep the users up to date as to the progress and development of the handbook.

A proposal has been made to the ENAPS consortium (and accepted) to design a course for the next scheduled ENAPS meeting in October, in Bremen, Germany. This course will be used to train or educate the agents in the project. What the course will exactly look like is still uncertain. For this, the agents will be asked in the next months what troubles they encounter when they go out and use the ENAPS methodology. According to their needs, a training session or workshop will be designed. For this, the instruction tools listed as *effective* in Table 3 will be used.

Foreknowledge

As discussed earlier, the handbook will aim at people with little foreknowledge on the subjects that are part of the handbook. It is decided that the handbook should be split up into independent sections. Then, the user can decide to skip the section if he thinks he has enough foreknowledge about that subject. This is a decision, the user has to make for himself. To support him in making that decision, a Reader's Guide is provided with every section. This Reader's guide consists of three sections:

- who the document is written for;

- what the document is about;

- what fore-knowledge is required (and what sections of the handbook to consume for that).

Also, a short summary, of about one page, of the document is given. So the user can see if he has already read the document or already has enough knowledge about the subject so he can decide to skip the document.

If the user decides to read the section of the handbook, it should be represented in such a way that he can read it in the order he wants. He must be in control of what to read and when. This can be provided by writing the documents in an interactive medium. An example of such a medium is the HTML format that is used in internet. This allows the user to click on key words and find more information on subjects if he wants. He can choose what words to click on and in this way is in charge of the structure and order in which he wishes to read the document. It is possible to create HTML documents that one can read with an internet browser locally. The documents can be downloaded to a Personal Computer and be read off-line the internet. This is done to save telephone costs.

Presentation Package and Intermediate Handbook

It is the responsibility of the agent to inform (or teach) prospective clients (managers) about the project and benchmarking. Still, the handbook should help the agent to do that with materials. Therefore, the handbook provides in a presentation package, consisting of:

- Introduction letter to the agents;

- Introduction letter of professor Rolstadås, manager of the ENAPS project addressing to industry;

- MS Word document about ENAPS, for the client to read;

- MS Powerpoint presentation that the agents can use to present ENAPS.

Further, a flyer will be developed so the agents all over Europe can send information to possible clients. Any further education or information to managers is left to the agents themselves. The presentation package can be found in appendix 6.

The agents are supposed to go out measuring companies even before the project has ended. They are supposed to start measuring from June 1997, that is one year before the project ends. The handbook is planned to be finished when the project ends. The agents objected to this and wanted some information when they where supposed to measure companies. Therefore task 6-4 was redefined into delivering a *preliminary handbook* in May 1997. This preliminary handbook consists of a description of all finished parts of the project so far. It is written on paper, so it is not dependant on the outcome of the handbook design, which identifies the instruction means and media in which the handbook should be developed. The preliminary handbook can be found in appendix 7.

8. Conclusions and Evaluation

Background
Problem Statement & Analysis
Research Variables

Contents Specification	Learning	Instruction Methods/Media

Design of the Handbook
Conclusions and Evaluation

In the previous chapter the design of the handbook was described. In this chapter conclusions are drawn from the whole thesis-study. Where possible, recommendations are given for existing problems. The conclusions are a reflection on the ENAPS project, on the three different research variables and in the chosen instruction methods and media.

Finally, and evaluation of the thesis study is given.

8.1. Conclusions

Reflection on ENAPS

In Chapter 2, some background information was given about the ENAPS project. At the end of that chapter, some conclusions were drawn. These will be recapitulated here.

The Performance Indicators are not Structured

The performance indicators as they are now, are not structured enough. They do not fit the framework that has been developed very well. The reason for this is that the procedure that was used to developed them was not executed correctly. The indicators are the result of a brainstorming session, where the developed framework was somehow lost. A solution for this problem is already suggested in the project. Comments on the performance indicators are collected in a structured way. Every three months a committee reviews the comments and tries to improve the performance indicators with the latest insights.

There are no 'Best Practice' Descriptions

There are no 'best practice' descriptions in the ENAPS database. So when an agent queries the database and finds an enterprise that performs better than his client, it is not clear why this enterprise is performing better. This problem is acknowledged by the project partners and a co-operation with another project (that does store 'best practices') might bring a solution.

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There is no structured means for knowledge transfer

There is no structured means for knowledge transfer. If an agent improves a process in a company and performance is improved, it could be useful for other agents to know how the improvement was accomplished. This information is not stored and any gained knowledge is not shared in a structured way. Somehow experiences with the benchmarking model and improvement methods have to be collected. With this information a knowledge base could be created. The goal of this knowledge base should be that an agent fills in the characteristics of the client's enterprise, a comparison is made with the 'best practice' and the knowledge base give suggestions on how the improve the client's organisation. This might be an idea for an ENAPS follow-up project.

No Open Data

For true benchmarking, open data is needed. But companies hesitate to give away 'sensitive' information about their processes and performance. Therefore some security measures were taken in the database to provide anonymity. Also queries will only be returned if there is data from three or more companies available. There is no real solution for this problem. Data is needed to fill the database and enable benchmarking. So the compromise has to be accepted.

Chicken-and-egg Problem

A real important problem is the 'chicken-and-egg' problem. The ENAPS database is still empty. The agents will have to go out to prospective clients to measure their performance and store it in the database. Once the database is filled, the agents can offer benchmarking. So at the moment they have nothing to offer, but must convince enterprises to have their performance measured. One solution could be to try and fill the database with other available information. This can be information from other benchmarking databases, it must then be possible to transform the data. Available statistical information from branch-organisations or statistical institutes might also be useable.

Learning objectives (contents)

At the moment of specifying the contents using learning objective (December 1996) the full content of the handbook was not clear yet. This because a number of things were still under construction. So the content could not be specified in detail. What was possible, was to specify the framework of the methodology. In this way, a rough specification of the contents could be given (appendix 5). At least the subjects are known.

This has consequences for the measurability of the intended outcome of the handbook. If at the end of the project an evaluation of the handbook is wanted, it is hard to measure it. Only the items that were specified (the learning objectives that were stated) can be measured. It has to be stated also that it is very difficult to measure cognitive learning goals. How should you measure the ability of the agent in interpreting differences in performance between his client and an enterprise in the database?

Stating learning objectives gives the designer of the handbook an insight in what has to be teached and what not. The subjects are known, maybe not their complete contents. The characteristics of a subject help the designer in choosing the right instruction methods, together with the learning characteristics of the users. Practical parts of the handbook suggest other methods of instruction than theoretical parts (practical experimenting versus inductive reasoning).

Using learning objectives did provide an effective means for communicating the contents. In an early stage, it became clear to all project partners what would, and what would not be included in the handbook.

Learning

In the section of learning types, a great deal of generalisation is used. Of course, the average consultant does not exist, just as the average manager does not exist. But individual handbooks can not be created. So some generalisation is needed. Still, there are differences in learning for people in different professions. Learning types give an indication of those differences. It is meant to give the designer a 'feel' for his target groups and reckon with that when specifying the instruction methods and media to be used in these learning materials.

Instruction methods and media

Even when learning types are known and the ideal methods and media to be used for those types are known, the handbook consists also of other methods and media. This is because other factors also play a role. Time and money are two important factors. There is limited time to develop the handbook, there is a tight project-planning that can not be extended. But there are also limited resources (money). There is a budget and there are almost no means to increase that budget. So a compromise has to be made in weighing all the criteria that play a role (time, costs and effectiveness for learning).

Frontczak and Higgins (1991) compare characteristics of the different learning types with characteristics of the different instruction methods. They then make a logical comparison and identify certain instruction methods that match learning types. They have not done any empirical research to prove their statement. There is still little known in this field. A recommendation could be to do some experiments to find evidence for their suggestions. Due to the limited time span of this thesis, these experiments were not conducted.

8.2.Evaluation

Work in the Project

The work that I did in the last nine months is more than just this thesis. TUE has a number of responsibilities in the ENAPS project, besides the handbook. TUE is involved in a number of other tasks in other workpackages. TUE is also workpackage leader for the so-called 'demonstrators'. This workpackage experiments with the benchmarking methodology in four enterprises in Europe. Since April 1997, another student is working on this workpackage, but up till then, I have done most of the work on that. When working in such a project, a number of administrative things have to be done. Every 6 months a progress-report has to be written for the European Committee. In this way, they review the progress and quality of the work that they finance. This report also includes cost-statements that justify the amount of money spent. I have also done other tasks in the project, for instance the redefinition of the existing performance indicators, attending project meetings, writing task-deliverables. For the handbook we have set up a co-operation with the partners from Switzerland.

ENAPS Project Structure

The Project structure of the ENAPS project consists of project partners and agents. The project partners are responsible for the design part of the project. They designed the business model that was the basis for the performance measures and the performance indicators. The agents will be the end users of the methodology and the products that are developed. In the design phase they participate in discussions and are asked for advise. A few agents even participate in the design.

The main role of the agents lie in the implementation phase. They are responsible for gathering data to fill the ENAPS database to enable benchmarking. This is one of the main problems of the project. When the database is empty, the agents (consultants) have nothing to offer their clients, with respect to benchmarking. Therefore they hesitate to go out measuring companies. In this way the database will stay empty and the project is failed to be doomed. Only if all agents take the initiative to go out and measure a number of companies in a short time, then the database is filled and the agents can go back to the companies they measured and offer benchmarking after all.

Difficulties

As mentioned in chapter 2 *The ENAPS Project* the partners come from five different countries. The people that work on the ENAPS project are therefore geographically spread over Europe. This gives some difficulties in communication. Communication finds place through E-mail and telephone. But not always are the people available at the time you want them to be. Even a fast communication means like E-mail can take a wile to be answered. So communication takes some time.

The partners are assigned to different workpackages and even to different tasks within those workpackages. Therefore there are some dependencies regarding information. Outputs from tasks and workpackages are input for other tasks and workpackages. This is also the case with the creation of the handbook. The handbook has to describe all the information that has come out of the work of all different workpackages. If there is a delay in one or more workpackages, then the outcome can not yet be described in the handbook.

Extra Tasks

The agents also wanted some kind of *presentation package* so they could present the ENAPS project to their customers. The creation of this presentation package was assigned to workpackage 6, the handbook. The presentation package consists of:

- Introduction letter to the agents;

- Introduction letter of professor Rolstadås, manager of the ENAPS project;

- MS Word document about ENAPS, for the client to read;

- MS Powerpoint presentation that the agents can use to present ENAPS.

This task meant extra work to be performed in the workpackage.

So we can distinguish work on the project and work on the thesis. Although there is an overlap. Below, an overview is given of the work performed:

Work on thesis	Work on project	Overlapping work thesis/project
	writing deliverables	research on the research objects
	creating a presentation package	designing the handbook (framework)
writing a report	creating a preliminary handbook	

Table 4 Work performed

The presentation package is included in appendix 6.

Another task that was executed in parallel was the writing of the preliminary handbook. The agents wanted some paper-handbook early in the project, because they were supposed to go out and do measurements to fill the database. But according to the project definition, the handbook was delivered at the end of the project (May 1998). It was decided that a preliminary handbook would be delivered in May 1997. This resulted in extra work to be performed. The preliminary handbook can be found in appendix 7.

Absence of a Problem

In a thesis study usually a 'problem' in an organisation has to be solved. In this thesis, there was not such a 'problem'. In this case there was a task to be performed within the project, so we could better speak of an assignment. Still there was some problem defined, that is, how should the handbook be designed to stimulate the learning processes of the target groups. To bring the assignment to a more academic level, the workpackage was redefined and the aspects of learning processes and instruction methods was brought in.

The people involved in the project are only looking at the outcome of a task. So they were more interested in the product delivered than in the method of development. They had a more practical than academical orientation. But they liked the idea of splitting up the design and the actual 'writing' of the handbook.

Project Planning

The ENAPS project plan is described in the so-called Technical Annex. This describes workpackages, tasks and due dates for deliverables. In the thesis we were dependant on the definitions of workpackages and tasks and the planning was dependant in the deliverable due dates.

Benefits

Dispite the difficulties and restrictions as described above, there are of course a number of advantages when working in such a project.

First of all the international orientation. Working with people from 15 different countries from Europe gives you a chance to taste the different cultures. You get the chance to meet different people which I think helps to integrate Europe.

Attending meetings at different places in Europe also enables you to see some places of Europe and visit the institutes that participate in the project.

Every participant in the project 'tastes' the potential of the project. There is not yet a similar database in Europe. Also the reviews of the European Committee are very positive. This all gives an enthusiastic atmosphere at the project meetings. If this enthusiasm can be used to higher the effort of all participants in the project, ENAPS will be successful.

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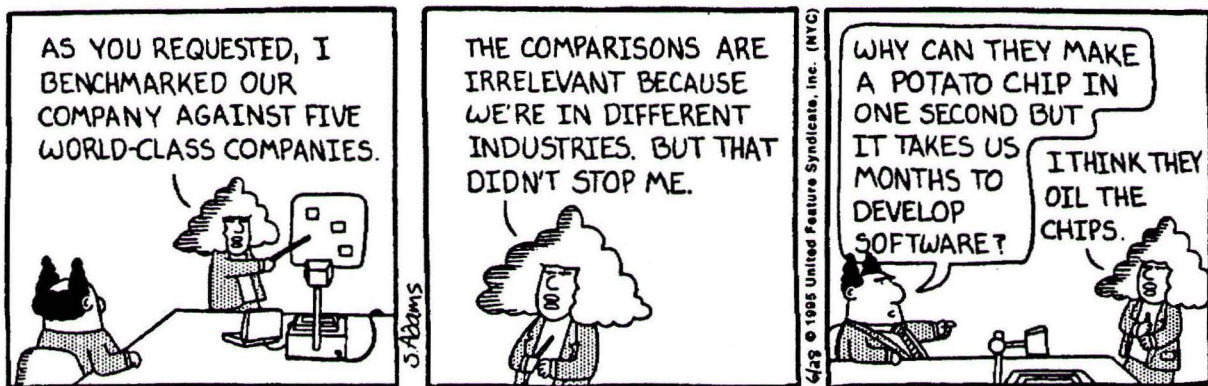Mintzberg, Henry, *The nature of managerial work*, Prentice Hall, 1980

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Transferring Knowledge

The Design of a Handbook for the Benchmarking Methodology of

ENAPS

Appendices

4 July 1997

Dennis J. Drieling

ID: 409530

Contents

Appendix 1
Jung's Personality Types

Introvert, Sensing, Thinking, Judging (ISTJ)

Serious, silent, earn success by concentration and hard work. Practical, orderly, facts, logical, realistic and reliable. Make sure everything is well organised. Take responsibility. Form their own opinion about what has to be accomplished and work to that, ignoring protests or distraction.

Introvert, Sensing, Thinking, Perception (ISTP)

Calm, reserved, observing and analysing live with curiosity and unexpected waves of original humour. Usually interested in impersonal principles, cause and effect, if, how and why mechanical things work. Usually do not more than they think is necessary, because waste of energy would be inefficient.

Introvert, Sensing, Feeling, Judging (ISFJ)

Quiet, friendly, responsibility, conscientious. Work dedicated to fulfil their obligations and care for their friends. Thorough, detailed and exactly. Need time to comprehend technical issues, because their interests often are non-technical. Patient with details and routine. Loyal, concerned and interest in other peoples feelings.

Introvert, Sensing, Feeling, Perception (ISFP)

Solitary, friendly, sensitive, modest about their qualities. Avoid arguments and do not force their opinion or values up to other people. Are often not leader, but are loyal followers. They are relaxed in executing assignments, because they enjoy the current moment and do not want that to be spoiled by unnecessary haste.

Extravert, Sensing, Thinking, Perception (ESTP)

Facts, no worries before tomorrow, enjoy whatever may come. Like mechanical matters and sports, with friends or just at the side line. Can be interpreted senseless or blunt. Can do mathematics or physics when they see the need of it. Do not like long explanations. Work best with things that can be disassembled and then assembled again.

Extravert, Sensing, Thinking, Judging (ESTJ)

Practical, realistic, facts, are most comfortable in business or mechanics. Not interested in unuseful matters, but can make an effort if necessary. Like organising and activities. Are mostly in control, especially if they reckon other peoples feelings and opinions in making decisions.

Extravert, Sensing, Feeling, Perception (ESFP)

Easy, susceptible, friendly, enjoy a good time. Love sports and creating things. They know what is going on and are egar to participate. Believe that remembering facts is more easy than mastering theories. They work best in situations where common sense is needed and practical abilities, as well with people as with things.

Extravert, Sensing, Feeling, Judging (ESFJ)

Warm-hearted, talkers, popular, conscientious, born co-workers, active board members. Always do something nice to somebody. Work best when encouraged and complimented. Less interested in abstracts thinking or technical subjects. Have great interest in things that visibly influence other peoples lives.

Introvert, Intuition, Feeling, Judging (INFJ)

Succeed by perseverance, originality and the need to do whatever is necessary. Do their best in their work. Silent, powerful, conscientious, concerned with others. Respected for their strong principles. Most probably are praised and followed for their clear conviction about how to serve common interest.

Introvert, Intuition, Feeling, Perception (INFP)

Full with enthusiasm and loyalty, but seldom talk about this until one get to know them well. Care for learning, ideas, language and independent projects. Tend to do to many activities, but eventually knows how to solve them all. Friendly, but too often occupied with business to socialise.

Introvert, Intuition, thinking, Judging (INTJ)

Are original and driven in matters that serve their own interests. Have the ability to organise and carry out work on areas that they find interesting with or without help. Sceptical, critical, independent, resolute, often stubborn. Have to learn to spend less attention to unimportant matters and spend more attention on important issues.

Introvert, Intuition, thinking, Perception (INTP)

Silent, reserved, brilliant in exams and tests, especially in theoretical or scientific subjects. Logical into the smallest details. Are especially interested in ideas with little preference for parties or chitchat. Have sharply defines interests. Have to choose a career in an area where they can use their interests in a useful way.

Extravert, Intuition, Feeling, Perception (ENFP)

Warm hearted, enthusiastic, good humour, ingenious, imagination. Able to do almost anything that interests them. Quick with solutions for any problem and also willing to help somebody. Often rely on their ability to improvise, instead of preparing in advance. Can often come up with compelling reasons for whatever their opinion is.

Extravert, Intuition, Feeling, Judging (ENFJ)

Always answering, responsible. Are concerned for other peoples opinions and act according to the feelings and opinions of others. They can present a proposal or lead a group discussion with tact. Social, popular and active in side issues, but spend enough time in main activities to deliver a good job.

Extravert, Intuition, Thinking, Perception (ENTP)

Fast, ingenious, good in a lot of things. Stimulating company, alert and frankly, discuss for their pleasure on whatever side of a statement. Come with solutions for new and challenging problems, but tempt to neglect routine activities. Change interests fast. Can always come up with logical reasons for what they want.

Extravert, Intuition, Thinking, Judging (ENTJ)

Open hearted, honest, good students, leaders in activities. Usually good in activities that require reasoning and intelligent conversation, like speaking in public. Are well informed and keep their knowledge up to date. Are sometimes too positive and too full with confidence than their experience can handle.

Appendix 2
Myers-Briggs Type Indicator

Please indicate which group of statements fits your personality best. Each time, choose the left or the right group. So in total you have to make four choices

WAYS OF DEALING WITH THE WORLD	
EXTRAVERTS	INTROVERTS
Like variety and action.	Like quiet for concentration.
Tend to be faster, dislike complicated procedures.	Tend to be careful with details, dislike sweeping statements.
Are often good in greeting people.	Have trouble remembering names and faces.
Are often impatient with long slow jobs.	Tend not to mind working on one project for a long time uninterruptedly.
Are interested in the results of their job, in getting it done and how other people do it.	Are interested in the idea behind their job.
Often do not mind the interruption of answering the phone.	Dislike telephone intrusions and interruptions.
Often act quickly sometimes without thinking.	Like to think a lot before they act, sometimes without acting.
Like to have people around.	Work contentedly alone
Usually communicate freely.	Have some problems communicating

WAYS OF DECIDING	
THINKING TYPES	FEELING TYPES
Do not show emotion readily and are often uncomfortable dealing with people's feelings.	Tend to be very aware of other people and their feelings.
May hurt people's feelings without knowing it.	Enjoy pleasing people, even in unimportant things.
Like analysis and putting things into logical order. Can get along without harmony.	Like harmony. Efficiency may be badly disturbed by office feuds.
Tend to decide impersonally, sometimes paying insufficient attention to people's wishes.	Often let decisions be influenced by their own or other people's personal likes and wishes.
Need to be treated fairly.	Need occasional praise.
Are able to reprimand people or fire them when necessary.	Dislike telling people unpleasant things.
Are more analytical oriented-respond more easily to people's thoughts.	Are more people oriented-respond more easily to people's values.
Tend to be firm-minded.	Tend to be sympathetic.

WAYS OF FINDING OUT	
SENSING TYPES	INTUITIVE TYPES
Dislike new problems unless there are standard ways to solve them.	like solving new problems.
Like an established way of doing things.	Dislike doing the same thing repeatedly.
Enjoy using skills already learned more than learn new ones.	Enjoy learning a new skill more than using it.
Work more steadily, with realistic idea of how long it will take.	Work in bursts of energy. powered by enthusiasm, with slack periods between them.
Usually reach a conclusion step by step.	Reach a conclusion quickly.
Are patient with routine details.	Are impatient with routine details.
Are impatient when the details get complicated.	Are patient with complicated situations.
Are not often inspired, and rarely trust the inspiration when they are.	Follow their inspirations, good or bad.
Seldom make errors of fact.	Frequently make errors of fact.
tend to be good at precise work.	Dislike taking time for precision.

ATTITUDE TOWARD THE OUTER WORLD	
JUDGING TYPES	PERCEPTIVE TYPES
Work best when they can plan their work and follow the plan.	Adapt well to changing situations.
Like to get things settled and finished.	Do not mind leaving things open for alternatives.
May decide things too quickly.	May have trouble making decisions.
May dislike to interrupt the project they are on for a more urgent one.	May start too many projects and have difficulty in finishing them.
May not notice new things that need to be done.	May postpone unpleasant jobs.
Want only the essentials needed to begin their work.	Want to know all about a new job.
Tend to be satisfied once they reach a judgement on a thing, situation, or person.	Tend to be curious and welcome new light on a thing, situation or person.

Appendix 3
Instruction Methods

Please indicate the effectiveness of learning of the following instruction methods:

Strong = effective learning experience is achieved

Medium = less effective learning is achieved

Weak = ineffective learning experience

Instruction method	Strong	Medium	Weak
Videotape			
Lecture			
One-on-one instruction			
Role playing			
Slides			
Computer-based training			
Games/simulations			
Case studies - group			
Case studies - individual			
Self-assessment/self testing			

Appendix 4
Characteristics of Instruction Methods

In this appendix, a number of characteristics are given for the ten instruction methods. The characteristics are derived from brainstorming. Of course, one can think of more. The list is meant to create a 'feeling' for the methods to match the methods with the learning styles.

Videotape

- need equipment
- watch either alone or with a group
- watch without a teacher
- watch whenever you want
- possibility of play-back (learner controls the medium)
- not interactive
- highly visual medium, which is not an appropriate means to teach conceptual subjects
- no feedback

Lecture

- limited interaction (depending on the group size)
- social interaction with other learners
- teacher can be flexible (adjust the pace, or the method used) depending on the needs of the group
- teacher can give exercises
- appropriate to teach theories and conceptual models
- a course or lecture has to be organised, planned at a fixed date/time
- need an accommodation to hold the lecture
- more feedback

One-on-one instruction

- highly interactive
- no social interaction with other learners
- teacher can give exercises
- appropriate to teach theories and conceptual models
- feedback

Role playing

- tries to change behaviour
- stimulates creativity
- social interaction
- need an accommodation to do the role playing
- results depend on individual contribution of others
- feedback can be provided
- learners have to be actors
- the group process might interfere with the learning processes of individuals

Slides

- not interactive
- no audio
- need equipment
- need a location that can be darkened
- no feedback

CBT

- hardware is needed
- medium interactive
- results depend on the quality of the software
- learner is in control of the pace
- possibility of collecting statistics about the learner(s)
- start and stop at any time
- limited feedback
- no social interaction

Games/simulation

- either alone or in a group
- transfer from the used model to reality might be difficult
- expensive?
- no flexibility unless more games/simulations are available
- feedback
- interactive
- there has to be some kind of instruction to lean how to use the game/simulation
- there has to be some instruction about the background of the used models

Case studies - group

- social interaction
- interactive
- feedback through discussions
- group needs a location for discussions
- it must be clear what has to be learned from the case(s)
- appropriate to give the learner more feel about the subject
- the group process might interfere with the learning processes of individuals

Case studies - individual

- no social interaction
- not interactive
- no feedback
- it must be clear what has to be learned from the case(s)
- appropriate to give the learner more feel about the subject

Self-assessment

- can do it in your own time
- can do it anywhere
- not interactive
- no feedback
- cheap
- objectives (what to learn) might not be clear
- results depend on initiative (motivation) of the learner

Appendix 5
Goals and Objectives of the Handbook

The goals are specified per block as identified in ENAPS methodology, these are numbered per block. The learning objectives are stated per goal.

Training Agent and Organisation

1. After the training of the agent, he is able to give a training in the participating organisation with the help of the material in the handbook;

   - The agent is aware of all the contractual conditions, obligations and the preservation of anonymity if required. He is also aware of his obligations towards the ENAPS consortium;

   - The agent knows some basic aspects about giving training in companies, enough to give a training in the organisation;

   - The agent knows the function of the business model (terms like processes, functions and production typologies);

   - The agent can fit a randomly chosen organisation into the ENAPS business model;

   - The agent understands all performance indicators used in ENAPS;

   - The agent can calculate a randomly chosen performance indicator and retrieve the right data for it;

   - The agent knows and understands future trends in the different production typologies;

   - The agent knows who in the organisation has to be trained (and who has to be involved);

   - The agent fully understands the ENAPS methodology;

   - The agent is able to provide information about 'continuous improvement' and other improvement strategies.

2. After the training of the right persons in the participating company, by the agent, the company understands the ENAPS methodology and is able to work with it.

   - The organisation is aware of all the contractual conditions, obligations and the preservation of anonymity if required;

   - The organisation understands the ENAPS methodology;

   - The organisation knows the function of the business model (terms like processes, functions and production typologies);

   - The organisation can fit the own business structure into the business model, but also other (similar) structures;

   - The organisation knows the function of the performance indicators;

- The organisation can indicate the relevance of the performance indicators for the own situation;

- The organisation can, together with the agent, draw up its own performance indicators;

- The organisation understands the future trends in the different production typologies.

Data Gathering

1. The organisation can, together with the agent, retrieve the *right data* in the *right format* from the organisation

    - The organisation knows which data is required;

    - The organisation and the agent know in what format the data should be retrieved;

    - The organisation knows where to search for the right information;

    - The organisation can, together with the agent, make a selection of relevant performance indicators for the company;

    - The organisation can, together with the agent, make an estimate of the reliability of the gathered data. To do this, it is necessary to know what factors influence the (un)reliability.

ENAPS Database

1. The agent is able to put the data into the database;

    - The agent knows how to operate the software:

        - How to put in data;

        - How to send the data.

2. The agent can create the necessary queries from the database.

    - The agent and the organisation know what queries are possible;

    - The agent and the organisation can create their own relevant queries.

Analysis and Improvement

1. The agent is able to interpret and analyse the results in the right way;

    - The agent can compare performance differences between the organisation and the information in the database in the right way;

    - The agent can make an estimate of the reliability of the comparison;

    - The agent and the company can indicate the necessity of improvements (on the basis of relevance for the organisation).

2. The agent is able to present the results to the company in the right way;

    - The agent delivers a report according to the ENAPS guidelines of lay-out and contents.

    - The agent is, together with the company, able to formulate an improvement program.

Appendix 6
Presentation Package

The Presentation package can be found right behind this page.

It consists of:

- An introduction letter to the agents;

- An introduction letter from professor Rolstadås, to European industry;

- A Word document with information about benchmarking and ENAPS;

- A MS Powerpoint presentation.

EUROPEAN BENCHMARKING

ENAPS

esprit
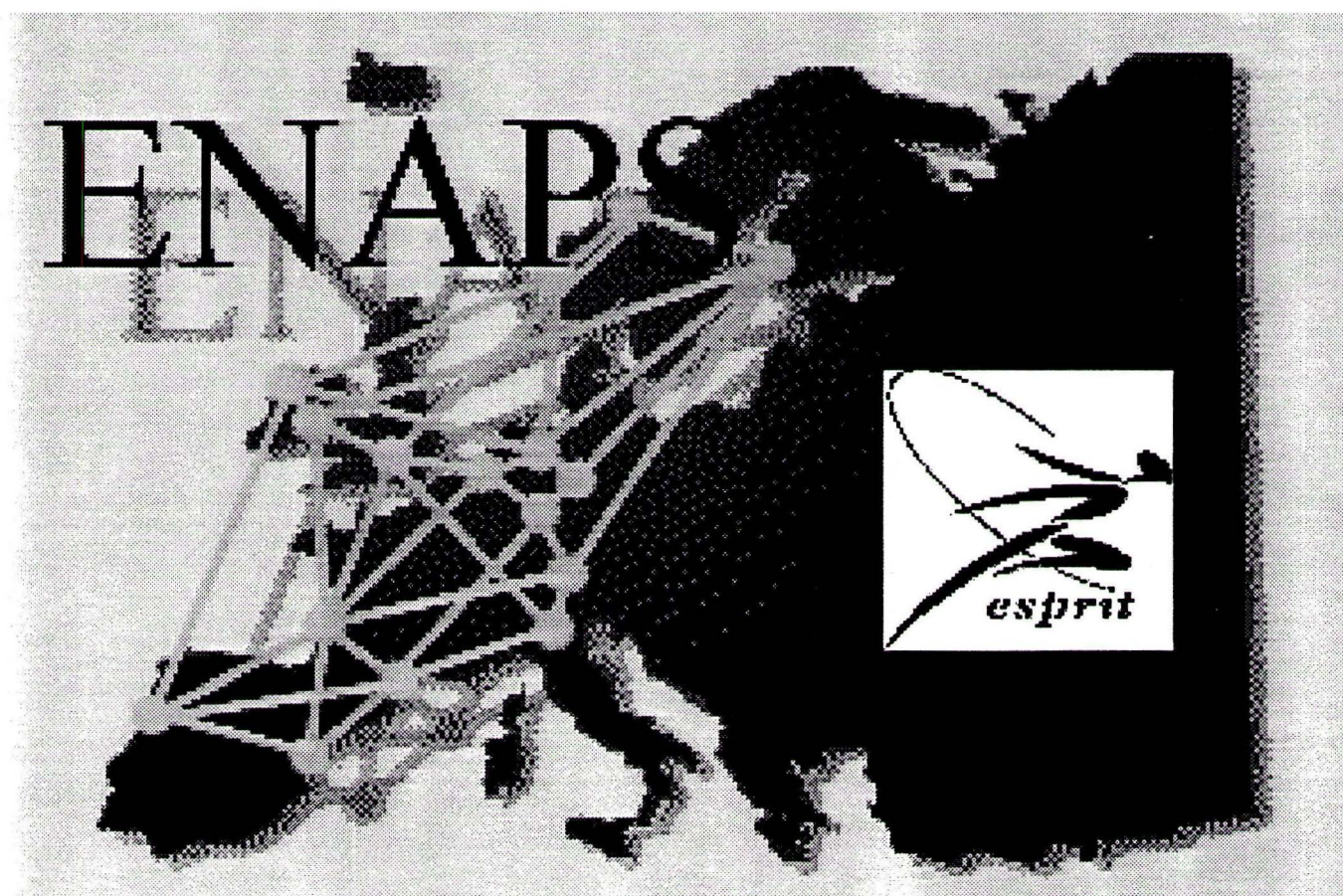
To all ENAPS agents

Dear ENAPS agent,

Hereby you receive the presentation package of ENAPS, especially for task 4-3 (filling of the database). You can use this presentation package for acquisitions for companies to be measured according to the ENAPS methodology. With the package you can hold presentations for industry and commerce.

The package consists of:

- This letter;

- Introduction letter from professor Rolstadås, already sent to you by SINTEF, but a copy is included in this package;

- A Word document that can be distributed to companies, this includes a concept contract you can use;

- A Powerpoint presentation, with which you can make slides to hold a presentation.

You are allowed to include your own company logo to the document and the presentation. We advise you to use the original letter from SINTEF. If you do not have the letter (any more) you can always contact Bjørn Andersen at SINTEF (E-mail: BJORN.ANDERSEN@PROTEK.UNIT.NO). To co-ordinate the presentation of ENAPS in all participating countries, we advise you to use this presentation material.

Hereby we repeat the agreements from the meeting in Nice (FR):

Objective

The objective of task 4-3 is to collect as much data as possible on the performance indicators and measures. In this way, the database can be filled. The agents involved in ENAPS are expected to do the measurements in at least 4 enterprises, but are welcome to do more.

This task is also used for first experimentation of the measures, performance indicators and the database. The experiences from this task can be used to improve the benchmarking method of ENAPS. Therefore your feedback is of great value.

Restrictions

In task 4-3, at least the performance indicators for the following business processes need to be measured:

- Orderfulfilment process;

- Product development process.

The unit of measurement must be an independent profit centre.

The enterprises to be measured need to come from the following NACE classification groups:

- DJ 28;
  - Manufacturing of fabricated metal products, except machinery and equipment

- DK 29;
  - Manufacture of machinery and equipment N.E.C.

- DL 30, 31, 32, 33;
    - Manufacture of office machinery and computers
    - Manufacture of electrical machinery and apparatus N.E.C.
    - Manufacture of radio, television and communication equipment and apparatus
    - Manufacture of medical, precision and optical instruments, watches and clocks
- DM 34, 35;
    - Manufacture of motor vehicles, trailers and semi trailers
    - Manufacture of other transport equipment

A more detailed description of the sectors is given in the Annex at the end of this document

Due dates

- April 5, 1997

    The agents are expected to have completed measurements and filled in the data in the database of at least one enterprise. They should report their experiences with the measures, the PI's and the database software, so further for improvement of these can be taken.

- April 17, 1997

    A training session for the agents involves in task 4-2 will be held in Bremen. The agents will be trained on the basis of the first experiences with the measurement method. We hope to see you all.

You will receive this presentation package by E-mail, mail, also on diskette. It will also be published on the ENAPS FTP-server. **HTTP://RexeLucg.ie/projects/enaps.htm**

If you have any remarks, suggestions to improve this presentation material, please let us know. you can contact us on the address on the bottom of this page.

We wish you good luck with the measurements and hope to see as much of you all in Bremen.

Sincerely yours,

Dennis Drieling, Peter Gijben

For Technical University Eindhoven,

Dennis Drieling, Peter Gijben

IPL-TNO
De Run 1150
5503LA Veldhoven
The Netherlands
Tel: +31 (0)40 230 93 00
Fax: +31 (0)40230 93 11
E-mail: DRI@IPL.NL or GYB@IPL.NL

Annex

Sectors included in ENAPS Measurements

Division	Group	Description
Subsection DJ		MANUFACTURE OF BASIC METALS AND FABRICATED METAL PRODUCTS
	28	MANUFACTURE OF FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT
	28.1	Manufacture of structural metal products
	28.2	Manufacture of tanks, reservoirs and containers of metal; manufacture of central heating radiators and boilers
	28.3	Manufacture of steam generators, except central heating hot water boilers
	28.4	Forging, pressing, stamping and roll forming of metal; powder metallurgy
	28.5	Treatment and coating of metals; general mechanical engineering
	28.6	Manufacture of cutlery, tools and general hardware
	28.7	Manufacture of other fabricated metal products
Subsection DK		MANUFACTURE OF MACHINERY AND EQUIPMENT N.E.C.
	29	MANUFACTURE OF MACHINERY AND EQUIPMENT N.E.C.
	29.1	Manufacture of machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines
	29.2	Manufacture of other general purpose machinery
	29.3	Manufacture of agricultural and forestry machinery
	29.4	Manufacture of machine-tools
	29.5	Manufacture of other special purpose machinery
	29.6	Manufacture of weapons and ammunition
	29.7	Manufacture of domestic appliances n.e.c.
Subsection DL		MANUFACTURE OF ELECTRICAL MACHINERY AND OPTICAL EQUIPMENT
	30	MANUFACTURE OF OFFICE MACHINERY AND COMPUTERS
	31	MANUFACTURE OF ELECTRICAL MACHINERY AND APPARATUS N.E.C.
	31.1	Manufacture of electric motors, generators and transformers
	31.2	Manufacture of electricity distribution and control apparatus
	31.3	Manufacture of insulated wire and cable
	31.4	Manufacture of accumulators, primary cells and primary batteries
	31.5	Manufacture of lighting equipment and electric lamps
	31.6	Manufacture of electrical equipment n.e.c.
	32	MANUFACTURE OF RADIO, TELEVISION AND COMMUNICATION EQUIPMENT AND APPARATUS
	32.1	Manufacture of electronic valves and tubes and other electronic components
	32.2	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
	32.3	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods

Division	Group	Description
	33	MANUFACTURE OF MEDICAL, PRECISION AND OPTICAL INSTRUMENTS, WATCHES AND CLOCKS
	33.1	Manufacture of medical and surgical equipment and orthopaedic appliances
	33.2	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment
	33.3	Manufacture of industrial process control equipment
	33.4	Manufacture of optical instruments and photographic equipment
	33.5	Manufacture of watches and clocks
Subsection DM		MANUFACTURE OF TRANSPORT EQUIPMENT
	34	MANUFACTURE OF MOTOR VEHICLES, TRAILERS AND SEMI TRAILERS
	34.1	Manufacture of motor vehicles
	34.2	Manufacture of bodies (coachwork) for motor vehicles, manufacture of trailers and semi trailers
	34.3	Manufacture of parts and accessories for motor vehicles and their engines
	35	MANUFACTURE OF OTHER TRANSPORT EQUIPMENT
	35.1	Building and repairing of ships and boats
	35.2	Manufacture of railway and tramway locomotives and rolling stock
	35.3	Manufacture of aircraft and spacecraft
	35.4	Manufacture of motorcycles and bicycles
	35.5	Manufacture of other transport equipment n.e.c.

The ENAPS Benchmarking Method

Performance Improvement through Performance Measurement

European Network for Advanced Performance Studies

The ENAPS project

What is ENAPS

ENAPS stands for European Network of Advanced Performance Studies. ENAPS is an Esprit research project. The Esprit programme is initiated by the European Community to provide European industry with a competitive advantage by means of information technology. The EC funds the research projects that contribute to this. The ENAPS project started in December 1995 and will last for 30 months.

The objective of ENAPS is knowledge transfer

The objective of ENAPS is to collect and transfer knowledge about 'best practices' within the European industry. To enable this, a network is established by leading industry and academic partners covering almost all of the countries in the European Union and the European Economic Area. The nodes of the network in the countries are referred to as agents.

The academic partners are: SINTEF (Norway), CIMRU (Ireland), BIBA (Germany), GRAI/LAP (France) and TUE (The Netherlands). These are also some industrial partners. The agents (mostly consultants) play an important role within ENAPS. They are the intermediates between ENAPS and the organisations who want to participate in benchmarking. In Figure 1, the relationships between the EC, European industry and partners in ENAPS is visualised.

ENAPS is an EC funded ESPRIT project

In Figure 1, the relationships between the EC, European industry and partners in ENAPS are visualised. The European Committee plays a role in the project by means of funding. But they also have requirements for management. Also conditions and law influence the possibilities and outcome of the project. The overall aim is to improve European industry by supplying methods and tools (like performance indicators, benchmarks, etc.). Feedback comes from industry when these tools are tested (by means of performance data, knowledge transfer, best practices, etc.).

Figure 1 The relationships between the EC, European industry and partners in ENAPS

By means of a benchmark model, competences and 'best practices' of European industry are collected. The network consists also of larger organisations but aims at knowledge transfer to small and medium sized enterprises (SME's). By means of the benchmark model performances of participating enterprises are measured and put into a central database. This offers organisations the possibility to compare their own performance with that of others and learn from the 'best' practices.

What is Benchmarking

ENAPS wants to initiate a continuous improvement process in the enterprises. To do this, it is necessary to compare the own performance with others on a regular basis. ENAPS has defined its areas of performance measurement. Therefore a suitable definition for benchmarking would be:

> *Benchmarking is a continuous and systematical process to compare the own performance with that of companies and organisations that represent 'the best' performance.*

So benchmarking is the continuous use of a collection of performance indicators that measure the performance of several activities of the enterprise. A performance indicator is a variable that gives the performance of a process, system or a part of that, by comparison with a given norm. The goal of this performance measurement is to improve the organisation on the areas that do not perform as well as they should. By continuously measuring and comparing the performance, a process of continuous improvement is initiated. Also by continuously measuring performance, trends in internal and external developments can be recognised. By better understanding of the world surrounding the enterprise, the enterprise is able to anticipate to developments taking place.

The Role of the Agent

The agent is the intermediate between ENAPS and European industry

During the development of the ENAPS benchmarking method, the agents are already involved. Agents are mostly consultant agencies that function as an intermediate between European industry and ENAPS. They are they only ones to have access to the ENAPS database. This has several reasons:

- They have contact with industry and industry itself is more likely to approach one of the agents for business improvement than they would approach academic institutions.

- Another advantage is that during the development of the method, they look at it from a practical point of view. They are more suited to judge the methodology from its practical use.

- Further more is anonymity more likely to be preserved if the agents are the only ones to have access to the database.

- One other important aspect is that the data that is entered in the database is more reliable. Because the agents know how to interpret the performance indicators en they know how to retrieve reliable data from the enterprises.

How will the agent support you in the process of benchmarking

The agents knows what information is required for the calculation of the performance indicators. He knows how to interpret the performance indicators and therefore the reliability of the data is preserved. He will guide you in the process of data retrieval. The agent will enter the data into the ENAPS database. Of course, anonymity is guaranteed on request. The agent can make relevant queries in the database to find data with which you can compare the performance of your company. With the help of the experience of the agent, he can search with you for opportunities to improve your business processes.

The Methodology

The Benchmarking Wheel

Improve

8 Implement Improvement

7 Plan Improvement

Plan

1 Determine the process

2 Document the process

3 Measure performance

Analyze

6 Identify gaps
  in performance

Find

4 Identify benchmarking
  partners

Collect

5 Understand and
  document partners'
  performance
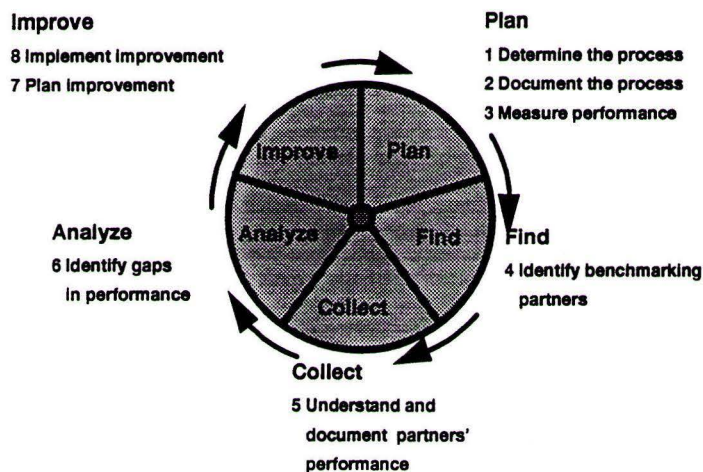
Figure 2 The benchmarking wheel

The steps to follow in general benchmarking

Figure 2 shows five steps that can be followed in a general benchmarking process. This process assumes that benchmarking finds place with a benchmarking partner. That partner is a similar company in the same sector, or a company from a different sector, but which has a similar process that can be compared.

ENAPS is different, because it uses operational, quantitative performance indicators

The ENAPS methodology is different from other benchmarking methods, because benchmarking is done via information in a database. Measurements from enterprises all over Europe will be collected in a central database. Then one does not have to search for the right partner. One can just search in the database. Of course benchmarking partners can also be found via the database, but that is not the main goal of ENAPS.

A central database in Europe
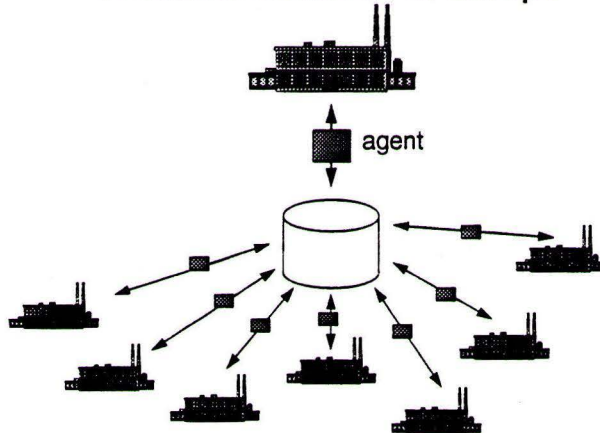
Figure 3 There are agents all over Europe

To put information into a database, it is required that all performance indicators (ratio's) are based on quantitative instead of qualitative data. So you do not have to fill in a long questionnaire that gives you a one time snapshot of the performance of your enterprise. The use of operational, quantitative performance indicators enables you to keep using the performance indicators to monitor the performance of your business processes even when the benchmarking process is finished. You can periodically (monthly, quarterly or yearly) compare your performance with information in the database.

The steps to follow with ENAPS benchmarking

The steps of the benchmarking wheel are defined as following:

Plan	Fit the organisation in the ENAPS Business Model Determine the process(es) to benchmark Measure the performance of that process(es)
Find	Put ratio's from the measurements in the database Make relevant queries in the database Retrieve information from the database
Collect	Understand and document the 'best practice' in the field
Analyse	Identify gaps in performance and the root causes for the gaps Identify possibilities and needs for performance improvement
Improve	Plan the implementation of improvements Implement improvements and monitor the implementation progress

These steps are explained more detailed in the following paragraphs.

Plan

To make a useful comparison between different enterprises possible, they have to be fit in the ENAPS Business Model. The enterprises will be fit into a typology on the basis of similar characteristics. In this way similar enterprises can be compared. But also similar processes from different kinds of enterprises.

The process or processes that the enterprise wants to measure has to be selected. These have to be compatible with the processes as defined in the ENAPS Business Model. All the people involved in the gathering of the data have to be involved in the benchmarking process. A benchmarking team can be formed. That team should consist of members from all the processes involved. They understand these processes as no one else. Also results or improvements are probably better accepted if the team introduces them.

Then the actual measurement starts. The right data has to be gathered for the specific performance indicators for that process(es). If all the data is gathered, ratio's can be calculated which have to be put into the database. Anonymity is preserved of course.

Find

This phase involves all the communication with the database. In the preceding phase, all the ratio's are calculated. These ratio's now have to be put into the database. The agent is the only one who has access to the ENAPS database. He has to fill in the electronic questionnaire which then is sent to the ENAPS database. This is done via the internet or via a floppy disk.

The agent and the participating company can design queries for the database. The output of these queries can be used for the comparison of performance. The agent knows which queries are possible. He must, in co-operation with the organisation, create some relevant queries for that specific organisation.

After the agent has put in all the data and created the queries, he retrieves all the necessary information from the ENAPS database.

Collect

All the information from the ENAPS database is now complete. In the information the description of the 'best practice' in the processes selected and the specified typology is given. It is important to understand the 'best practice' and also the individual differences of the enterprises involved which may attribute to the differences in performance. No organisation is identical.

Analyse

Now the own performance is compared with the best and average practices in the industry. It is important to understand why there is a performance gap. There could be differences in approaches to customers or other companies aim at another part of the market. If one knows why there is a performance gap, one can identify the need for improvement. This should be related to the individual circumstances of the organisation. The agent plays an important role in this process. He was involved in the benchmarking process of this individual enterprise, so he is most qualified to advise the enterprise on improvements to be made. The ENAPS consortium can not make a general improvement handbook for all enterprises. It can only give guidelines for the analysis.

Improve

Once the areas where improvements are needed are identified, the agent can together with the enterprise design an improvement plan. Improvements can then be planned and executed. This is a task for the agent and enterprise themselves. By going through the cycle again, improvements can actually be measured. A process of continuous improvement can be initiated.

What Enterprises can Participate

Right now, we are selective in the enterprises that can participate in the benchmarking process. Due to the fact that we have to start up filling the database with information, it is better to select a number of sectors for the time being.

The participating companies have to be an independent profit centre in one of the following sectors:

- Manufacturing of fabricated metal products
- Manufacture of machinery and equipment N.E.C.
- Manufacture of office machinery and computers
- Manufacture of electrical machinery and apparatus N.E.C.
- Manufacture of radio, television and communication equipment and apparatus
- Manufacture of medical, precision and optical instruments, watches and clocks
- Manufacture of motor vehicles, trailers and semi trailers
- Manufacture of other transport equipment

In the Annex at the end of this document you can find a more detailed description of the sectors that can participate in the measurements at this moment.

What is Measured

ENAPS makes a distinction between Business Processes and Secondary processes. All the performance indicators that are used, measure the performance of these processes.

On the next page you can see which processes are included in the ENAPS becnhmarking method (Figure 4).

Business Processes

Product Development
- Product Research
- Product Engineering and Design
- Process Engineering and Design
- Co-Engineering

Obtaining Customer Commitment
- Market Development
- Marketing
- Tendering

Order Fulfilment
- Order Processing
- Production Planning and Control
- Procurement and Inbound Logistics
- Manufactuting and Assembly
- Distribution and outbound Logistics
- Invoicing and Payment

Customer Service
- After-sales Service
- Product takeback

Secondary Processes

Support
- Financial Management
- Human Resource Management
- Information management
- Maintenance
- Internal Control of Health, Environment and Safety

Evolution
- Continuous Business Process Improvement
- Production Technology Research
- Human resource Development
- Supplier Base Development
- Development of External Relations
- Strategic Planning

Figure 4 Business Processes and Secondary processes in ENAPS

Emphasis at this moment lies in filling the database as soon as possible. Therefore the number of processes that are measured in 1997 are limited to the Product Development and Order Fulfilment processes.

In every process, several Performance Indicators are defined. The performance Indicators try to measure several dimensions:

- Time;
- Cost;
- Quality;
- Flexibility;
- Environment.

What can We Offer You

At this moment ENAPS is still under development. The stage we are in right now is the data collection to fill the database. Therefore we are looking for enterprises that want to see their performance measured and compared with other European enterprises.

Measurements are starting in over 100 European enterprises at this moment. Now you can compare yourself with those companies. And in the future with far more enterprises. As time is passing, more and more information is coming available.

The measurements with the performance indicators can help you to locate strong and weak spots in your enterprise. Also searching for the right information helps to check the information flow in your organisation. Continuously measuring enables you to monitor the performance of your business processes.

Measuring the performance of the business processes helps to get your people more involved. They get more interested and they can identify the factors that influence the performance. But they can identify also interdependencies of different departments.

By periodically comparing your own performance with that of other companies in Europe, enables you to take an external view at the world.

Agreement on Confidentiality

On the next page, a contract is included. The method and all the information in this project is confidential. Therefore, if you participate in this benchmarking method, we want you to sign a confidentiality agreement.
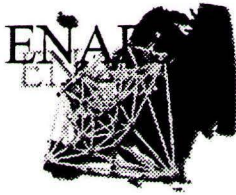
European Network for Advanced Performance Studies

Client Data Contribution Agreement - ESPRIT Project No. 20888 ENAPS

The client noted below states his commitment for the ESPRIT project No. 20888 ENAPS.

The client agrees to contributing performance measures for the calculation of Performance Indicators for the processes of Order Fulfilment and/or Product Development as described in the ENAPS methodology. The client gives ENAPS the right to store the data in the ENAPS Database. The performance measures are collected from the client for calculation of Performance Indicators through use of the ENAPS Electronic Questionnaire by or under the guidance of the agent. It is the responsibility of the ENAPS Agent to submit the Performance Indicators to the ENAPS Database.

The performance measures and resulting Performance Indicators contributed by the client will be treated confidentially by ENAPS. To ensure confidentiality, queries into the data contributed by the client will only be allowed on a confidential basis and in cases where the specified query returns data from at least three enterprises. If the client wishes to do so, the data may also be contributed on an open basis, i.e., giving ENAPS the rights to store the data with the enterprise name attached and returned with the data in queries.

In return for contributing data, the client is given the right to perform queries into the ENAPS Database through the Agent.

ENAPS is still in the development phase, thus this contract expires December 31st 1997, and will replaced by a modified version. The client will maintain its rights to query the ENAPS until the end of the ENAPS funded period in June 1998. Further use of the ENAPS Database for regular operation will be specified by June 15th 1997 and will be integrated into a final client contract.

Signature field

Client Organisation

Agent Organisation

_____

_____

Name _____

Name _____

Position _____

Position _____

Date _____

Date _____

Signature _____

Signature _____

Annex

Sectors included in ENAPS Measurements

Division	Group	Description
Division	*Group*	*Description*
Subsection DJ		MANUFACTURE OF BASIC METALS AND FABRICATED METAL PRODUCTS
	28	MANUFACTURE OF FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT
	28.1	Manufacture of structural metal products
	28.2	Manufacture of tanks, reservoirs and containers of metal; manufacture of central heating radiators and boilers
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	28.7	Manufacture of other fabricated metal products
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	29	MANUFACTURE OF MACHINERY AND EQUIPMENT N.E.C.
	29.1	Manufacture of machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines
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	29.3	Manufacture of agricultural and forestry machinery
	29.4	Manufacture of machine-tools
	29.5	Manufacture of other special purpose machinery
	29.6	Manufacture of weapons and ammunition
	29.7	Manufacture of domestic appliances n.e.c.
Subsection DL		MANUFACTURE OF ELECTRICAL MACHINERY AND OPTICAL EQUIPMENT
	30	MANUFACTURE OF OFFICE MACHINERY AND COMPUTERS
	31	MANUFACTURE OF ELECTRICAL MACHINERY AND APPARATUS N.E.C.
	31.1	Manufacture of electric motors, generators and transformers
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	32.3	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods

Division	Group	Description
	33	MANUFACTURE OF MEDICAL, PRECISION AND OPTICAL INSTRUMENTS, WATCHES AND CLOCKS
	33.1	Manufacture of medical and surgical equipment and orthopaedic appliances
	33.2	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purpose except industrial process control equipment
	33.3	Manufacture of industrial process control equipment
	33.4	Manufacture of optical instruments and photographic equipment
	33.5	Manufacture of watches and clocks
Subsection DM		MANUFACTURE OF TRANSPORT EQUIPMENT
	34	MANUFACTURE OF MOTOR VEHICLES, TRAILERS AND SEMI TRAILERS
	34.1	Manufacture of motor vehicles
	34.2	Manufacture of bodies (coachwork) for motor vehicles, manufacture of trailers and semi trailers
	34.3	Manufacture of parts and accessories for motor vehicles and their engines
	35	MANUFACTURE OF OTHER TRANSPORT EQUIPMENT
	35.1	Building and repairing of ships and boats
	35.2	Manufacture of railway and tramway locomotives and rolling stock
	35.3	Manufacture of aircraft and spacecraft
	35.4	Manufacture of motorcycles and bicycles
	35.5	Manufacture of other transport equipment n.e.c.

ENAPS Benchmarking
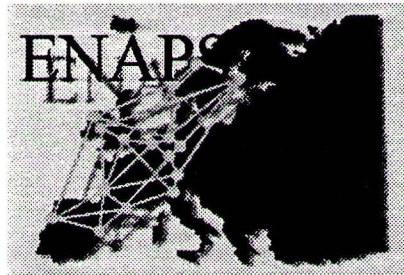
Performance improvement through performance measurement

Trends

- Move to the *information society*
- The *globalisation* of the market place
- Growing demand for *customised solutions*
- Increasing importance of the *environment*

Take an *external* view

What is benchmarking

Benchmarking is a continuous and systematical process to compare the own performance with that of enterprises and organisations that represent the 'best' performance

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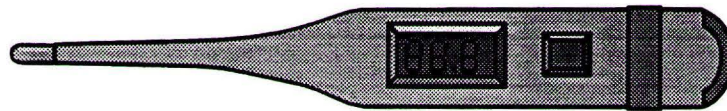
The ENAPS consortium

- Academic partners:
  - SINTEF (Norway)
  - CIMRU (Ireland)
  - TUE (The Netherlands)
  - BIBA (Germany)
  - GRAI (France)

- Industrial partners:
  - TBL (Norway)
  - AMT (Ireland)
  - ITC (The Netherlands)
  - Volkswagen (Germany)
  - AUGRAI (France)

- Agents (25 consultant agencies from 17 countries)

A central database in Europe

agent
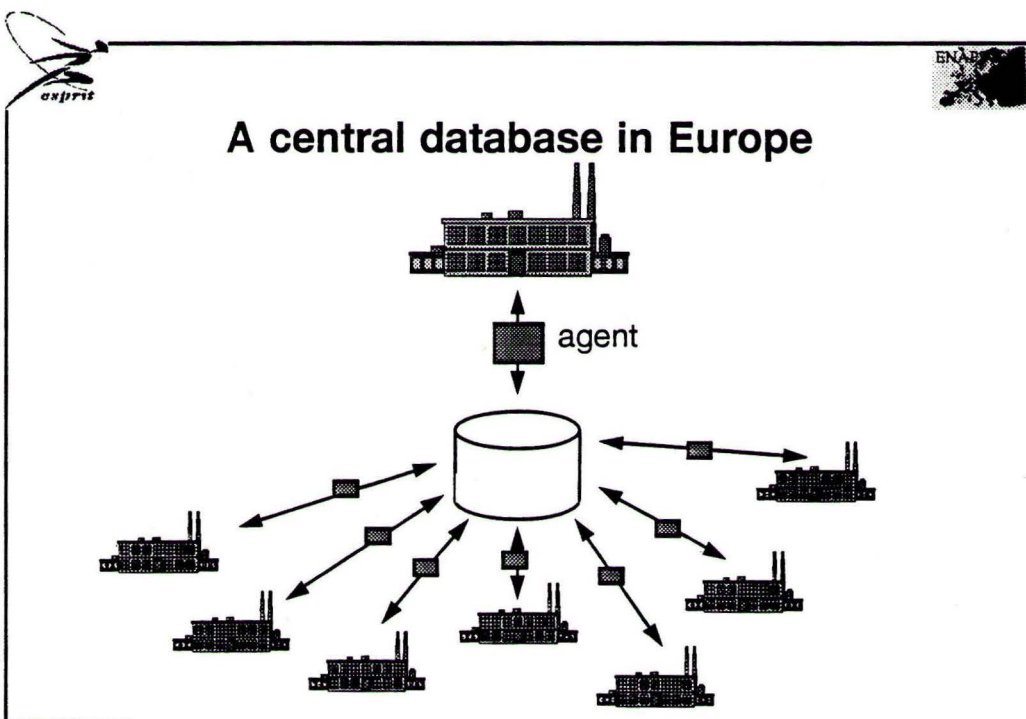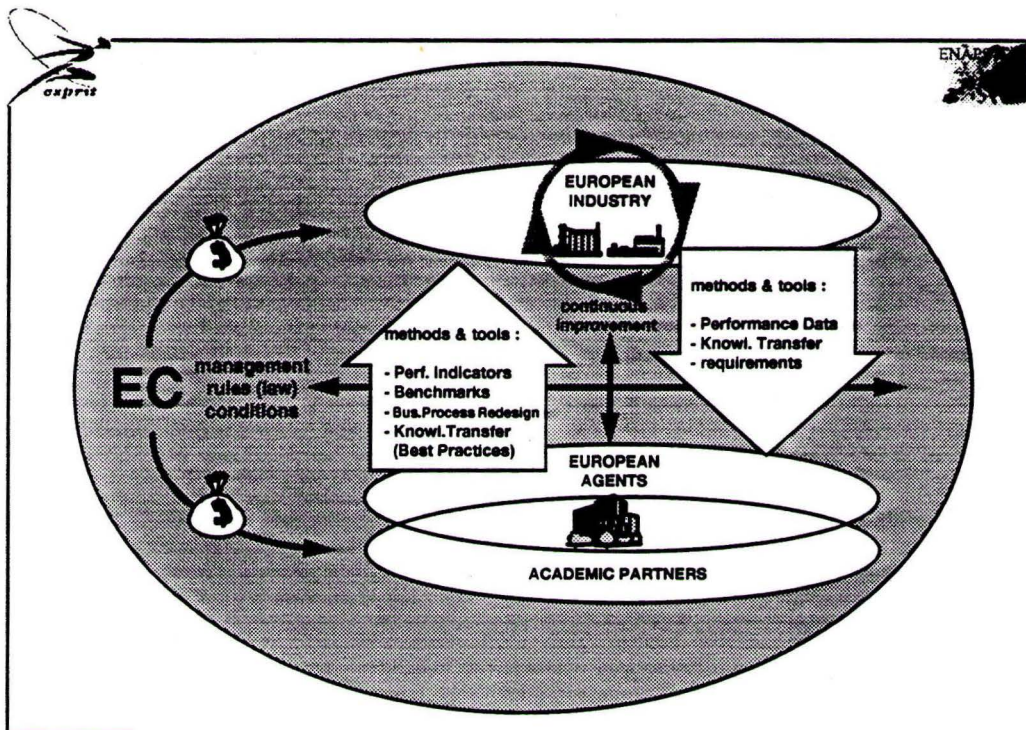
PI's that measure business processes

CONCEPT	PRODUCT DEVELOPMENT	LAUNCH
MARKET-ANALYSIS	OBTAINING CUSTOMER COMMITMENT	SALES
ORDER	ORDER FULFILMENT	PAYMENT
DELIVERY	CUSTOMER SERVICE	OUT-OF-USE

SUPPORT

EVOLUTION

Performance Indicators

Business process functions

BUSINESS PROCESSES

PRODUCT DEVELOPMENT
- Product Research *
- Product Engineering and design
- Process Engineering and design
- Co-engineering

OBTAINING CUSTOMER COMMITMENT
- Market Development (Analysis?)
- Marketing and Sales
- Tendering

ORDER FULFILMENT
- Procurement and inbound logistics
- Production planning & control
- Manufacturing and assembly
- Distribution and outbound logistics
- Order processing

CUSTOMER SERVICE
- After sales-service
- Product take back

SECONDARY PROCESSES

SUPPORT
- Financial management
- Human resource management
- Information management
- Maintenance
- Internal control of health, environment and safety

EVOLUTION
- Continuous business process improvement
- Product research *
- Production technology research
- Human resource development
- Supplier base development
- Development of external relations
- Strategic Planning

* It is possible for a function to belong in more than one process.

The ENAPS benchmarking wheel

Improve

10 Plan the implementation
   of improvements

11 Implement and monitor
   improvements

Plan

1 Fit organisation in business model

2 Determine the process(es) to benchmark

3 Measure performance of that processes

Analyze

8 Identify gaps
  in performance

9 Identify possibilities
  and needs for
  improvement

Find

4 Put ratios from PI's in the database

5 Make relevant queries in the database

6 Retreive information from the database

Collect

7 Understand and
  document best practice
  in the field

(Wheel diagram with segments: Improve, Plan, Analyze, Find, Collect)

How does it work

- Measure the performance of the business processes with *operational, quantitative performance indicators*
- Store the data in the ENAPS database and retreive relevant comparison data
- Analyse differences in performance with the 'best in class'
- Start improvement process
- Measure again to show difference

The role of the agent

- He knows the performance indicators
- He is the only one to have access to the database
- He preserves the integrity and reliability of the data
- He preserves anonimity
- He supports the enterprise with performance improvement

Where are we now?

- To benchmark we need data
- Right now, there is not enough data to benchmark
- So why would you participate?

What can we offer you now?

What does ENAPS offer you

- Your position as to European industry
- Locate your weak and your strong spots
- Get people more involved in the business processes
- Identify trends in production
- Use the PI's for performance management
- An external view at the world

Measure to get data

- We need to measure the performance of as many enterprises as possible to fill the database
- We can show your position within European industry
- Total sample size in 1997: approx. 100 enterprises
- Anonimous data
- During 1997, focus on:
  - *order fulfilment process*
  - *product development process*

Appendix 7
The Preliminary Handbook
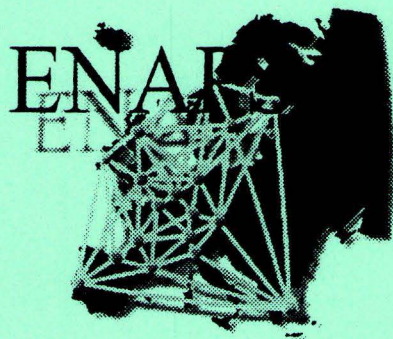
European
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The ENAPS Handbook
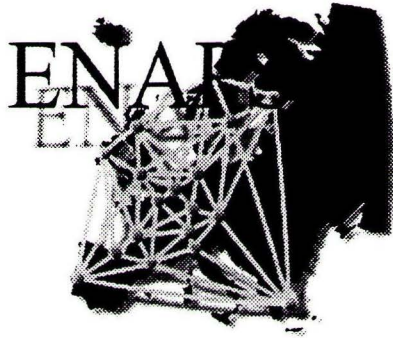
A Preliminary Version of the ENAPS Handbook

**European
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The ENAPS Handbook

A Preliminary Version of the ENAPS Handbook

Introduction

The Complete ENAPS handbook will consist of different materials and may be produced in different media then paper. Though there is a need for a 'paper handbook' as a reference, since it is easier to use as a reference, then it would be in a digital form.

The agents also let the ENAPS consortium know that there was a need for a handbook or guidelines earlier than planned in the project. Therefore this preliminary handbook is created. It is not yet a complete handbook, since the database, the performance indicators and the electronic questionnaire are still under development. As soon as each part is finished, it will be included in the handbook.

This preliminary handbook gives the agent (or anyone else) an insight in the ENAPS consortium and benchmarking. It describes the business model that underlies the performance indicators. Further it gives the agent guidelines in how to conduct a benchmarking study. Improvement techniques like Total Quality Management and Business Process Reengineering are described.

This preliminary handbook was created with the help of Stine Randmal of SINTEF and Jan Rijnen from TUE, for which we wish to thank them.

Reader's Guide

The handbook so far consists of separate documents that handle a separate subject. In every document there is a reader's guide that states:

- who the document is written for;

- what the document is about;

- what fore-knowledge is required (and what documents to read for that).

Also a short summary of the document is given. So you can see if you have already read the document or you already have enough knowledge about the subject so you can decide to skip the document.

Right now, the following documents are available:

1 Introduction to ENAPS Benchmarking

What is Benchmarking and What is ENAPS

2 The Business Model in ENAPS

An explanation of the Business Model which is a basis for the performance indicators

3 The ENAPS Methodology

A Description of the Methodology Used in ENAPS

4 Benchmarking Teams

How to Deal with Teams in Benchmarking

5 Business Process Reengineering

BPR as an Improvement Technique to be Used with Benchmarking

6 Total Quality Management

TQM as an Improvement Technique to be Used with Benchmarking

It is advised to read the documents in the following order:

```
┌───┐
│ 1 │
└───┘
  │
  ▼
┌───┐
│ 2 │
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│ 4 │
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│ 5 │◄───►│ 6 │
└───┘     └───┘
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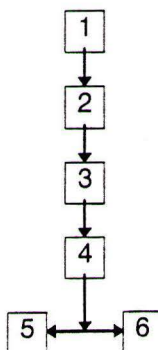
Work in Progress

As mentioned earlier, then handbook is not complete yet. Several documents are still under development. These are for example:

- Explanation of the measure and performance indicators

- Manual for the electronic questionnaire

- Manual for the ENAPS database software

- Manual for the ENAPS benchmarking tools

- How to conduct Analysis in benchmarking

- ...

As soon as these documents are finished, they will be published.

Your Contribution

We would like to get feedback from you about these documents. If you think something is incomplete, or you have a need for a document that is not yet mentioned, or have any other comments, please let us know. For this, contact:

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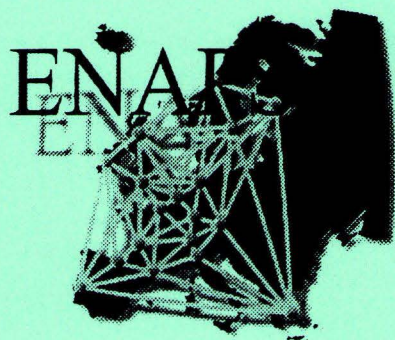
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Introduction to ENAPS Benchmarking

What is Benchmarking and What is ENAPS
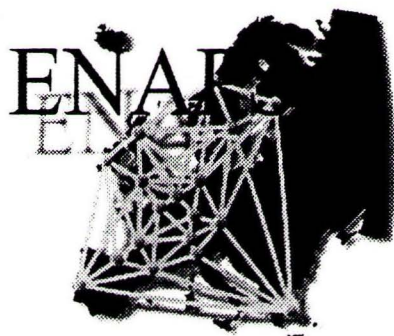
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Introduction to ENAPS Benchmarking

What is Benchmarking and What is ENAPS

Reader's Guide

Who Should Read This Document

This document is written for those agents who are unfamiliar with the ENAPS project. The document is meant for agents that want to participate in the Network for Advanced Performance Studies and have very little foreknowledge about the project.

People that just want to fresh up their knowledge are of course welcome to read this writing.

Purpose of This Document

The document gives information about the ENAPS project, benchmarking in general and the method used in ENAPS. The role of the agent is described as well as the benefits for your client.

Required Fore-knowledge

None.

Summary

ENAPS stands for European Network for Advanced Performance Studies. ENAPS is an ESPRIT project, funded by the European Community. The project consists of partners (universities) and agents (mostly consultants). The goal is to set up a network of partners and agents and to set up a database for benchmarking and performance measurement.

Benchmarking is a continuous and systematically process to compare the own performance with that of companies and organisations that represent 'the best' performance. The ENAPS project creates operational performance indicators to measure performance of an enterprise that can be compared to other European enterprises.

The agents are the intermediates between European Industry and the ENAPS consortium. They are the only ones to have access to the ENAPS database, for security reasons.

The ENAPS methodology helps to find strong and weak spots in your clients enterprise. Comparing performance with others helps to monitor progress in performance. Measuring performance gets employees more involved. They can identify factors that influence the level of performance.

Contents

The ENAPS project

What is ENAPS

The European Network for Advanced Performance Studies, ENAPS, is a project funded by the European Commission to set up a permanent network and database for benchmarking and performance measurement. Work has been performed to produce a framework of business processes and corresponding performance indicators, as well as the structure for a benchmarking database and communication with it. The ultimate goal of ENAPS is to help European enterprises improve through benchmarking and business process improvement.

ENAPS is organised with Partners and Agents. The 23 Agents, who are present in most European countries, will constitute the permanent network once regular operation starts. All contact between client enterprises and ENAPS will take place locally through the Agents, who will form the link to the ENAPS database. In addition, ENAPS Agents can also provide follow-up services to further aid the improvement efforts of the client.

By means of a benchmark model, competence and 'best practices' of European industry are collected. The network consists also of larger organisations but aims at knowledge transfer to small and medium sized enterprises (SME's). By means of the benchmark model performances of participating enterprises are measured and put into a central database. This offers the possibility to compare their own performance with that of others and learn from the 'best' practices.

The future success of ENAPS is depending on the Partners and Agents ability to launch the services based on an already extensive benchmarking database. This database will have to be build up in the funded period, i.e. before June 98.

How does ENAPS work

The benchmarking is done by the uses of Performance Indicators (PI's). A PI is a variable indicating the effectiveness and/or efficiency of a part or whole of the process or system against a given norm/target or plan. To calculate the PI's ENAPS use measurements. All together there are 95 indicators based on 111 measures. The collection and retrieval of these data is done by the agents. Each agent has the choice to offer further services to the client enterprises.

The objective of ENAPS is knowledge transfer

The objective of ENAPS is to collect and transfer knowledge about 'best practices' within the European industry. To enable this, a network is established by leading industry and academic partners covering almost all of the countries in the European Union and the European Economic Area. The agents are represented in the network are referred to as nodes.

The academic partners are: SINTEF (Norway), CIMRU (Ireland), BIBA (Germany), GRAI/LAP (France) and TUE (The Netherlands). These are also some industrial partners who have a more active role in the development of ENAPS than the other agents. The

agents (mostly consultants) play an important role within ENAPS. They are the intermediates between ENAPS and the organisations who want to participate in benchmarking.

ENAPS is an EC funded ESPRIT project

ENAPS is an Esprit research project. The Esprit program is initiated by the European Community to provide European industry with a competitive advantage by means of information technology. The EC funds the research projects that contribute to this.

The EC plays an important role in the project by means of funding the development and testing of ENAPS. But they also have requirements for management. Also conditions and law influence the possibilities and outcome of the project. The overall aim of ENAPS is to improve European industry by supplying methods and tools (like performance indicators, benchmarks, etc.). Feedback comes from industry when these tools are tested (by means of performance data, knowledge transfer, best practices, etc.).

The ENAPS project started in December 1995 and will last for 30 months.

What is Benchmarking

ENAPS wants to initiate a continuous improvement process in the enterprises. To do this, it is necessary to compare the own performance with others on a regular basis. ENAPS has defined its areas of performance measurement. Therefore a suitable definition for benchmarking would be:

> *Benchmarking is a continuous and systematically process to compare the own performance with that of companies and organisations that represent 'the best' performance.*

So benchmarking is the continuous use of a collection of performance indicators that measure the performance of several activities of the enterprise. A performance indicator is a variable that gives the performance of a process, system or a part of that, by comparison with a given norm. The goal of this performance measurement is to improve the organisation on the areas that do not perform as well as they should. By continuously measuring and comparing the performance, a process of continuous improvement is initiated. Also by continuously measuring performance, trends in internal and external developments can be recognised. By better understanding of the world surrounding the enterprise, the enterprise is able to anticipate to developments taking place.

The most obvious reason to go through a benchmarking process is improvement in quality and productivity. Which in turn will give increased profit, motivation and creativity in the enterprise.

The Role of the Agent

The agent is the intermediate between ENAPS and European industry

The agents have been involved during the whole development of the ENAPS benchmarking method. Agents are mostly consultant agencies that function as an intermediate between European industry and ENAPS. They are the only ones to have access to the ENAPS database. This has several reasons:

- The agents have contact with industry and industry itself is more likely to approach one of the agents for business improvement than they would approach academic institutions.

- They are more suited to judge the methodology from its practical use, than the academic partners. During the development of the method, they look at it from a practical point of view.

- The anonymity will be preserved if the agents are the only ones to have access to the database.

- The data that is entered in the database will be reliable. Because the agents will have the knowledge to interpret the performance indicators and know how to retrieve reliable data from the enterprises. The agents will have the required information for the calculation of the performance indicators. They know how to interpret the performance indicators and therefore the reliability of the data is preserved.

The agent will guide the clients in the process of data retrieval, as well as entering the data into the ENAPS database. The agent can make relevant queries in the database to find data with which the client can compare the performance of the client enterprise. With the help and the experience of a agent, the client can search for opportunities to improve the business processes.

Methodology: The Benchmarking Wheel

Improve
8 Implement improvement
7 Plan improvement

Plan
1 Determine the process
2 Document the process
3 Measure performance

Analyze
6 Identify gaps
In performance

Find
4 Identify benchmarking
partners

Collect
5 Understand and
document partners'
performance

Figure 1 The benchmarking wheel

The steps to follow in general benchmarking

Figure 1 shows five steps that can be followed in a general benchmarking process. This process assumes that benchmarking finds place with a benchmarking partner. That partner can either be a similar company in the same sector, or a company from a different sector, but which has a similar process that can be compared.

The ENAPS methodology is different from other benchmarking methods, because benchmarking is done via information in a database. Measurements from enterprises all over Europe will be collected in a central database. Then the client does not have to search for the right partner. One can just search in the database. Of course benchmarking partners can also be found via the database, but that is not the main goal of ENAPS.

To put information into a database, it is required that all performance indicators (ratio's) are based on quantitative instead of qualitative data. Quantitative data provides Performance Indicators that are comparable over time, instead of a one time snapshot of the performance the enterprise with qualitative information. The use of operational, quantitative performance indicators enables the clients to keep using the performance indicators to monitor the performance of their business processes even when the benchmarking process is finished. They can periodically (quarterly or yearly) compare their performance with information in the database.

What is Measured

ENAPS makes a distinction between Business Processes and Secondary processes. All the performance indicators that are used, measure the performance of these processes.

On the below you can see which processes are included in the ENAPS benchmarking method

Business Processes

Product Development
- Product Research
- Product Engineering and Design
- Process Engineering and Design
- Co-Engineering

Obtaining Customer Commitment
- Market Development
- Marketing
- Tendering

Order Fulfilment
- Order Processing
- Production Planning and Control
- Procurement and Inbound Logistics
- Manufactuting and Assembly
- Distribution and outbound Logistics
- Invoicing and Payment

Customer Service
- After-sales Service
- Product takeback

Secondary Processes

Support
- Financial Management
- Human Resource Management
- Information management
- Maintenance
- Internal Control of Health, Environment and

Evolution
- Continuous Business Process Improvement
- Production Technology Research
- Human resource Development
- Supplier Base Development
- Development of External Relations
- Strategic Planning

Emphasis at this moment lies in filling the database as soon as possible. It is important that the database have commercial value when the funded period is over. Therefore the number of processes that are measured in 1997 are limited to the Product Development and Order Fulfilment processes.

In every process, several Performance Indicators are defined. The performance Indicators try to measure several dimensions:

- Time;
- Cost;
- Quality;
- Flexibility;
- Environment.

What Can the Agents Offer the Clients

The performance indicators can help clients to locate strong and weak spots in their enterprise. Also searching for the right information helps in this process. By periodically comparing your own performance with that of other companies in Europe, enables the client to monitor the performance of his business processes.

Measuring the performance of the business processes often helps to get employees more involved. They get more interested and they can identify the factors that influence the performance. But they can also identify interdependencies of different departments.
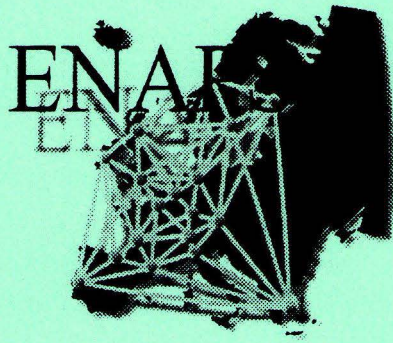
ENAPS

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The Business Model in ENAPS

An explanation of the business model which is a basis for the

performance indicators
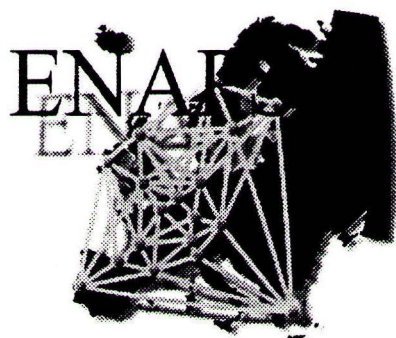
European
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Performance
Studies

The Business Model in ENAPS

An explanation of the business model which is a basis for the

performance indicators

Reader's Guide

Who should Read this Document

Every person that will use or will be involved in the ENAPS benchmarking process.

Purpose of this Document

Lay out the foundation of the performance indicators. Give the user more insight in the underlaying models used in ENAPS

Required Fore-knowledge

Although not necessary for reading this document you are advised to know about the ENAPS consortium and the ENAPS project. The assumption is made that the you know a little about benchmarking in general.

Suitable handbook documents for this for-knowledge are:

- Introduction to ENAPS Benchmarking

Summary

The ENAPS performance indicators and the associated measures (data or information to be retrieved to calculate the performance indicators) are based on a business model.

The performance indicators have several measerement dimensions, they try to measure aspects like:

- Time
- Cost
- Quality
- Volume
- Flexibility
- Environment

The busines model used in ENAPS consists of two different elements:

The Manufacturing Typology

This typology is based on the customer order decoupling point. Due to different positions of this decoupling point, several manufacturing situations can be distinguished:

- Make To Stock
- Assemble To Order
- Make To Order
- Engineer To Order

The ENAPS Business Model

This model identifies different business processes. A process consists of several activities in the enterprise. A process usually overlaps several departments in an enterprise. In the ENAPS model, a distinguish is made between business processes and secondary processes.

Business Processes:

- Product Development
- Obtaining Customer Commitment
- Order Fulfilment
- Customer Service

Secondary Processes:

- Support
- Evolution

Contents

Benchmarking in ENAPS

No company is identical to another company, not even in the same sector. Differences in market approach and differences in products cause this. So how should benchmarking find place? It is of course possible to identify similarities between enterprises. On the basis of these similarities a business model is developed through which useful comparison can find place. This could also mean that a comparison is done between companies that operate in totally different sectors, but have one or more processes in common.

Definitions of the performance indicators

Depending on the level of detail in the measurements, they can be used for somewhat different purposes. At a too low level of detail, the measures are generally publicly available and often known by the actors in an industry. Such measures, though important, can really only be used for making rankings of enterprises within and between industrial sectors. If, on the other hand, the level of detail is too high, the data will often be difficult to obtain, as the companies might be unwilling to disclose such detailed information. It is also doubtful that such measures, even if obtainable, could be used for conducting comparison and benchmarking indirectly through the use of a database. Both since the measures would often not be comparable from enterprise to enterprise and because only the measures would not be able to convey a complete picture of the best practices resulting in the measures.

Thus, a conclusion is that the performance measures should be of a medium level of detail, i.e., at a main business process level. Such measures can both be used for comparing performance across enterprises, industrial sectors, and national borders. Furthermore, a database of these measures can in turn be used for identifying relevant benchmarking partners in specific benchmarking studies. Therefore three levels of measurement are defined in ENAPS: *Business level*, *Process level* and *Function level*. Above the level of the business and secondary processes there is a business level which requires a set of measurements. The process and function levels require a set of generic measures which may be applied to any enterprise.

1. **Business Level Measures**: Financial and other high level measures;

2. **Process Level Measures**: Measures of such processes as Customer Order Fulfilment, and Product Development;

3. **Function Level Measures**: Measures of the functions which comprise the processes, for example a measurement of the production planning and control function within the customer order fulfilment process.

It should be pointed out that it is possible to distinguish between the database being built in ENAPS and the consultant methodology to be used by the agents. The agents can add value to their clients in a number of ways, including acting as an identification service for benchmarking partners, enabler of performance comparison, and conducting detailed performance measurement in the enterprises for internal use as a self assessment and monitoring of improvement.

Measurement dimensions

Each process and function will have several measures associated with it. To assist in the development of these measures a set of measurement dimensions is used. These are:

- Time;

- Cost;

- Quality;

- Volume;

- Flexibility ;

- Environment.

It is not necessary to have a measure for each dimension - the dimensions are used as a guideline not a rigid framework.

Measurement views

Each enterprise will want to look at a certain set of measures which determine a crucial aspect of the business. For example one set of measures may indicate the degree of customer satisfaction that the enterprise is providing. Three views allow the enterprise to group a set of measures together so as to monitor these important aspects of the enterprise.

- Customer satisfaction;

- Internal business performance;

- Innovation and learning.

Measurement Metrics

All measurements will be quantitative, that is the measure is a number which can be calculated definitively by the enterprise. Qualitative measures which require the opinion of those answering will be avoided since they are not useful for the purpose of comparison. Each measure will have an associated unit and definition.

Manufacturing Typology

For companies of different structure, the content and extent of their processes will generally vary. Such a typology can help to ensure that performance is compared for similar processes, thus making the comparisons meaningful.

Two manufacturing typologies are proposed for use within the ENAPS project:

- The customer-order decoupling point;

- The uncertainty/complexity grid.

Each of these typologies has relevance to the ENAPS project.

Customer-order decoupling point

As we move from MTS to ETO environments the "customer order decoupling point" defines the point after which any material is dedicated to a particular customer area. The positioning of this customer order decoupling point is vital, as it defines the parts of the process which are driven by customer orders and the parts that are driven by forecasts. Figure 1 illustrates the positioning of the customer order decoupling point in the different manufacturing environments. In general, the decoupling point between the manufacturing driven and sales driven operations is tending to move towards earlier stages of the manufacturing process.
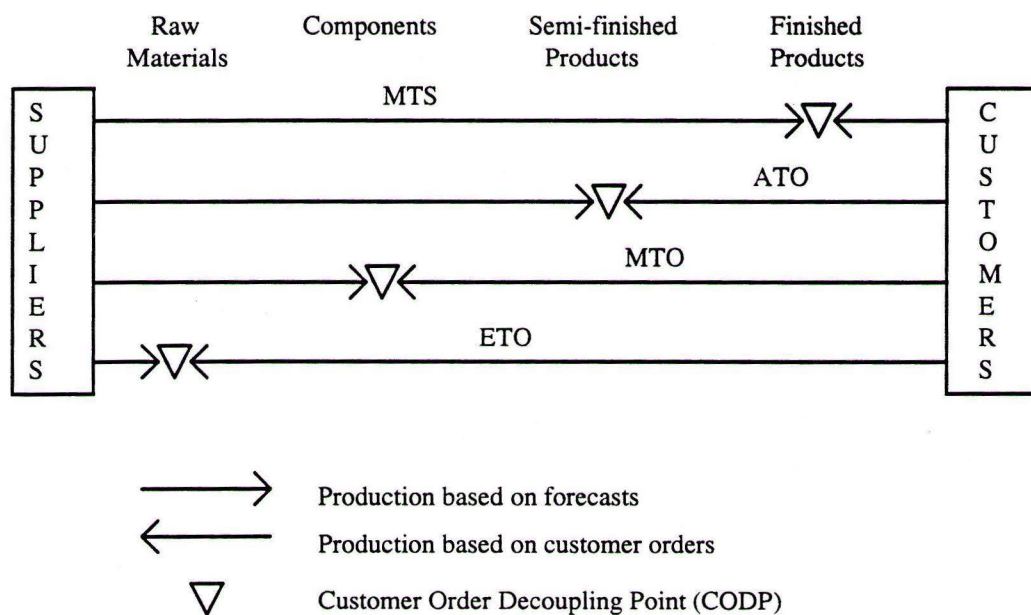
Figure 1 Customer Order Decoupling Point

More information about the Customer Order Decoupling Point can be found in Appendix 1.

Complexity/Uncertainty Grid

Manufacturing may also be classified according to the sector of business in which it operates. Using the Uncertainty-Complexity grid, shown in Figure 2, it is possible to identify four categories of manufacturing, namely Capital Goods, Fashion, Commodities and Durables. The uncertainty/complexity grid classifies manufacturing by its Market uncertainty and product complexity.
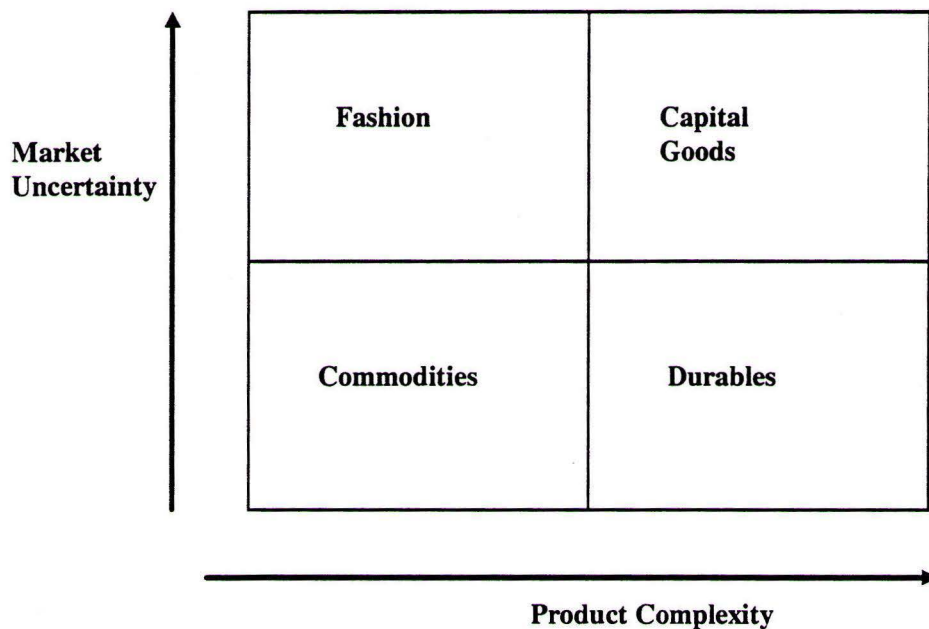
Figure 2 Uncertainty/Complexity Grid

Each of the four manufacturing categories, identified in the grid, are now described under the headings of key characteristics and required competencies.

Capital Goods Manufacturers

Capital Goods manufacturers exhibit high product complexity and high market uncertainty. Capital Goods manufacturers can be identified by a number of key characteristics:

- Effective and advanced design;
- Few customers;
- Complex and often customised products;
- Single major final assembly;
- Many sub-assemblies/components/raw materials;
- Many low/medium volume works orders;
- High sourcing activity;
- Typically discrete ordering;
- Many suppliers.

Examples of Capital Goods products are industrial equipment, mainframe computers and airplanes.

Durables Manufacturers

Durables manufacturers exhibit high product complexity and low market uncertainty. Manufacturing within the Durables Industry can be identified by a number of key characteristics:

- Modular design flow;
- Range of medium and major customers;
- High volume of customer orders;
- Range of products with limited options;
- sub-assembly manufacture and customised assembly;
- High volume subassembly works orders;
- Medium volume assembly works orders;
- Vendor scheduling and call off.

Examples of Durables products are computers, white goods and cars.

Commodities Manufacturers

Commodities manufacturers exhibit low product complexity and low market uncertainty. Commodities manufacturing can be identified by a number of key characteristics:

- Many customers;
- Standard products;
- Few raw materials;
- High volume of simple orders;
- High volume distribution network-intermediate distribution centres possible;
- Many product derivatives; packaging variety often significant;
- Few major suppliers.

Examples of commodity products are food and paper.

Fashion Manufacturers

Fashion manufacturers exhibit low product complexity and high market uncertainty. Fashion Manufacturing can be identified by a number of key characteristics:

- High design content;
- Rapid response to change;
- Few customers;
- Variable supplier base;
- Simple fashion productions, parts for repair.

Examples of fashion products include clothing and crafts.

ENAPS Business Model

The ENAPS business model agreed by the ENAPS project partners is described in this section of the document. The Extended ENAPS Business Model is shown in Figure 3. This model identifies the various functions within a manufacturing business and the links to the customer, supplier, recycler and service provider. This model reflects a future view of manufacturing systems as it incorporates the recycling of products at their end of life. This recycling focus, while playing an important role in future manufacturing systems, is not common in current manufacturing systems.
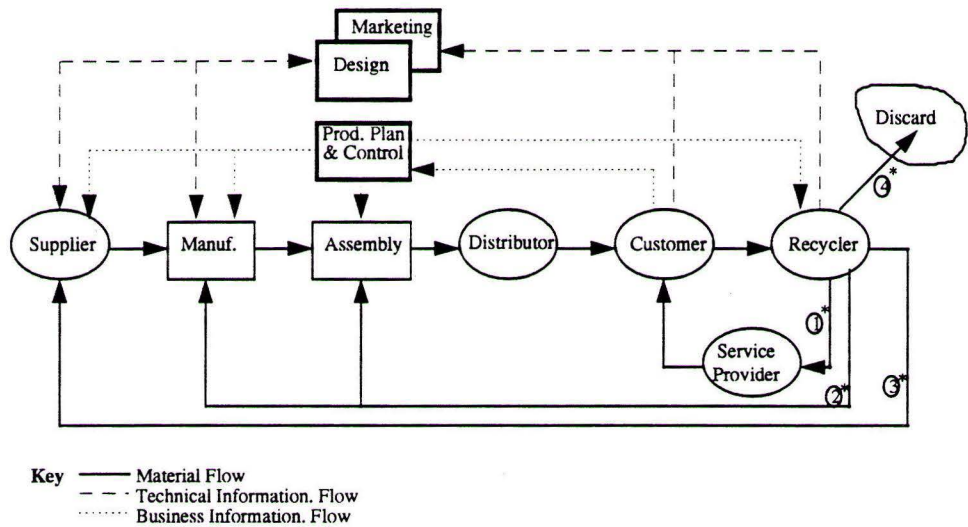
Figure 3 Extended ENAPS Business Model

A basic version of the extended business model is shown in Figure 4. This basic model identifies the various functions in a manufacturing system and its links to the customer and supplier. This basic model does not incorporate the recycling focus of the extended model.
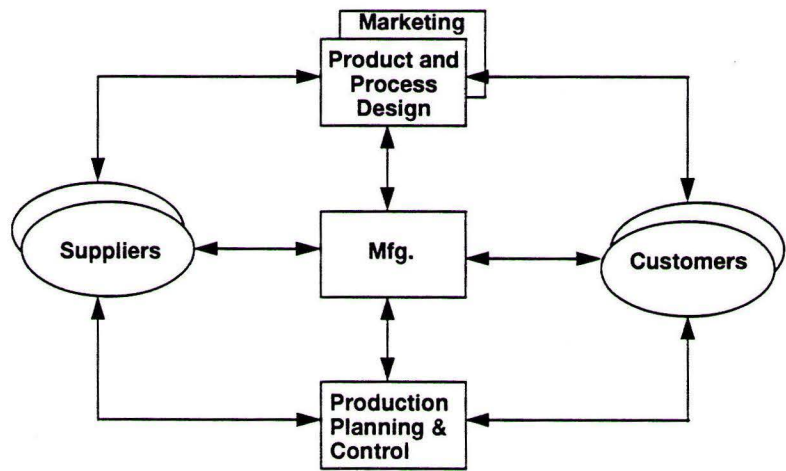
Figure 4 Basic ENAPS Business Model

The ENAPS business model is intended as a means of identifying the various functions within a manufacturing system and then showing how business processes can be mapped to these functions. The business model also incorporates a link to the customers and suppliers. In the following sections, the business processes identified using the ENAPS business model are described.

ENAPS Processes

ENAPS processes are described using the Generic Enterprise Framework. The generic framework consists of two types of processes: Business processes and secondary processes. Each of these levels consists of a collection of processes and each of these processes consists of a range or sequence of functions.

The generic enterprise framework is shown in Figure 5.

ENAPS - GENERIC - FRAMEWORK

BUSINESS PROCESSES

PRODUCT DEVELOPMENT
- Product Research *
- Product Engineering and design
- Process Engineering and design
- Co-engineering

OBTAINING CUSTOMER COMMITMENT
- Market Development (Analysis?)
- Marketing and Sales
- Tendering

ORDER FULFILMENT
- Procurement and inbound logistics
- Production planning & control
- Manufacturing and assembly
- Distribution and outbound logistics
- Order processing

CUSTOMER SERVICE
- After sales-service
- Product take back

SECONDARY PROCESSES

SUPPORT
- Financial management
- Human resource management
- Information management
- Maintenance
- Internal control of health, environment and safety

EVOLUTION
- Continuous business process improvement
- Product research *
- Production technology research
- Human resource development
- Supplier base development
- Development of external relations
- Strategic Planning

* It is possible for a function to belong in more than one process.

Figure 5 ENAPS Generic enterprise framework

It is recognised that at the business process level and the secondary process level the processes are generic. Below that the functions contained within a process is dependent on the typology of the enterprise. The functions listed in Figure 5 represent a listing. The sequence and the range of functions will need to be defined for each enterprise category according to the ENAPS typologies.

Business Process Definitions

A summary of the business process definitions is shown in Figure 6.

ENAPS process definitions

CONCEPT — PRODUCT DEVELOPMENT — LAUNCH
All activities involved in researching, designing, engineering and releasing products to manufacturing

MARKET-ANALYSIS — OBTAINING CUSTOMER COMMITMENT — SALES
All activities involved from market-analysis to sales

ORDER — ORDER FULFILMENT — PAYMENT
From receipt of an order until the customer has received and paid for the product

DELIVERY — CUSTOMER SERVICE — OUT-OF-USE
All activities involved in providing after sales service including product take-back

Figure 6 Definitions of the ENAPS business processes

These processes are defined by their scope, i.e. when they start and when they finish, rather than their content since content may change with differing manufacturing typologies.

The ENAPS processes and Business Model

The processes can be superimposed on the ENAPS business model as shown in Figure 7.
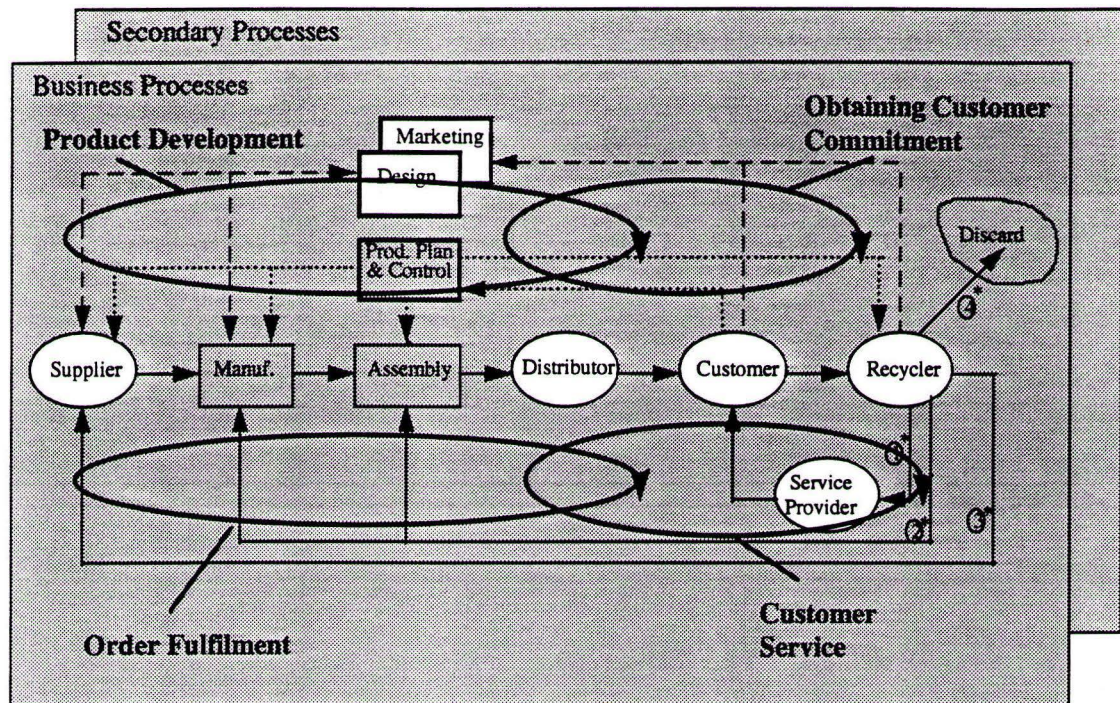
Figure 7 Business processes superimposed on the ENAPS business model

The "product development" process involves product research within the enterprise but also involving meetings with customers to obtain requirements. This process also includes co-engineering, a term used to describe the co-operation of enterprises with suppliers to develop components. The "obtaining customer commitment" process involves the marketing aspect of the enterprise and the customers. The "order fulfilment" process involves the customers, the production planning and control activity of the enterprise, the suppliers and the manufacturing activity of the enterprise. Finally the "customer service" process involves the entire enterprise, with the possible addition of a service provider, working with the customer to provide after-sales service and product take-back.

Conclusions

The ENAPS business model and generic enterprise framework of processes provides a sound generic description of a manufacturing enterprise. It provides the basis for the ENAPS performance studies. Performance measurements will be devised for each business process and each function within that process. Performance improvement projects can focus on these processes in a business and seek to help enterprises to manage their processes in a better way so as:

- to increase customer satisfaction;
- to improve internal business performance;
- to ensure "long term competitiveness".

The business model and processes will also be useful to other research and industrial projects as a generic business framework which may be used as a starting point for re-engineering.

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Appendix 1

Customer Order Decoupling Point

Introduction

The marketplace has changed dramatically in the last twenty or so years. It is important to realise that in today's manufacturing environment, the customer interaction with the manufacturer of the products is greater. Customisation to consumer needs is the emerging trend. Customers are no longer satisfied with standard products and are moving in the direction where each consumer wants a customised product, which will uniquely fulfil his/her expectations. Previously, manufacturers produced standard products and stored them in a warehouse which acted as a buffer for finished goods inventory. The customer then withdrew the products from the buffer, thereby having little or no interaction with the manufacturer. The factory scheduled the manufacture of products in order to keep the finished goods inventory at a specific level.

Figure 8, part (A) depicts the traditional type of system where customer and factory interaction was at a minimum. New pressures on manufacturing have led to a new situation, where the customer interface with the factory is on a different basis to what it has been previously. Typically there is no longer any finished goods inventory buffer from which the customer orders the products. The client may now go directly to the manufacturer and express his/her preferences on product specifications and functionality. In effect, the customer is ordering a customised product and this situation is expressed in part (B) of Figure 8. In many cases there is only limited customisation of products and standard components and subassemblies still exist.
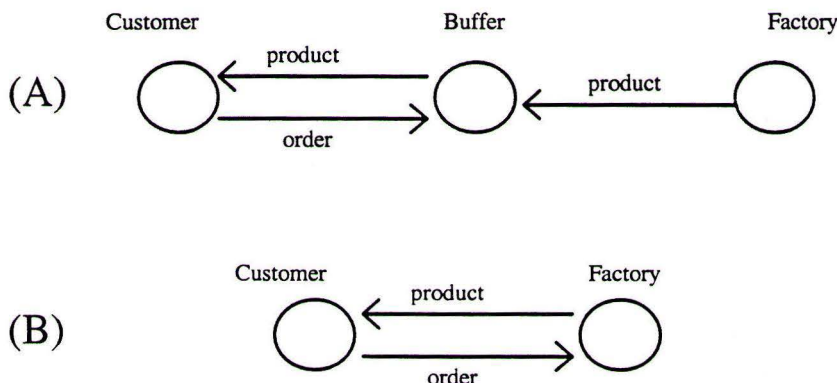
Figure 8 Evolution of manufacturing

The fact that there is a greater interaction between the customer and the manufacturer, means that, in order to produce goods to customer specifications, the manufacturer must be in close contact with both the suppliers and the customers. Figure 9 depicts the information and material flows

present in any manufacturing system. This highlights the presence of information flows as well as the material flows between the manufacturer and the suppliers and customers. The relationships with suppliers and customers is becoming one of the most important issues in today's manufacturing environment. Customers request faster delivery times and are more specific in their requirements of products. In order to achieve this improved delivery performance, manufacturers need to have closer links with their suppliers to reduce material supply lead times. The Master Production Schedule function provides the means of closing the link between the manufacturer and the customer.

information flow   *material flow*
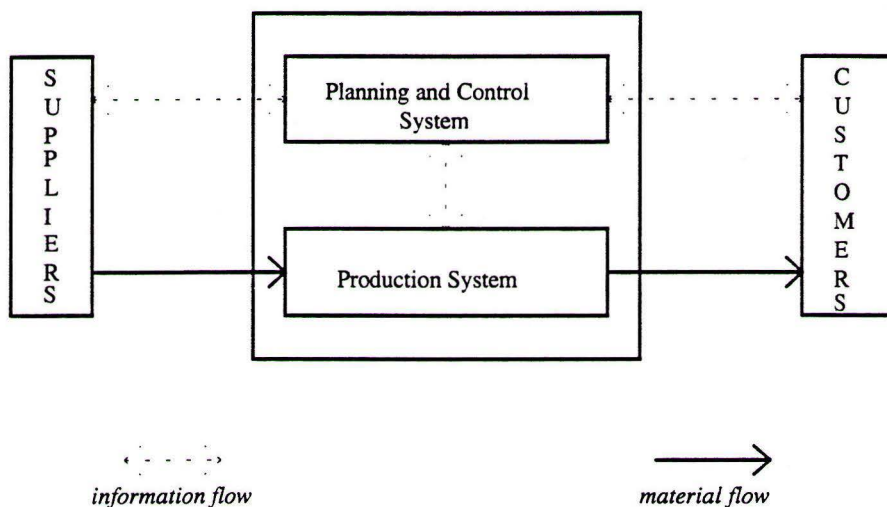
Figure 9 Information and Material Flows

The following typology describes four types of manufacturing environments, classified in terms of customer involvement. These four types are 'Make to Stock', 'Assemble to Order', 'Make to Order' and 'Engineer to Order'.

'Make to Stock' (MTS)

MTS characterises the manufacture of products based on a well known and relatively predictable demand mix. In this environment interaction with the customer is rather distant, the production volume of each sales unit is high with customer delivery time, determined by the availability of finished goods inventory, relatively short. The finished goods acts as a buffer against uncertain demand and stockouts. Part (A) of Figure 8 portrays a typical MTS system. The MTS system has the advantage of normally having quick delivery time but inventory costs are large and customers are unable to express preferences as to the product design. The MTS environment is characterised by reasonably long and predictable product life cycles.

'Assemble to Order' (ATO)

ATO involves having the same core assemblies for most products and the ability to vary all other components of the final assembly. A manufacturing environment working on this strategy has primarily only got contact with the customer at a sales level. The delivery time is of relative medium length and is based on the availability of major subassemblies. Assembly only takes place on receipt of an order, and buffers of modules or options may exist. The product routing in the factory is typically fixed. No final inventory buffer exists and the customer has limited input into the design of the product.

'Make to Order' (MTO)

MTO involves having all the components available along with the engineering designs, but the product is not actually specified. The finished product from this system is partially one of a kind, but not pure one of a kind because the final product is not usually designed from a basic specification. Manufacturing of the product begins with receipt of an order, and the configuration of the product is likely to change from the initial specification during the course of processing. Interaction with the client is extensive and is based on sales and engineering. The delivery time ranges from medium to long. Promise for completion of orders is based on the available capacity in manufacturing and engineering. The Bill of Material (BOM), which is a listing of all the subassemblies, parts and raw materials that go into a parent assembly showing the quantity of each required to make an assembly, is usually unique for each product.

'Engineer to Order' (ETO)

ETO is an extension of the MTO system with the engineering design of the product being done almost totally based on customer specifications. The same characteristics apply here as to the case of MTO, but customer interaction is even greater. True one of a kind products are "Engineered to Order".

Over the past twenty years manufacturing has moved along the continuum (Figure 10) in a direction from MTS to ETO due to the fact that customers are tending to demand customised products.
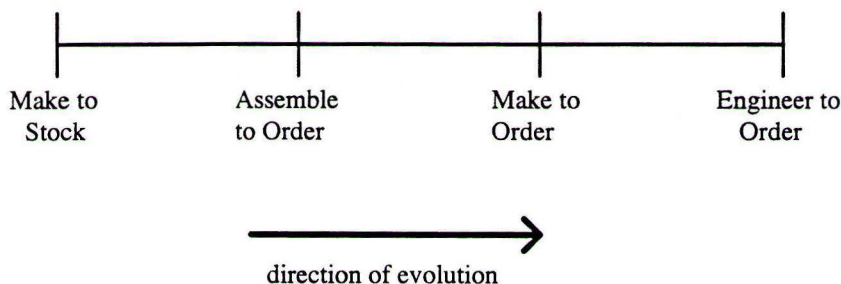
Figure 10 *Manufacturing Continuum*

As we move from MTS to ETO environments the "customer order decoupling point" defines the point after which any material is dedicated to a particular customer area. The positioning of this customer order decoupling point is vital, as it defines the parts of the process which are driven by customer orders and the parts that are driven by forecasts (Van Veen). Figure 11 illustrates the positioning of the customer order decoupling point in the different manufacturing environments. In general, the decoupling point between the manufacturing driven and sales driven operations is tending to move towards earlier stages of the manufacturing process.
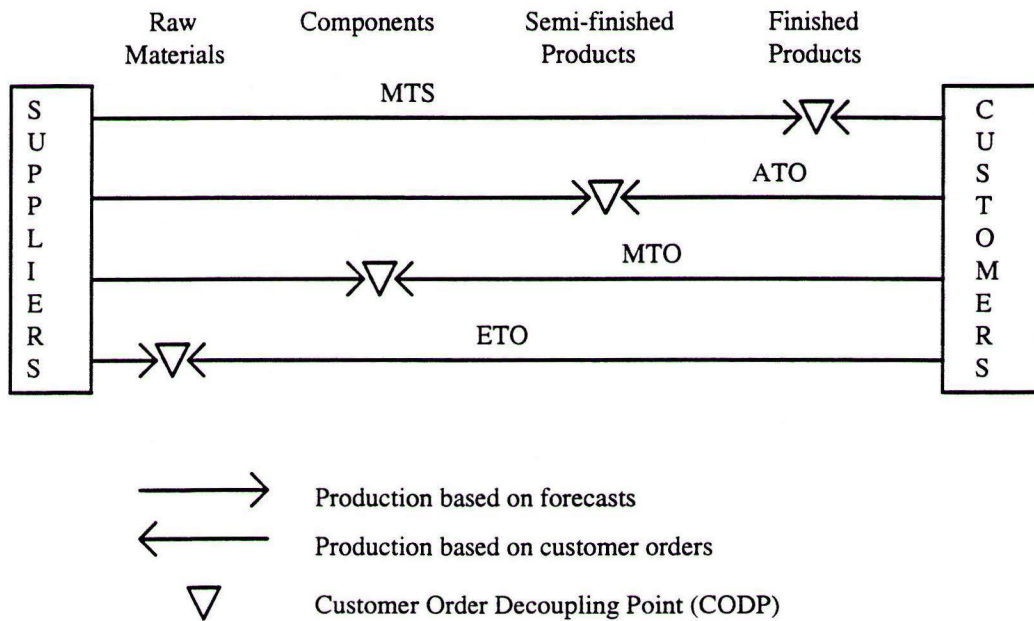
Figure 11 Customer Order Decoupling Point

Wemmerlov states that a manufacturing company's operation can be classified as MTS, ATO, MTO or a combination of these. Deciding which approach a company should adopt is a strategic decision, and will strongly affect the way that a company conducts its manufacturing, planning and control activities. MTS and MTO represent two "pure" manufacturing strategies, while ATO is a hybrid strategy. It is likely that most companies originate as either MTS or MTO firms and later, progress into the ATO stage. A company starting out as a MTO firm may chose to get into ATO manufacturing because of an expanding volume or a strong similarity between some of its products. Alternatively, an ATO firm may previously have produced to stock. This move to ATO is usually made to obtain a greater market share through offering a larger variety and better service. The following tables compare and contrast the different approaches.

Aspect	MTS	ATO	MTO	ETO
Interface between manufacturing and customer	Low/Distant	Primarily at sales level	Engineering and sales level	Primarily at engineering level
Delivery time	Short	Medium	Variable	Variable
Production volume of each sales unit	High	Medium	Low	Very low
Product Range	Medium	High	Low	Very low
Order promising (based on..)	Available finished goods inventory	Availability of components and major sub-assemblies	Capacity for manufacturing or engineering	Capacity for manufacturing or engineering

Table 1 Customer Interaction

Aspect	MTS	ATO	MTO	ETO
Basis for production planning and scheduling	Forecast	Forecast and Backlog	Backlog and Orders	Customer Orders
Handling of demand and uncertainty	Safety stocks of sales units	Overplanning of components and sub-assemblies	Little uncertainty exists	No control

Table 2 Production Planning

Aspect	MTS	ATO	MTO	ETO
Master scheduling unit	Sales unit	Major components and sub-assemblies	End products sub-assemblies stocked and fabricated parts	End products
Final assembly schedule	Close correspondence to the master schedule	Determined by customer orders received by Order Entry	Covers most of the assembly operations	Covers all of the assembly operations
Bill of material structuring	Standard BoMs (one BoM for each sales item)	Planning BoMs are used	BoMs are unique and created for each customer order	BoMs are unique and created for each customer order

Table 3 Implications for Master Scheduling
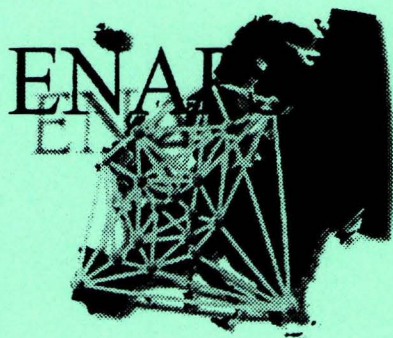
European Network for Advanced Performance Studies

The ENAPS Methodology

A Description of the Methodology Used in ENAPS
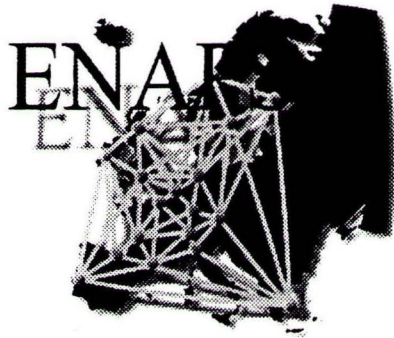
European
Network for
Advanced
Performance
Studies

The ENAPS Methodology

A Description of the Methodology Used in ENAPS

Reader's Guide

Who Should Read This Document

People involved in benchmarking but have never done the process themselfs.

Agents that have not yet used the ENAPS methodology.

Inexperienced agents that have not done many consultancy assignments.

Purpose of This Document

Explanation of benchmarking methodology. Explanation of the ENAPS-benchmarking methodology. Introduction of an eight-step-plan for benchmarking in consultancy.

Required Fore-knowledge

Before reading this document you should know about the ENAPS consortium and the ENAPS project. The assumption is also made that the you know a little about benchmarking in general.

Suitable handbook documents for this for-knowledge are:

- Introduction to ENAPS Benchmarking

Summary

In literature many benchmarking processes are decribed. All these desriptions have many phases or steps in common. Therefore Andersen (1995) identified a general benchmarking methodology called the 'benchmarking wheel'. This wheel is used in ENAPS to describe the benchmarking process.

The steps in the benchmarking process are the following:

- Plan

- Find

- Collect

- Analyse

- Improve

The only difference in the ENAPS project is that benchmarking is done through a database in stead of a one-to-one comparison of two companies. ENAPS uses quantitative data in stead of qualitative data to be as objective as possible over different countries in Europe.

Kempen and Keizer (1995) distinguish a ten step plan in a general consultancy process. To give the agent a guideline in how to approach the customer with ENAPS benchmarking, the ten step plan of Kempen and Keizer and the benchmarking wheel of Andersen have been combined to an Eight-Step-Plan. The steps in this plan are:

1. External Orientation

2. Introduction

3. Orienting Interviews

4. Analyse

5. Feedback Session

6. Workplanning and Project Organisation

7. Execution of the Benchmarking wheel

8. Completion

Experienced consultants probably will have their own approach to do such an assignment. The plan is given to provide the more inexperienced with a guideline.

This document was created in co-operation with Jan Rijnen, student at TUE.

Contents

The benchmarking wheel

In literature, many benchmarking processes are described. Many of these descriptions identify different steps or phases. These steps or phases identified by different authors have many steps in common, therefore the described processes all look alike. The ENAPS methodology follows largely the 'benchmarking wheel' (B. Andersen, 1995). This benchmarking wheel describes the most general form of benchmarking. The benchmarking wheel (Figure 1) originally consists of the following steps:

Plan	Determine the process to benchmark based on the organisation's critical success factors
	Form a benchmarking team
	Understand and document the own process
	Measure performance of own process
Find	Identify benchmarking partners
Collect	Understand and document the benchmarking partner's performance and practice
Analyse	Identify gaps in performance and the root causes for the gaps
Improve	Plan the implementation of improvements
	Implement improvements and monitor the implementation progress
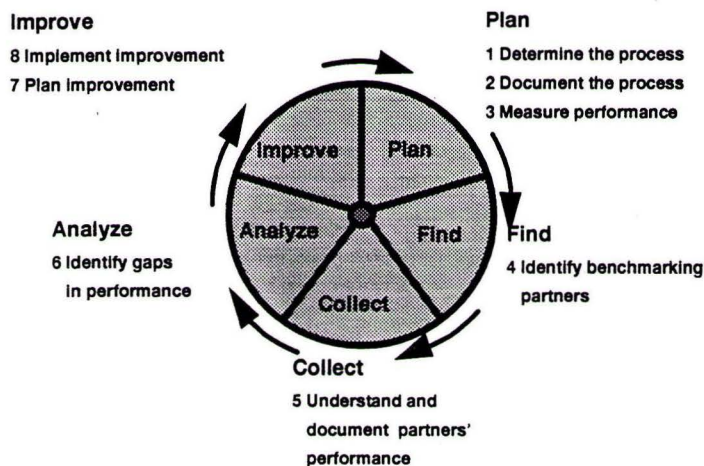
Figure 1 The benchmarking wheel

The ENAPS methodology is slightly different because benchmarking is done through information in the database. Of course benchmarking partners can also be found with the database. Therefore some of the steps of the benchmarking wheel are defined differently.

Plan	Fit the organisation in the ENAPS Business Model
	Determine the process(es) to benchmark
	Form a benchmarking team
	Measure the performance of that process(es)
Find	Put ratio's from the measurements in the database

	Make relevant queries in the database
	Retrieve information from the database
Collect	Understand and document the 'best practice' in the field
Analyse	Identify gaps in performance and the root causes for the gaps
	Identify possibilities and needs for performance improvement
Improve	Plan the implementation of improvements
	Implement improvements and monitor the implementation progress

Plan

To make a useful comparison between different enterprises possible, they have to be fit in the ENAPS Business Model. The enterprises will be fit into a typology on the basis of similar characteristics. This way similar enterprises can be compared. But also similar processes from different kinds of enterprises.

The process or processes that the enterprise wants to measure have to be selected. These have to be compatible with the processes as defined in the ENAPS Business Model. All the people involved in the gathering of the data have to be involved in the benchmarking process. A benchmarking team should be formed. That team should consist of members from all the processes involved. They understand the processes as no one else. Also results or improvements are probably better accepted if the team introduces them.

Then the actual measurement starts. The right data (measures) has to be gathered for the specific performance indicators for that process(es). One has to be careful that data gathered is reliable. Information procedures have to be checked to make sure that data found in information systems are correct. If all the data is gathered, ratio's can be calculated for the performance indicators.

Sorting and organising information

All the documentation should be collected in one place. The material that has been collected should be in some sort of basic order. Comparative measurements and hard figures should be sorted in the first instance, with collected explanatory material as a background. Simple matrices can be used to summarise measurements.

Quality control of information

The material should be checked and investigated whether there are any obvious anomalies or discrepancies. Whether there are figures and measurements which deviate so much that they can hardly be correct, or otherwise give rise to suspicions concerning the quality of the material.

There are several possible reasons why the information may fail to reflect the reality it is intended to measure. The benchmarking team may have misinterpreted answers and particulars given to them in interviews and questionnaires. There may have simply been errors in note-taking and copying. It is also possible that answers and information received were simply wrong. The following steps could be taken:

- Check the material for copying or other errors that have been made by the benchmarking team;

- Check back with the informant;

- Check other sources of information;

- Disregard the suspect information.

The quality of parameters and measurements of performance is important, not just to ensure the precision of the comparisons but also to secure the organisation's acceptance of the results.

Find

This phase involves all the communication with the database. In the preceding phase, all the relevant performance indicators (ratio's) are calculated. All the measures and ratio's now have to be put into the database. The agent is the only one who has access to the ENAPS database. He has to fill in the electronic questionnaire from which relevant data is sent to the ENAPS database. This is done through the internet or via a floppy disk.

The agent and the participating company can design queries for the database. The output of these queries can be used for the comparison of performance. The agent knows which queries are possible. He must, in co-operation with the organisation, create some relevant queries for that specific organisation.

After the agent has put in all the data and created the queries, he retrieves all the necessary information from the ENAPS database.

Collect

After measuring the performance of the own processes and retrieving information from the database, all the necessary information can now be completed. In the information the description of the 'best practice' in the processes selected and the specified typology is given. It is important to understand the 'best practice' and also the individual differences of the enterprises involved which may attribute to the differences in performance. No organisation is identical.

At this phase, the mass of information should be sorted and organised with a view to identify gaps in performance. This involves the following steps:

- Correction for non-comparable factors, if any;

- Identification of performance gap to best demonstrated practice and understanding of the underlying operative content that explains the existence of the gap.

Non-comparable factors

Non-comparable factors are circumstances and influences which make a comparison 'unfair', differences which the managers of the operations concerned cannot be expected to influence within a reasonable time-frame. Identifying and making allowance for non-comparable factors is an intellectually demanding task. The credibility and acceptance of the benchmarking data can be enhanced if non-comparable factors are taken into account. Non-comparable factors can be divided into a number of subclasses. they will be described below.

- ### Differences in operative content

There are operations in the business which differ so much that performance, which is determined by operative content, cannot be compared. For instance a situation in which a stereo and television wholesale company wants to benchmark its delivery-from-stock function against a textile mail-order company. Comparison is still possible if corrections are calculated for the difference in size and weight of the products.

- ### Differences in scope of operations

The term scope refers to the degree of integration in the business. Some functions of large companies can benefit from sharing services with other functions of that company (i.e. joint procurement of materials). This should be taken into account if a comparison is made with a company that cannot benefit from such constructions.

- ### Differences in market conditions

Although companies can have the same workprocess characteristics, it is possible that they serve different markets, causing differences in performance according to the needs of those markets. This can be corrected if the local market conditions are taken into account.

- *Differences in cost position*

Rentals and property prices are examples of variables which can not be influenced in the short term. the differences are not necessarily determined by the market. Taxes and subsidies may vary from one region (or country) to another.

Still caution is needed when taking these differences into account. A company may have lower personnel costs, they may also have a higher rate of personnel turnover.

- *National differences*

Although countries of the European Community are growing together economically, there are still differences in conditions from one EC country to another. In some cases it may be necessary to correct for factors that are beyond the power of the companies involved in the benchmarking study to influence. There may be differences in environmental legislation, social security contributions, demographic conditions, etc.

Analyse

Now the own performance is compared with the best and average practices in the industry. It is important to understand why there is a performance gap. There could be differences in approaches to customers or other companies aim at another part of the market. If one knows why there is a performance gap, one can identify the need for improvement. This should be related to the individual circumstances of the organisation. The agent plays an important role in this process. He was involved in the benchmarking process of this individual enterprise, so he is most qualified to advise the enterprise on improvements to be made. The ENAPS consortium can not make a general improvement handbook for all enterprises. It can only give guidelines for the analysis.

Identifying the performance gap to best demonstrated practice

The gap revealed by the comparative measurement should now be identified and studied. The performance factors which explain the origins and existence of the gap should be understood. Correct and relevant conclusions should be drawn from the analysis.

The performance gap

Benchmarking requires that the underlying content and work processes should be understood. That way an explanation for the performance gap can be found. The appearance of the performance gap is determined by which types of performance have been benchmarked and which units have been used to measure them. A performance gap can be negative (others are better), neutral (almost no difference) or positive (better than the rest).

One of the most essential steps is getting to the bottom of things in order to understand why performance differs. This knowledge can be applied in the company's operations. Identifying and understanding the performance gap requires detailed study and review of all the knowledge and experience that the team has accumulated as a result of the benchmarking study. The analysis and conclusions can then be documented in a benchmarking report.

Improve

Once the areas where improvements are needed are identified, the agent can together with the enterprise design an improvement plan. Improvements can then be planned and executed. This is a task for the agent and enterprise themselves.

By going through the cycle again, improvements can actually be measured. A process of continuous improvement can be initiated.

Opportunities for improvement

On the basis of the gap that the benchmarking study has revealed and the knowledge of the underlying operative content that has been gained, the opportunities for improvement should be evaluated, defined and quantified. Ways and means of making improvements should be discussed with the people affected by the results of the study.

The benchmarking team should play an important part at this stage. During the information-gathering and analytical stages its members have acquired a fund of detailed knowledge both of their own operations and of those of the benchmarking partners they have studied. They should pass this knowledge to their colleagues so that the potential for improvement indicated by the benchmarking gap can be translated as faithfully as possible into the language the organisation speaks.

Implement for effect

The last stage of the benchmarking process comprises the work of closing the gap which the analytical stage has identified, and translating the potential for improvement into tangible results. This last stage comprises the following steps:

- Integrate with the regular business plan;
- Prepare a plan for changes to be made;
- Implement the plan.

Report the results of the study to the people it affects

Before the implementation phase gets to the stage of practical application, the benchmarking study must be reported and accepted by the key people in the organisation whom it affects. The results must be reported to the top-management or management group, but also to all the middle managers whose areas of responsibility are likely to be affected by the process of implementation.

Another important criterion for assessment is whether the report appears to be neutral and impartial. The impartiality aspect is specially important if the benchmarking team has no outside representatives but is made up of people from inside the organisation. Presentation to top management is a critical point; it is essential to secure their full approval of the results of the study.

Integrate with the regular business plan

Most companies and organisations work with a more or less detailed business plan of some kind. Implementation of action to improve results on the basis of the benchmarking project must not of course be allowed to conflict with the aims or level of ambition of the regular business plan. The two should be integrated so that they work in harmony or even in synergy to achieve the best possible result.

Draw up a plan for implementation

When the results of the study have been fully accepted by all concerned in the organisation and the potential for improvement with reference to the benchmarking gap has been evaluated, it is time to formulate new goals and aims.

The goals formulated by the organisation need to be carefully analysed. The expectations that follow from the formulation of goals, must be based on businesslike assessments, and not an expression of pious management hopes. If goals and aims are to be practical tools for stretching the organisation to its full potential, their criteria must be challenging but realistic. When formulating goals, the following criteria can be helpful:

- What performance is attainable according to the benchmarking gap;

- What performance the organisation is capable of achieving.

With benchmarking as the foundation of this process, this process is already far advanced thanks to the points of comparison.

The Eight-Step-Plan
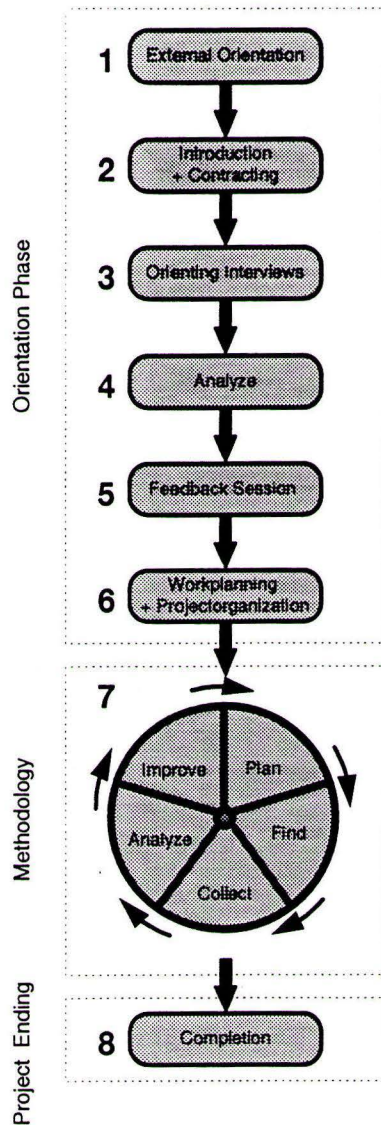
Figure 2 The Eight-Step-Plan

In the following part eight steps will be described, narrowed down for the use in benchmarking projects. The Eight-Step-Plan is designed for consultants who want to use the benchmarking methodology with their clients. Especially inexperienced consultants will find this description helpful.

In this method of approach for the demonstrator-projects emphasis is put on the orientation. When the orientation would be neglected misunderstandings and obscurities will occur, that could have been avoided. Also time that seems to be lost in doing the exploration will be caught up, because one has more knowledge on the process (and more support within the organisation).

Andersen (1995) developed a benchmarking wheel, with 5 steps (8 tasks) for a benchmarking-study. These steps are adjusted within ENAPS to be used in an 'ENAPS-Benchmarking project'. Kempen en Keizer (1995) distinguish 10 steps in a (general) organisation consulting process. In this section, both of the approaches are joined to create a complete work plan which can be used in benchmarking projects.

There are two reasons for making an extended workplan instead of using just the benchmarkwheel. First benchmark-approaches (like the benchmarkwheel) are written for use within an organisation. It is useful for the external (and certainly the inexperienced) consultant to explicitly take a few more steps. Secondly having a formal plan, makes it easier to compare several projects to each other afterwards and make sure no (important) steps are skipped.

Step 1: External orientation

preliminary study about the company and the branch

A lot of problems in companies have an external cause (change in demand & supply, technological development, change of laws). Benchmarking shows what is possible under similar circumstances. Before starting a benchmark project however it is good to have an insight of the market and the market position of the company where the consultant will be working.

Doing an exploration of the company and the branch one can use information in the company itself, but also external references should be checked.

Questions that should be answered are:

- What are the most important developments in the branch;

- What is the market position of the company;

- What are the recent business developments.

Step 2: Introduction / Exploratory Interview

check for a successful basis for the project

In this phase the first appointments will be made and the contractor will be introduced to the steps in the workplan for the benchmarking project. In this phase, the goal of the individual project will be made clear and the assignment is defined.

Questions that should be answered with regard to the project are:

- Who will be mostly involved (in the field of research & development and orderfulfilment)?

- Who will act as contractor?

- How will the consultant (and his project) be introduced to the organisation (in the management-meeting, announcement in the personnel newsletter)?

- What future appointments are made? (Visit the factory, appointments for the orienting interviews)

- Retrieved documents (organisational chart, lay-out factory, annual report)

Step 3: Orienting interviews

gain of (internal) data and insights

One of the first tasks for the external consultant will be to have interviews with people involved or connected to the benchmarking-project. The goal of these conversations is to find out some important data en to gain insights in:

- the company's primary processes;
- de opinions of the people involved;
- de business culture;
- available research-data;
- commitment & support (of personnel and management).

This data can be collected in five to ten interviews, which will be exploring and inventory. The orienting interviews are means to the consultant to introduce himself to the organisational members (who probably will be members of the benchmark team). Also they will be used to collect data about the organisation, the processes and about the cultural aspects.

Step 4: Analyse

order and interpret the gained information

In this phase the information that is gained thusfar will be ordered an interpreted to make final agreements on the project.

The following subjects must be clear after the analysis:

- supporters and opponents of the project;
- what process(es) should be selected for the benchmarking;
- who should be a member of the benchmark team;
- what specific problems should be solved in the next session to assure a successful project.

In this phase, the benchmarking team can be composed. The consultant now has enough information to know who would be suitable members for the benchmarking team.

The described steps are actually the first two tasks in the 'planning-step' of the benchmarkwheel. The analysis is a step the consultant should do for himself to prepare himself for the next step, a session with all the people involved. In that session the actual agreements and appointments for the project will be made.

Step 5: Feedback Session and Contracting

agreement on the workplan

Now we'll get to the actual benchmarking steps. All the people involved in the benchmarking-project must be present in this session. Consensus should be gained about the method of approach (the ENAPS-Benchmarkwheel).

If not already done, the proper processes and indicators must be selected. A definitive benchmarking team should be constructed and appointments made about the execution.

The members of the benchmarking team should now be officially defined. There has to be agreement about:

- the problem;
- the assignment (what should and what should not be measured/benchmarked);
- the approach of the problem (steps of the benchmarking wheel).

Step 6: Workplanning and project organisation

detailed workplan = the ENAPS-benchmarkwheel

This is the last step in the 'Orientation phase'. The benchmarking-steps must now be planned in an (detailed) project planning, which will include responsibilities and a time phase. This can be done by using for example a GANNT-chart.

Also some clear agreements must be made about conferences/meetings and reporting.

Step 7: The ENAPS-Benchmarking wheel

searching for performance-gaps, possibilities for improvement and the actual improvement

The next step will be the execution of the steps in the benchmarkwheel in finding performance gaps, possibilities for improvement and the implementation of the actual improvement. The final step will be to construct a rapport.

The global steps in the benchmarkwheel are:

Plan

- Categorise/Classify the organisation in the ENAPS Business Model
- Document the (actual) process(es)
- Measure the performance of that process(es)

Find

- Put ratio's from the measurements in the database
- Make relevant queries in the database
- Retrieve information from the database

Collect

- Understand and document the 'best practice' in the field

Analyse

- Identify gaps in performance and the root causes for the gaps
- Identify possibilities and needs for performance

Improve

- Plan the implementation of improvements
- Implement improvements and monitor the implementation progress
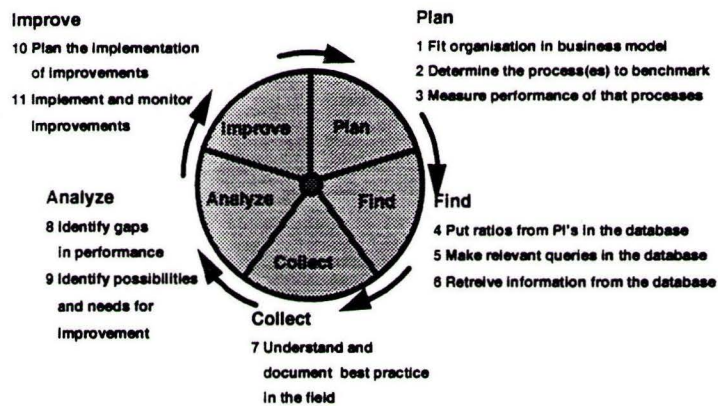
Figure 3 The ENAPS benchmarking wheel

The ENAPS-benchmarking wheel will therefore look as shown in Figure 3.

The benchmarking process is a cycle. After improving the process the performance again is measured (and maybe again an improvement is necessary).

The last thing a consultant has to do (and this will be even more important for the demonstrator-projects) is writing his report:

Step 8: Completion

writing the final rapport and having concluding conversations

To end the project in a proper way, some activities have to be done:

- writing the final rapport or hold a final presentation;

- having concluding conversations;

- evaluate the assignment and perhaps adjust the methodology.

Figure 2 gives an overview of the eight steps, including the ENAPS-Benchmark model.

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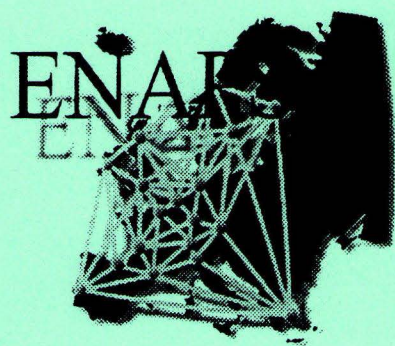
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Benchmarking Teams

How to Deal with Teams in Benchmarking
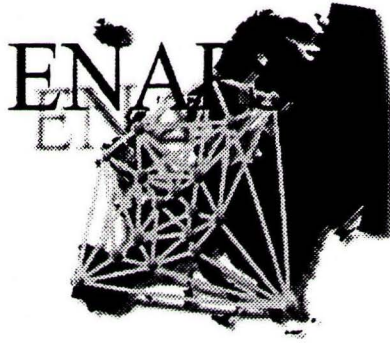
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Benchmarking Teams

How to Deal with Teams in Benchmarking

Reader's Guide

Who Should Read This Document

This document is written for those agents who are unfamiliar with working with groups and group dynamics. Especially agents that are conducting benchmarking studies within enterprises.

People that just want to fresh up their knowledge on this field are of course welcome to read this writing.

Purpose of This Document

This document gives information about working with groups and group dynamics. It is especially helpful for agents that work with, or are going to work with, groups in benchmarking or improvement processes.

Required Fore-knowledge

It is advised to you to know about general benchmarking processes before rading this document. It is also advised to know about ENAPS and the ENAPS consortium. For this information you can read the following documents of the handbook:

- Introduction to ENAPS Benchmarking;

- The ENAPS Methodology.

Summary

When undertaking a benchmarking study, it is advised to work with a benchmarking team. The members have knowledge about the business processes and solutions or improvements are likely to be better accepted if they come from members of the organisation.

A group undergoes a natural development process:

- Forming: individuals are becoming members of the group;

- Storming: natural leadership develops within the group;

- Norming: the group becomes cohesive and a common set of expectations develops;

- Performing: the group starts performing at the tasks at hand;

- Adjourning: the group has to be disbanded.

As with any group of people, in a benchmarking team, conflicts can arise. These do not have to he deconstructive, they can even help improve the performance of the team. To resolute conflicts, the next steps can be undertaken:

- Separate the people from the problem;

- Focus on interests, not on positions;

- Before trying to reach agreement, invent opinions for mutual gain

- Insist on using objective criteria.

Contents

Introduction

According to American Productivity & Quality Center, in the book The Benchmarking Management Guide, ninety-four percent of the organisations surveyed report using a team approach to benchmarking. This indicates that benchmarking is not an individual effort. Sara Cook states that the success of a benchmarking project largely depends on the care that is taken in selecting the appropriate project team members for the tasks and in training and supporting them.

Teamwork is not the same as meetings for sharing information. The wish to solve a problem by using teams, instead of individuals, is because a group together has larger experience and therefore are able to come up with more suggestions on how to solve a problem. In addition the team-members can inspire each other so that there is a synergyeffect. Successful teamwork will also contribute to a better social environment and understanding of the process and each others tasks at the workplace.

Five good reasons to work in teams:

1. Small groups seems to be good for people. Teams can satisfy important membership needs and provide a fairly wide range of activities for individual members. They can provide support in times of stress and crisis.

2. Groups seems to be good problem-finding tools. They seem to be useful in promoting innovation and creativity.

3. A group often makes better decision than individuals do.

4. The teams are great tools for implementation. They gain commitment from their members so that the groups decision are likely to be willingly carried out.

5. Groups are a natural phenomena, and facts of organisational life. They can be created, but their spontaneous development cannot be prevented.

Forming a Team

Having gained commitment and sponsor for the project, the next step is to form a project team. The team should, according to Andersen, fill the following roles:

- Team leader, i.e., a person who has the overall responsibility for calling meetings, monitoring the progress of the project, make sure minutes are prepared, that necessary information is gathered and distributed, etc. Many of these tasks can usually be delegated, but the responsibility still remains with the team leader. It is quite common, but not necessary, that this role is given to the person in the team with the highest position in the organisational hierarchy.

- Link to or support from management, either through representation in the team from management or by giving someone authority to represent the management.

- Process owner or the person who in other ways is responsible for the whole or most of the process to be focused on.

- Other persons involved in the process, preferably from a cross-section of the organisational units the process runs through. It is extremely important to make sure that the team does not consist of people who really are located above or on the side of the process to be improved. If those who will later have to change their routines are involved in the team, making the necessary changes might be hard to do.

- A customer of the process, internal or external. Along with a process view comes also a commitment to viewing the customer of the process as the most important part of the puzzle. By involving the customer in the team, it is possible to make sure that the customer's views are adhered to in the improvement activity.

- A supplier to the process, internal or external. In the same way that any process has a customer, any process also has a supplier that provides some sort of input. The supplier is to a smaller or larger extent a part of the factors that shape the performance level of the process through the input being supplied, and should therefore be included in the improvement activity.

- Possibly some kind of external assistance (i.e. an facilitator) in the cases where the improvement tool to be used is new to the team.

One person can take on several of these roles. With regard to the link to management and sponsor for the benchmarking study, this is a very important point. Any attempt to conduct a benchmarking study and following change implementation without having this support will end in failure. Even if the team does not include a management representative as a member, it is important to remember to establish such a link and to keep the superiors informed about the study and its progress. The team should include a mix of seniority and knowledge (old hands and fresh blood).

Members of the team should have sufficient drive and credibility to get their recommendations approved, otherwise their efforts will fail. Members should be drawn from across the organisation. The team should not have more than six to seven members, even though this obviously depends on the extent and complexity of the project. At the same time, care should be taken to not form a team that is too small, as this may limit the team's ability to perform its tasks and undermine a broader sense of ownership of the project's results.

Something to avoid, according to Andersen and Pettersen, is squeezing the line management immediately above the benchmarking team between the team and upper management. If the benchmarking team acquires support from top-level management for the study and goes ahead with it without including the line management, this situation can easily occur. The line manager might feel threatened by the study and its possible conclusions, and thus try to sabotage it. The simplest advice is always to keep your cards open and keep everyone that might be affected by the benchmarking activity informed.

Participants should have the knowledge, influence, capacity, and motivation to undertake the project. Ideally, the mix of team members should include those who are;

- systematic and analytical in their approach,
- good communicators,
- good motivators,
- prepared to question and challenge the status quo,
- creative in their outlook,
- willing to progress the task outside team meetings,
- able to promote good team spirit, and

- credible whitin the organisation.

Whatever the team composition, it should be headed by a project leader who can co-ordinate the activities of the group and ensure that there are the resources to complete the project. Ideally this person should be the process owner - the person who has ultimate responsibility for the outcome of the process. Alternatively the leader can be a team-member actively involved in the process to be benchmarked.

Stages in group development:

The five stage model:

Forming

is characterised by much uncertainty

The first step is characterised by a great deal of uncertainty about the group's purpose, structure, and leadership. Members are "testing the waters" to determine what types of behaviour is acceptable. This stage is complete when members of the group start to think of themselves as members of the group.

Storming

is characterised by intragroup conflict

The next stage is one of intragroup conflict. Members accept the existence of the group, but there is resistance to the constraints that the group imposes on individuality. Further, there is conflict over who will control the group. When the stage is complete, there will be a relatively clear hierarchy of leadership within the group.

Norming

is characterised by close relationships and cohesiveness

The third stage is where the close relationship develop and the group demonstrates cohesiveness. There is now a strong sense of group identity and camaraderie. The norming stage is complete when the group structure solidifies and the group has assimilated a common set of expectations of what defines correct member behaviour.

Performing

is characterised by a fully functional group

The structure of the performing stage is fully functional and accepted. Group energy has moved from getting to know and understand each other to performing the task at hand. For permanent work groups, performing is the last stage in their development. However, for temporary committees, task forces, teams, and similar group that have a limited task to perform, there is an adjourning stage.

Adjourning

is characterised by concern with wrapping up activities rather than task performance

In this last stage, the group prepares for its disbandment. High task performance is no longer the group's top priority. Instead, attention is directed toward wrapping up activities.

Responses of group members vary in this stage. Some are upbeat, basking in the groups accomplishments. Others may be depressed over the loss of camaraderie and friendships gained during the group's life.

Teamwork and Communication

Effective teams are, according to Aune, described by:

- A common goal that is agreed on by all group members.

- Open communication where the participants freely expresses their feelings and opinions, and the team-members listens to each other.

- Trust in that non of the participants will abuse others members comments or ideas.

- Social support between group-members by showing interest, understanding and recognition.

- Utilising individual differences to everybody's advantage.

- Decisionmaking done by the team, not by one dominating team-member.

- Flexible leadership in order to give the person perceived to be the most likely to solve a problem the most influence.

Ineffective groups, on the other hand, are described by the relationship between the members being dominated by indifference, tension and rivalry. The communications in these groups are not good and some individuals are eager to push forward their own opinions. The group will easily come to conflict because disagreements and oppositions are not allowed to be expressed, and criticism occurs rarely or never. Whenever criticism surfaces it is negative, seems embarrassing, and creates tension. Decisions are often made by a mere majority.

In effective groups there is three major types of actions;

- problem oriented,

- work or maintenance oriented, and

- individual oriented.

Aune states that problem oriented actions must be executed as a part of the problem solving. These actions consists of defining and confine the problem, and collect the information needed. Furthermore the group must produce opinions and suggestions on how the problem should be attacked. These suggestions will then be used as a base for further work. The group must hold track of the time, test the agreement in the group and execute the decisions. Its important to keep minutes, hold track on the suggestions, decisions and results of the discussions, and have a representative from the group to present results etc. The group leader will hold primarily the responsibility of these actions.

In order for the group to function properly there have to be a number of actions on co-operation and continuance. We all need encourages, recognition, and praise from time to time. In conflict situations someone will have to hold the responsibility to settle differences and reduce the tension, and contribute to solve a locked situation. Everybody has the responsibility to make sure every member in the group is heard and that no one is isolated from the rest of the group. Objectives and standards for co-operation within the group must be expressed, and all members must be loyal to the decisions that have been

made. The responsibility to make sure that this happens lays with the group leader, but the group members must take responsibility to make it happen.

Individual oriented actions differ from the other actions by being strictly aimed at the individuals needs. In groups with a high degree of individual oriented engagement the problem solving actions will be suffering. This does not mean that the participants can not bring personal matters into the group. The team's good feeling depends both on solving the tasks and satisfaction of individual needs.

Conflicts in groups

A general definition of conflicts can be a disagreement in which we invest time and energy. Others will only define a conflict when there is a destructive impact on the opposition.

Conflicts occur in every kind of co-operation. In groups the conflicts become clear when the individuals become visual and the differences acknowledged. If the team has reached a certain level of maturity there will usually be enough courage to confront disagreements and conflicts. The conflicts have, if dealt with, a binding function for the team and contributes to its growth.

The absence of conflicts is not a sign of maturity or strength, rather of fear and indifference. Some teams get locked in a conflict situation, and the conflict can be an excuse not to move on to other, more demanding problems. The conflict can in some situations become more important to the team then the task itself.

Conflicts in or between groups should not be considered to be entirely bad or good, Some conflicts support the goals of the group and improve its performance; these are functional, constructive forms of conflict. Other conflicts hinder group performance; these are dysfunctional or destructive forms of conflict.

The distinction between functional and dysfunctional is neither clear nor precise. No one level of conflict can be adopted as acceptable or unacceptable under all conditions. The type and level of that creates healthy and positive involvement toward one group's goals today may, in another group or in the same group at another time, be highly dysfunctional.

The criterion that differentiates functional from dysfunctional conflict is group performance. Since groups exist to attain a goal or goals, it is the impact that the conflict has on the group, rather than on any individual member, that determines functionality.

Effective management of group conflicts requires both understanding and appropriate action. Understanding group conflict involves diagnosis of attitudes, behaviours, structures, and their interaction. Power differences between group members or groups promote fear and ignorance that result in reduced exchange of information in the group and the potential for either explosive outbursts of escalated conflict or escalating oppression. Managers must cope with fear, ignorance, and their consequences to effectively manage conflicts between unequally powerful groups or group members.

Conflict resolution.

Ficher and Ury's principled negotiation

Four steps:

Separate the people from the problem.

The conflicting parties are often highly emotional. They perceive things differently and feel strongly about the differences. Emotions and objective facts get confused to the point where it is not clear which is which. Conflicting parties tend to attack one another rather than the problem. To minimise the likelihood that the conflict will become strictly interpersonal, the substantive problem should be carefully defined. Then every one can work on it rather than on each other.

Focus on interests, not positions.

When negotiations focuses on interests, the negotiator must determine the underlying concern of the other party. Knowledge of the other party's interest allows a negotiator to suggest solutions that satisfy one party's interests without agreeing with the other's position

Before trying to reach agreement, invent options for mutual gain.

The parties in conflict usually enter negotiations knowing the outcome they would like. As a result, they are blind to other outcomes and are not particularly creative. Nonetheless, as soon as the substantive problems are spelled out, some effort should be devoted to finding a wide variety of possible solutions, or elements, that advance the mutual interest of the conflicting parties. Success at finding options that produce mutual gain positively reinforces win-win negations.

Insist on using objective criteria.

Rather than bargaining on positions, attention should be given to finding standards (e.g. market value, expert opinion, law, company policy) that can be used to determine the quality of an outcome. Doing this tend to make the negations less a contest of wills or exercise in stubbornness.

Problem solving in groups

Quality and acceptance are essential dimensions in decision making. The quality dimension refers to the objective features of a deception - in other words, how does it compare with the objective facts? The acceptance dimension refers to the degree in which the group that must execute the decision accepts it - in other words, how does the group feel about this decision? High quality and high acceptance are both needed in order to make effective decisions. This means that group discussion must effectively deal with both facts and feelings.

A major problem is raised because the methods for dealing with facts are quite different from those dealing with feelings. The skilled team leader must recognise when he is dealing with facts and ideas and when he is confronted with feelings and biases. The difference is not always too apparent, because feelings are often hidden behind made-up reasons or rationalisations. Diagnostic skill therefore is one of the project managers leadership requirements.

Once he is able to make diagnostic judgements his next step is to deal effectively with each. The skill for removing group obstacles in the form of feelings and in the form of ideas are quite different, and each set of skills has its place.

The skill requirements in conference leadership are not difficult to learn. The problem lies more with the interference caused by old habits. Once one can break away from these and get a fresh start, the battle is half won. The first step is to recognise the existence of

qualitative distinctions. No one skill is best for all purposes. If the basis distinctions are made, progress in each area becomes relatively easy.

Maintaining momentum in the team

Many teams enjoy terrific starts and then soon fizzle. The real challenge, according to The Memory Jogger II, is to keep a team focused on its purpose and not the histories of its members and their relationships to one another.

Agree on the Improvement Model to Use.

- Standard steps. Use your organisation's standard step-by-step improvement process or choose from the many published options.

- Data. Gather relevant data to analyse the current situation. Define what you know, and what you need to know, but know when to stop. Learn, as a team, to say when your work is good enough to proceed to the next step in the process.

- Develop a plan. Use your organisation's standard improvement model to provide the overall structure of a project plan. Estimate times for each step and for the overall project. Monitor and revise the plans as needed.

Use Proven Methods Based on Both Data and Knowledge.

- Data-based methods. Use tools like the TQM improvement tools (described in the handbook chapter Total Quality Management - Which improvement techniques are available?) in order to take emotions out of discussions and keep the process moving.

- Knowledge-based methods. Many of the methods (such as Affinity Diagram and interrelationship Diagraph) used for improvement in TQM help to generate and analyse ideas to reveal the important information within. They help create consensus, which is the ideal energy source for a team.

Manage Team Dynamics

- Use facilitators. A facilitator is someone who monitors and helps team members to keep their interactions positive and productive. This is the stage when a facilitator can help the team stay focused on its purpose while improving its working relationships.

- Managing conflict. As a team grows, so do conflicts. This is a natural process as communication becomes more open. The entire team can learn techniques for conflict resolution and use the facilitator as a resource.

- Recognise agreement. Managing agreement is often as much of an effort as to managing disagreement. Test for agreement often and write down the points of agreements as they occur.

- Encourage fair participation. Each team member must eventually take responsibility for participating consistently in all discussions. Likewise, the entire team should be constantly working to "pull back" the dominant members and draw out the quieter members.

Ending Teams/Projects

Most teams and all projects must eventually end. Both often end in unsatisfactory ways or do not "officially" end at all. Before ending, the team should review the following checklist, suggested in The Memory Jogger II:

- We checked our results against our original goal and customer needs.

- We identified any remaining tasks to be done.

- We established responsibility for monitoring the change over time.

- We documented and trained people, when necessary, in the new process.

- We communicated the changes to everyone affected by them.

- We reviewed our own team's accomplishments for areas of improvement.

- We celebrated the efforts of the team with a lunch, newsletter article, special presentation to the company, or other expressions of celebration.

- We feel proud of our contribution and accomplishments, our new capabilities, and our newly defined relationships with co-workers.

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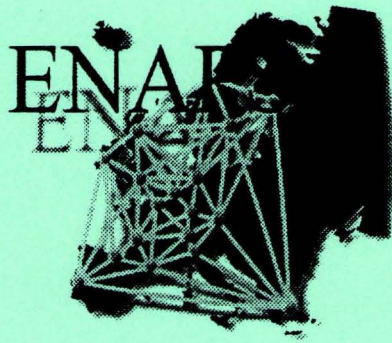
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BPR as an Improvement Technique to be Used with Benchmarking

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BPR as an Improvement Technique to be Used with Benchmarking

Reader's Guide

Who Should Read This Document

People involved in the benchmarking process. Especially people involved in the improvement of processes in enterprises. These can be agents as well as people from the organisation.

Purpose of This Document

Introduction to BPR as one of the existing improvement techniques. This is just an introduction, not a complete manual how to do BPR, for that we refer to existing literature.

Required Fore-knowledge

It is advised to you to know about general benchmarking processes before reading this document. It is also advised to know about ENAPS and the ENAPS consortium. For this information you can read the following documents of the handbook:

- Introduction to ENAPS Benchmarking;
- The ENAPS Methodology.

Summary

Business Process Reengineering (BPR) is one improvement technique that is mentioned often with benchmarking. It is almost the opposite of Total Quality Management, which is described in another handbook document.

In BPR, the aim is to forget how the enterprise works at the moment and start from scratch to redesign the process(es). This implies radical changes. The reengineered processes should be simpler and much more efficient.

The combination of a strategic alignment with central processes, Reengineering and Benchmarking are tools which supports each enterprise effectively in the process of continually improving their performance.

Some succes factors for BPR are:

- choose appropriate improvement parameters and establish quantitative objectives;

- create an action plan with activities, responsibilities and due dates;

- effective project management and involvement of the right people;

- thinking of the entire enterprise, so outside functions, to prevent sub optimisation;

- use information technology as a catalysator;

- respond to behavioural changes as a reaction to the radical changes.

Maganelli and Kleins present a reengineering methodology which consists of five steps:

1   **Preparation**

The purpose of this step is to mobilise, organise, and energise the people who will perform reengineering.

2   **Identification**

The purpose of this step is to develop and understand a customer-oriented process model of the business.

3   **Vision**

The purpose of the third stage is to develop a process vision capable of achieving breakthrough performance.

4a   **Solution: Technical Design**

The purpose of is to specify the technical dimension of the new process.

4b   **Solution: Social Design**

The purpose of this stage is to specify the social dimension of the new process.

5   **Transformation**

The purpose of this stage is to realise the process vision by implementing the process design produced in stage 4.

Contents

Introduction

In this section we present Business process Reengineering (BPR) as an improvement technique. The aim has not been to make a handbook on how to perform a reengineering, but introduce the methodology as an option to improvement next to TQM tools. One does not necessary exclude the other, but while TQM uses continuos improvements, BPR aims to redesign the value-adding processes, in order to reduce the non-value adding work.

The goal of BPR is to gain a competitive advantage. In order to do that it is important to understand customer needs, have solid data about your competitors and know your own company. Economic impact analyses show whether business process changes will improve the competitive position. Potential financial impact is a key consideration for dramatic change.

Business Process Reengineering is based on the enterprises forgetting what they know about what they know about running a business- most of it is wrong. The reason to this, according to Hammer & Champy is that the function based organisation no longer is appropriate for today's market and the rapid development of the information technology. A gap has occurred between technology development and its practical utilisation. In order to take full advantage of the new technology the companies have to operate in a more radical way.

Hammer & Champy believe that there are three strong forces that influences the enterprises to enter unknown fields. These forces are customers, competition and change, and these forces influence the companies both alone and in combination with each other. The forces are by no means new, but they have changed dramatically.

Hammer & Champy believe that reengineering is the road to improvement. Reengineering means to start over, and that is extremely important to start over from zero, instead of trying to improve on an already existing system. The keywords in reengineering is fundamental, radical, dramatic, and process.

- The assumptions questioned should be fundamental to the enterprise.

- Radical scope of change.

- A reengineering process should aim for dramatically improvement goals. Reengineering does not have much in common with continuos improvement. If the enterprise aims for a 5-10% improvement they should use another methodology than reengineering.

- The reengineering should be process oriented.

According to Hammer and Champy, reengineered processes are designed to be simpler than those they replace. Several jobs might be combined into one and the number of checks and controls reduced. Frequently the result is that work is performed where it makes most sense, and workers can make more decisions themselves. Often, a new hybrid of centralised and decentralised operations is created. New information technology (such as, knowledge-based, expert systems or sophisticated telecommunications equipment) is frequently employed in the design of these processes.

Carr and Johansson describe Process Focus, Radical Change and Dramatic Improvement as the pillars of BPR, with competitiveness as the motivation. In order to succeed the BPR-process should be firmly grounded on risk- and change management.

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      Competitiveness
   ┌─────────────────────────────┐
   │ Business Process Reengineering │
   └─────────────────────────────┘
   │  │        │         │        │
   │ Process   Radical  Dramatic  │
   │ Focus     Change   improvement│
   │  │        │         │        │
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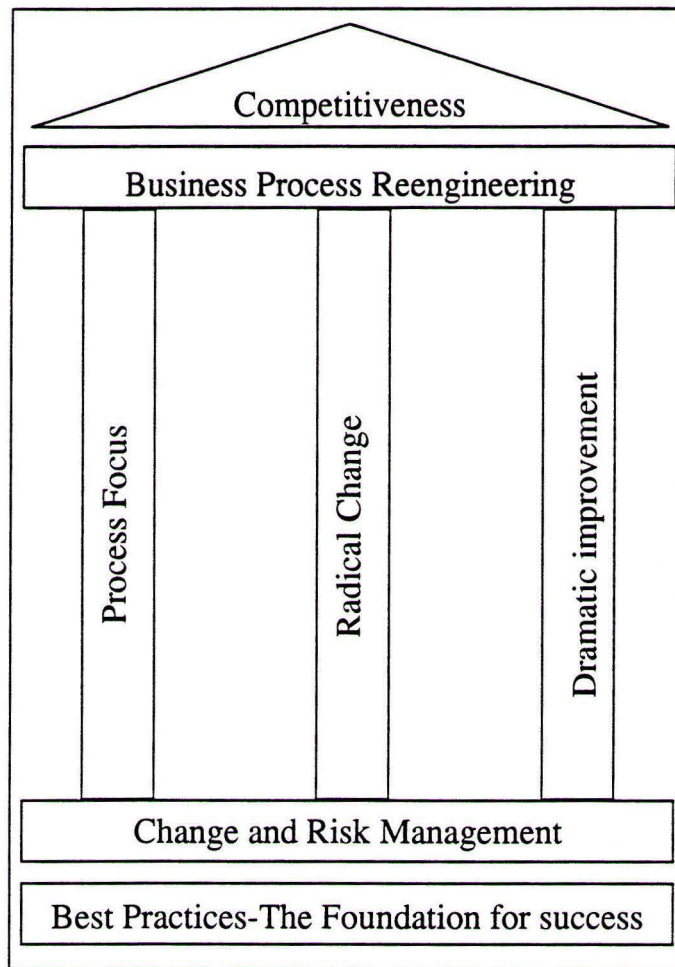
BPR and Benchmarking

Far-sighted enterprises have always been used to collect information about competitors and have always compared themselves with them. The combination of a strategic alignment with central processes, Reengineering and Benchmarking are tools which supports each enterprise effectively in the process of continually improving their performance.

Market changes are reflected in constantly modified objectives. A well-directed benchmarking supplies the standard values to attain, Reengineering initiates the accomplishment of the objectives by setting up new business processes. The business process indicates the improvements. At the same time it represents the initial position for the next restructuring process.

The Reengineering Process

- Management. It is extremely important that the employees feels enthusiastic about the reengineeringprocess. A good manager is described by being able to make people want to do the same as himself, instead of making them do what he wants. The leader must also go in front in risky situations, and let his employees know that it is better to try and fail, than never to try at all. To succeed in the reengineering process Hammer and Champy feels it might be strategic to start with an uncomplicated process, and use this a good example as motivation. It is also good to include pronounced skilful employees in the reengineeringteam. This sends the message of high priority and it gives an incentive to become a team member.

- Processes. After the firms processes are described it is time to decide which processes should be reengineered and in which order. The three criteria's the decision should be made upon is; how the process is functioning, how much it affects customers and the chances to succeed. According to Hammer & Champy the best results come from reengineering one process at a time.

- Roles. Hammer & Champy does not give any methods as to who should perform the reengineering, but they do give some guidelines. Three of the roles that often appear in the reengineering are the manager, the process owner and the reengineeringteam.

To change the company's competitive ability does according to Hammer & Champy not mean to make the employees work harder, but to tech them to work different.

Success-factors for Reengineering

Experiences from Europe and USA indicate fundamental success-factors which can make or brake a project.

Radical improvements require dramatic goals. The most important success-factor in BPR projects is based on the choice of the appropriate improvement-parameters and the establishment of quantitative objectives that is presumed to be far more ambitious than what is thought of as attainable. The most important criteria for choosing the parameters is that the improvements should be measurable and perceptible for the customers of the process.

An action plan with activities, responsibilities, and target dates is important in order to achieve the change. Without an action plan, there will be false starts because people will not know what to do next, or how the different actions all move toward the same goal.

Getting the right people involved is important because successful BPR requires a mix of functional/technical skills and perspectives. Companies can obtain the skills they need in-house or by working with consultants. Effective project management is critical to successful BPR. Project managers should have the authority and credibility.

It is important to observe the forest, not just the trees. Thinking of the entirety is a prerequisite to succeed in Reengineering. As humans we have a tendency to seek the answers where we are used to find them. Especially we focus on our own functions or organisations instead of the entirety. Often the solution to a problem can be found in an entirely different place than we would suppose. Therefore we should avoid the temptation to sink down in profound analyses within our own domain, and rather diagnosticate every link in the value-adding-chain locking for alternative, radical solutions whom can contribute to dramatically improvements.

The Information Technology has to be utilised as a catalysator, not as concrete. Almost 90% of all utilisation in modern enterprises are spent on automation of existing routines and tasks. BPR wants to use information technology to change today's way of working. The same technology that is used to automate existing tasks can be used to render possible new processes with fantastic improvements in productivity and added value.

We must understand and handle organisations reactions to radical improvement. Reengineering involves the breakdown of power structures, territories are less definite, and the tasks change meaning. One way to handle this is to use incentives. Without incentives it is more difficult to make people change or they will only make gradual changes. Incentives include recognition and rewards, as well as individual comprehension. When incentives are used, people find a way to make the incentives pay off for them and the organisation achieves the change desired.

Methodology

Maganelli and Kleins reengineering methodology consists of five stages shown in the picture below. These stages are designed to be performed consecutively. The end of each stage represents a milestone in the reengineering project. The stages are further divided into tasks, listed below under its corresponding stages. The order in which these tasks are listed are not absolute.
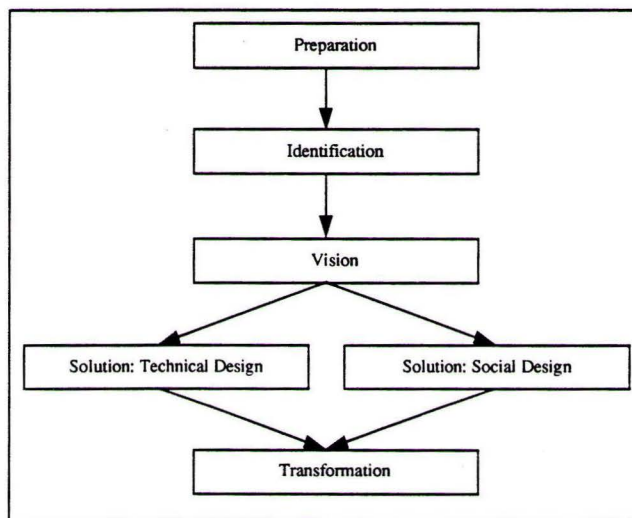
1. Preparation

The purpose of this step is to mobilise, organise, and energise the people who will perform reengineering. The preparation stage introduces a mandate for change, an organisation structure and charter for the reengineering team, and a game plan.

- Recognising the need.
- Developing executive consensus.
- Training the reengineering team.
- Planning the change.

2. Identification, questions

The purpose of this step is to develop and understand a customer-oriented process model of the business. The identification stage produces definitions of customers, as well as measures of performance and success, identification of value adding activities, a process map of organisation, resources, volumes, and frequency, and the selection of the processes to reengineer.

- Model Customers
- Define and Measure Performance.
- Define Entities
- Model Processes
- Identify Activities
- Extend Process Model
- Map Organisation
- Map Resources
- Prioritise Processes

3. Vision

The purpose of the third stage is to develop a process vision capable of achieving breakthrough performance. The vision stage produces identification of current process elements such as organisations, systems, and information flow, and current process problems and issues. The vision stage also produces performance, improvement opportunities and objectives, a definition of what changes are required, and a statement of the new process "vision."

- Understand Process Structure
- Understand Process Flow
- Identify Value-adding Activities
- Benchmark Performance
- Determine Performance Drivers
- Estimate Opportunity
- EnVision the Ideal (External)
- EnVision the Ideal (Internal)
- Integrate visions
- Define SubVisions

4a. Solution: Technical Design

The purpose of is to specify the technical dimension of the new process. The technical design stage produces descriptions of the technology, standards, procedures, systems, and controls employed by the technology, standards, procedures, systems, and controls

employed by the reengineered process. Together with stage 4b: Solution: Social Design, it produces design for the interaction of social and technical elements. Finally, it produces preliminary plans for systems and procedures development, procurement of hardware, software, and services, facilities enhancement, test, conversion, and deployment.

- Model Entity Relationships
- Re-examine process Linkage
- Instrument and Informate
- Consolidate Interfaces and Information
- Redefine Alternatives
- Relocate and Retime Controls
- Modularise
- Specify Deployment
- Apply Technology
- Plan Implementation

4b. Solution: Social Design

The purpose of this stage is to specify the social dimension of the new process. The Social Design Stage produces descriptions of the organisation, staffing, jobs, careerpaths, and incentives employed by the reengineering process. Together with step 4b it produces design for the interaction of social and technical elements. Finally, it produces preliminary plans for recruitment, education, training, reorganisation, and redeployment of personnel.

- Empower Customer, Contact personnel, Identify job Characteristic Clusters
- Define Jobs/Teams
- Define Management Structure
- Redraw Organisational Boundaries
- Specify Job Changes
- Design Career Paths
- Define Transitional Organisation
- Design Change Management Program
- Design Incentive
- Plan Implementation

5. Transformation

The purpose of this stage is to realise the process vision by implementing the process design produced in stage 4. The transformation stage produces pilot and fullproduction versions of the reengineered process and continual changes mechanisms. Depending on the specifics of the process design and on the number and nature of its subVisions, some tasks in stage 5 may be used to move from subVision to subVision.

- Complete Business System Design, Perform Technical Design

- Develop test and Rollout Plans
- Evaluate Personnel
- Construct System
- Train Staff
- Pilot New Process
- Refine and Transition
- Continuos Improvement

Other authors on BPR methodology; Adair & Murray, Johansson, McHugh, Pendlebury, & Wheeler, Morris & Brandon and Tichy & Sherman.

Differences in TQM and BPR

	TQM	BPR
Level of change	Incremental (5-20%)	Radical (at least 50%)
Starting Point	Existing Process	Clean Slate
Frequency of Change	One-time/Continuous	One-time
Time required	Short	Long
Participation	Bottom-Up	Top-Down
Typical Scope	Narrow, within functions	Broad, cross-functional
Risk	Moderate	High
Primary Enabler	Statistical Control	Information Technology
Type of Change	Cultural	Cultural/structural
Area	Everywhere	Focused
Breadth	Small process(es)	Large process(es)
Depth	Existing business process	Entire business system
Technique	Identify root causes	Break rules/paradigms
Technology	Industrial engineering	Innovation/change management
Theme	Eliminate waste/variation	Information Technology as a key enabler/leveler

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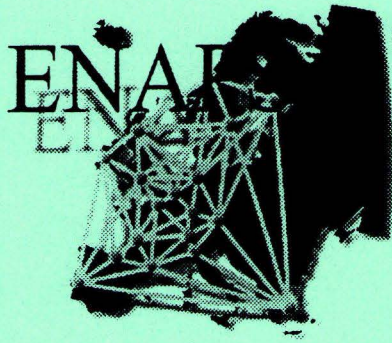
European
Network for
Advanced
Performance
Studies

Total Quality Management

TQM as an Improvement Technique to be Used with Benchmarking

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Reader's Guide

Who Should Read This Document

People involved in the benchmarking process. Especially people involved in the improvement of processes in enterprises. These can be agents as well as people from the organisation.

Purpose of This Document

Introduction to TQM as one of the existing improvement techniques. This is just an introduction, not a complete manual how to do Continuous Improvement, for that we refer to existing literature. It just gives you some tools to work with

Required Fore-knowledge

It is advised to you to know about general benchmarking processes before reading this document. It is also advised to know about ENAPS and the ENAPS consortium. For this information you can read the following documents of the handbook:

- Introduction to ENAPS Benchmarking;

- The ENAPS Methodology.

Summary

Total Quality Management (BPR) is one improvement technique that is mentioned often with benchmarking. It is almost the opposite of Business Process Reengineering, which is described in another handbook document.

Several tools are identified for continuous improvement. Two groups are distinguished:

- Simple Methods

- Advanced Methods

For a more detailed description, you can read a lot of literature on this subject that is available.

Contents

Introduction

PI's are no goal, but a mean to an end. Implementation is sensible only if the organisation wants to perform "continuous improvement". This is an essential condition, because it guaranties that information presented as PI's will indeed be used. It is also important with top management involvement. Here we present tools that can be used to perform continuous improvement.

Which improvement techniques are available?

The Memory Jogger has a Technique Selection Guide which is useful when selecting what technique to use in order to solve a certain problem.

Decide which problem will be addressed first (or next).	Flowchart Check Sheet Pareto Chart Brainstorming
Arrive at a statement that describes the problem in terms of what it is specifically, where it occurs, when it happens, and its extent.	Check Sheet Pareto Chart Histogram Stratification
Develop a complete picture of all the possible causes of the problem.	Check Sheet Ishikawa Diagram Brainstorming
Agree on the basic cause(s) of the problem.	Check sheet Pareto Chart Scatter Diagram Brainstorming
Develop an effective and implementable solution and action plan.	Brainstorming
Implement the solution and establish needed monitoring procedures and charts.	Pareto Chart Histogram Control charts Process capability Stratification

The improvement methods presented here can be divided into two groups:

- Simple methods: Seven Quality Control Tools, Seven Management Tools/Seven New Tools, brainstorming,

- Advanced methods: Design of Experiments, Statistical Process Control (SPC), Quality Function Deployment (QFD), Business Process Re-engineering (BPR), Benchmarking,

Business Process Reengineering and Benchmarking will be described in other places of the handbook and therefor not be included here.

Seven Quality Control Tools (also called Seven Tools of Quality)

Ishikawa diagram (also called Cause & Effect Diagram)

Relates causes and effects within a process

The Ishikawa diagram is used to identify, explore and display the possible causes of a specific quality problem or condition. It was developed to represent the relationship between an "effect" and all possible "causes" influencing it. The effect or problem is shown in the box on the right side of the chart and major influences or "causes" who lead to this effect are shown on the left side of the diagram.

The Ishikawa diagrams are drawn to illustrate the various causes affecting a process by sorting out and relating the causes. For every effect there are likely to be several major categories of causes. The major causes might be summarised under four categories; people, machines, methods and materials, or (for administrative matters); Policies, procedures, people and plant. These categories are only suggestions, any major category that emerges or helps people think creatively can be used.
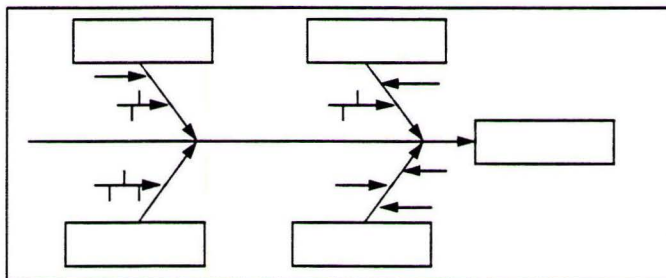
Histogram

Graphically summarises variation within a set of data for one characteristic.

Often we have a large amount of data. Then we can not represent each observation in the figure. Instead we have to divide the measurement axis into different parts, classes, and let the number of values in each class be represented by a rectangle. The area of this rectangle is made proportional the number of observations in the class. Also the sum of

the areas of all these rectangles is made equal to unity. This type of figure is called a frequency histogram.

Using the histogram is a good way to illustrate how a product or process characteristic varies. A histogram easily can be obtained using a frequency table as a basis. The big difference is that the histogram generally describes relative frequencies and not numbers of observations.
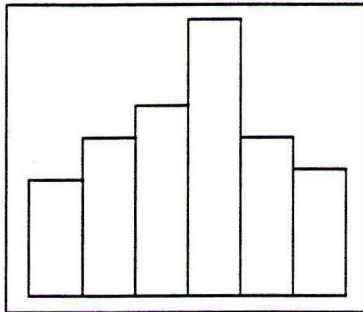

Data Collection (also called Check Sheet)

Records data on a form that readily allows interpretation of results from the form itself.

The collection of data is considered to be one of the most important steps in a program for quality improvement. Having a substantial basis for decisionmaking is vital. It is also essential that the basis interprets the topic in question. If incorrect or misleading data are collected, not even the most sophisticated methods will help in the analysis.

From the very start we have to be aware of the purpose of data collection:

- What is the quality problem?

- What facts are required to interpret the problem?

Only after these questions have been answered it is possible to move on to collecting data. When we are collecting data, we can design a table in which each observation is represented, as it appears. Every new fact is marked in the check sheet as shown below.
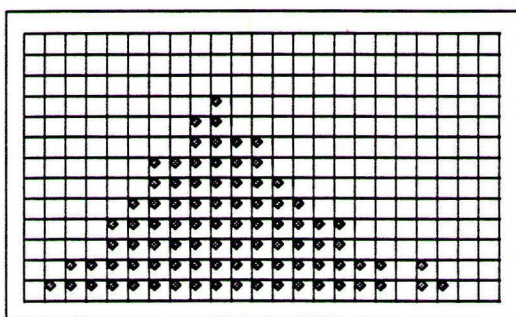
Flowchart

Displays how a process works.

A Flowchart is used to identify the actual ideal paths that any product or service follows, in order to identify variation. It is a pictorial representation which shows all the steps in a process.

Flowcharts provide excellent documentation of a program and can be a useful tool for examining how various steps in a process are related to each other. Flowcharting uses easily recognisable symbols to represent the type of processing performed. By studying these charts it is possible to uncover loopholes which are potential sources of trouble. Flowcharts can be applied to anything from the travel of an invoice to the flow of materials, to the step in making a sale or servicing a product.
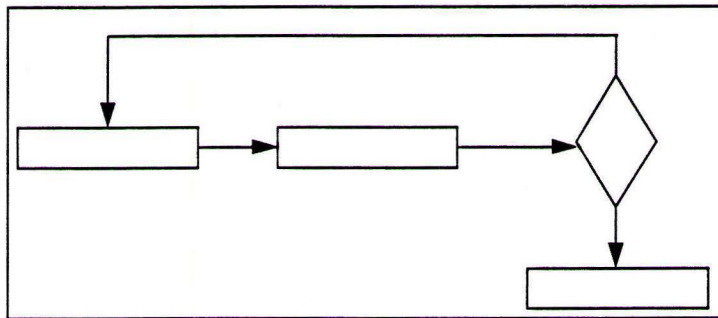
The flowchart is most widely used in problem identification in a process called imagineering. The people with important knowledge about the process come together to:

1. Draw a flowchart of what steps the process actually follows.

2. Draw a flowchart of what steps the process should follow if everything worked right.

3. Compare the two charts to find where they are different because this is where the problem arise.

Scatter Diagram

Displays relationship between two variables.

Scatter diagrams are used to study and identify the possible relationship between the changes observed in two different sets of variables. The diagram is used to test for possible cause and effect relationships. It cannot prove that one variable causes the other, but it does make it clear whether a relationship exists and the strength of that relationship.
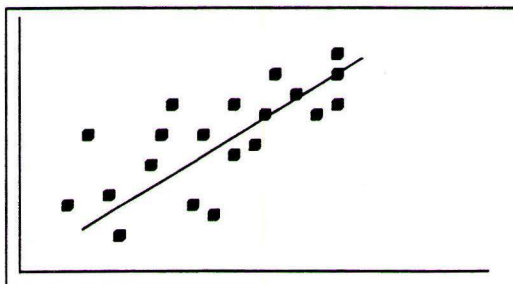
The axis of the Scatter diagram represents the two variables. And the tightness of the cluster gives a clue of the strength of the relationship between the two variables. The more the cluster resembles a straight line, the stronger the correlation.

The Scatter diagram does not predict cause and effect relationships. It only shows the strength of the relationship between two variables. The stronger the relationship, the greater the likelihood that change in one variable will affect change in the other variable. However we have to be on guard against nonsense correlation's. The two variables in the diagram might both be depending on a third variable which gives the correlation.

There are often many variables influencing the product characteristic of interest. In such cases we should make a series of Scatter plots, one diagram for each combination of the parameters, and of the product characteristic in combination with the parameters.

Control Chart

Identifies stability, capability and central tendency of a process.

A control chart is used to discover how much variability in a process is due to random variation and how much is due to unique events/individual actions in order to determine whether a process is in statistical control.

The Control Chart is a visual means to present the information about variation within a process with statistically determined upper and lower control limits (UCL and LCL) lines drawn on either sides of the process average. It can be used to monitor the changes that occur within a process, to differentiate between special and random causes of variation and to indicate when corrective actions needs to be taken. The observations are often a average at a certain moment in time This is done because an average (i.e. of five observations) is more sensitive to systematic changes than a single observation and to not cause a falls alarm if there is a measurement error or a special cause. The aim is to catch systematic variations, and try to eliminate these.
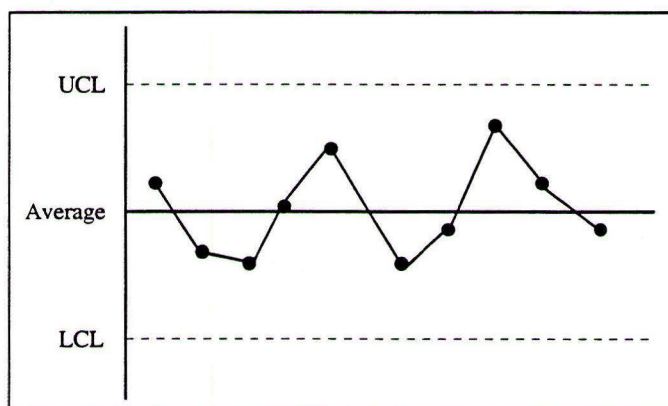
Pareto Chart

Displays frequency or cost of events to assist in determining importance.

There are several problems present in connecting with a program for quality improvements. In general only one problem can be solved at a time. The Pareto chart is then of great help when deciding in which order the problems should be attacked.
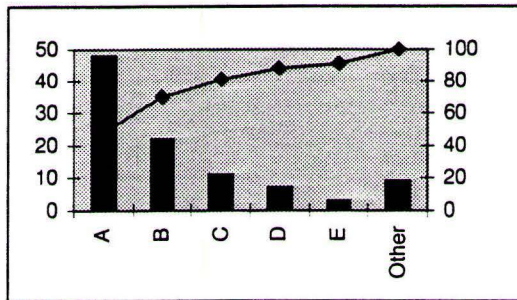
Note that in a Pareto chart:

- Each type of defect is illustrated by a rectangle whose height equals the number of defectives is also shown on the left-hand scale. Sometimes the accumulated number of defectives is also shown on the right-hand scale.

- The order between the different types of defects is such that the one with the largest frequency is placed furthest to the left. After that the number of defects decreases to the right. The smallest columns can be put together in one group called others, if each of them make to small contribution to be of any interest to the improvement process.

- A line illustrating the cumulative number of detects or fraction defectives is often, but not always, drawn.

- It is important always to state where and when data has been collected.

On the basis of the Pareto chart the most serious problem is very clearly made visible. when that problem is solved we can move on to the next. In this way each problem is focused on, one at a time.

Often the Pareto chart shows that very few problems account for a large number of the errors or the non-quality costs. Juran, therefore, speaks of "the vital few and the trivial many". The so-called 80-20 rule, which is often found in the field of business economics, states the same thing.

It is important to emphasise that it is not only the total number of errors or complaints that determines what step to take. It is also possible to draw a Pareto chart based on the experienced consequence costs of the different types of defects.

Seven Management Tools

These seven tools are used in order to achieve a systematic approach to problem analysis based on the use of verbal data. The tools are compiled from various sciences such as behavioural science, operational analysis, optimisation theory and statistics, by the Union of Japanese Scientists and Engineers.

Affinity Diagram

Clarifies problems by sorting language data according to their affinity.

The Affinity Diagram is used to allow teams to creatively generate a large number of ideas/issues and then organise natural groupings among them to understand the essence of a problem and breakthrough solutions.

The work of creating an Affinity diagram is preferably done by a group. Experience shows that a suitable group size is 6-8 persons, who have worked together before. The typical question being answered by a Affinity Diagram is **why** a certain incident occurs. The diagram is often designed by three steps. First defining the subject that is to be the basis of the collection of data. Then to write down the data the group generates in "brainstorming" on the subject. And lastly to group the related data together under subordinate headings at different levels.
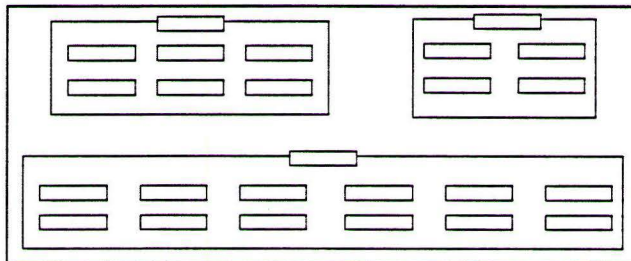

Tree Diagram (also called systematic diagram)

Maps out the full range of paths and tasks that need to be accomplished to achieve a primary goal and related sub goals.

The tree diagram provides a systematic way of breaking down an essential problem, a central idea or a need from the customer into its constituents at different levels. Unlike the affinity diagram and the relation diagram, this tool is more "goal-oriented".

The tree diagram is not efficient as a tool when used by a group. The working method resembles that described for the affinity diagram. However, it is important that the topic or problem, which is to be investigated is clearly identified. A completed diagram looks as shown in the illustration below.
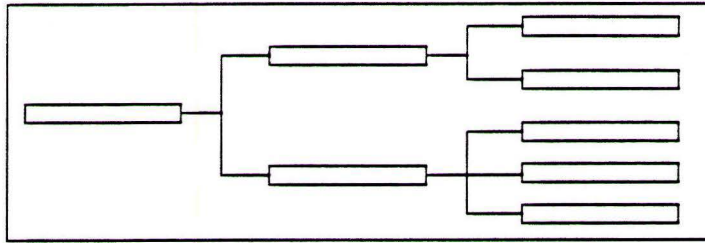
The tree diagram is for instance appropriate to use in any of the following cases:

- To break down vaguely formulated customer wishes of a product into customer wishes on a manageable level.

- When we investigate all possible parts that cause a problem.

- To investigate what short term goals have to be attained before a comprehensive goal can be reached.

Prioritisation Matrices

A combination of tree and matrix techniques to prioritise tasks, issues, etc. based on known weighted criteria.

Prioritisation Matrices are used to narrow down options through a systematic approach of comparing choices by selecting, weighting, and applying criteria. The matrix will quickly identify basic disagreements so that they may be resolved beforehand. The method forces a team to focus on the best things to do, not everything they could do, dramatically increasing the chances for success of implementation. And reduces the chances of selecting someone's "pet project".
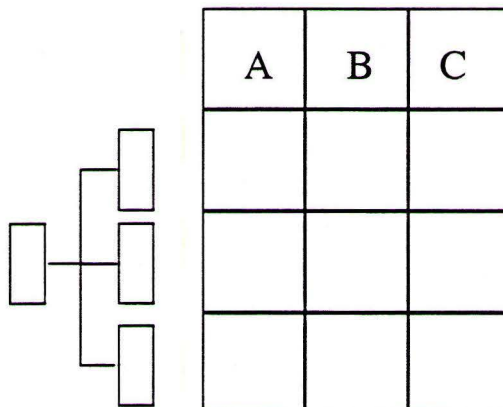
Process Decision Program Chart (PDPC)

Examines possible results of a proposed solution.

PDPC is a planning tool earlier used in operational analysis. It is used for displaying the sequence of actions and decisions needed to reach a desired result. The PDPC tool has for example the following two applications:

- When designing a new plan to achieve a desired result. The tool provides the possibility of planning for, and taking care of, the problem that may arise in the line of work.

- For "catastrophe planning" to avoid a certain undesired event. This event is written down and the process steps that lead up to it are systematically listed.
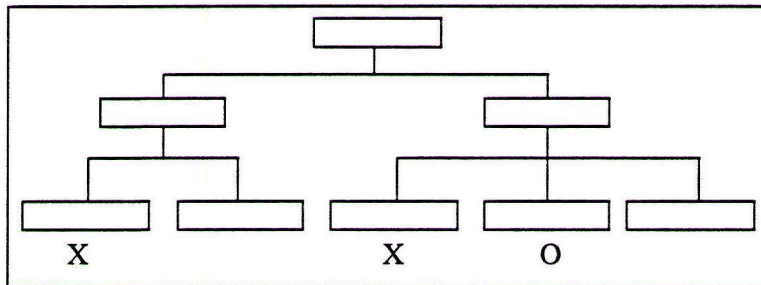
# Relation Diagram (also called Interrelationship Digraph)

Exposes related factors involved in complex, multi-variable problems.

A relation diagram illustrates the local connectors between an essential idea, a problem or a question at issue and various data. That is why there are certain similarities between relation diagrams and Ishikawa diagrams.

The data used can for example be generated using an affinity diagram. The relation diagram is mainly a logical tool as opposed to the affinity diagram, which is more creative. Examples of situations when the diagram may be useful are:

- When a topic is so complicated that relations between different ideas cannot be established through conventional reasoning.

- When the time sequence, according to which a number of steps are taken, is decisive.

- When suspicions are raised that the problem in question is exclusively a symptom of a more fundamental underlying problem.

As for affinity diagrams the work on the relation diagram should be conducted in groups. It is important that the topic (result) to be investigated has been carefully defined. The causes and the fundamental causes required for the work may have been generated, for example, from an affinity diagram or a Ishikawa diagram.
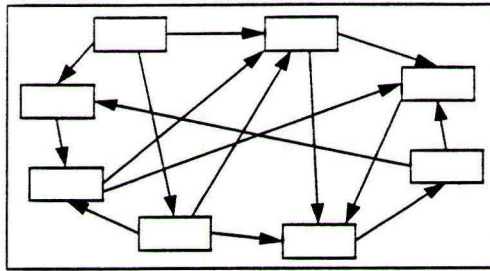
Matrix Diagram

Clarifies problems using pluralistic thinking

The matrix is a tool that helps to organise the data in order to see the coherence between the different elements. The matrix can also be used in order to choose between the possible options.

The matrix is one of the most versatile tools available. The matrix can be designed in many ways, but the most common is the matrix used in Quality Function Deployment.
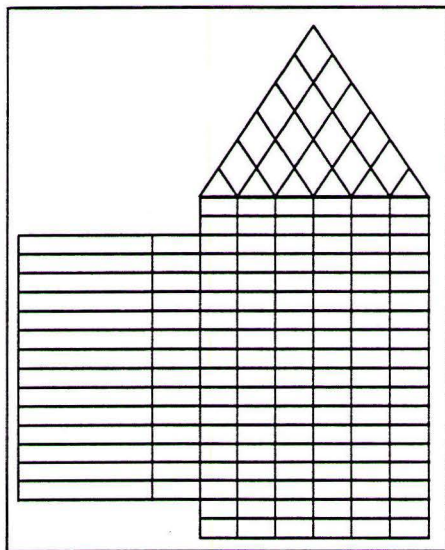

Activity Network Diagram

Used to plan the most appropriate schedule for the completion of a complex task and its related sub-tasks.

The Activity Network Diagram is used to find both the most efficient path and realistic schedule for the completion of any project by graphically showing total completion time, the necessary sequence of tasks, those tasks that can be done simultaneously, and the critical tasks to monitor. The Activity Diagram also facilitates control in the courses of work. The traditional way of executing such planning is to use a so-called Gantt-chart.

The Activity Network Diagram enables all team-members to have a realistic picture of what their piece in the plan requires. The diagram clearly shows why a team-member is critical to the overall success of the project. Unrealistic timetables will be discovered already at the planning stage.
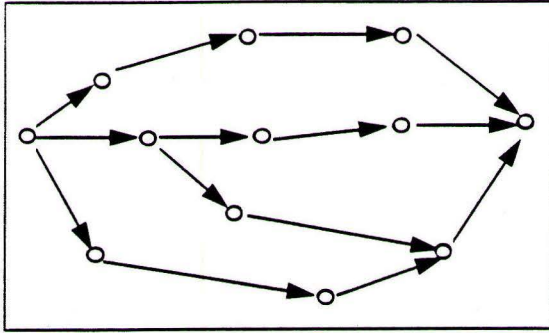
Brainstorming

Brainstorming is being used to establish a common method for a team to creatively and efficiently generate a high a high volume of ideas on any topic, by creating a process that is free of criticism and judgement. The method encourages open thinking when a team is stuck in the "same old way" of thinking, gets all team members involved and enthusiastic so that a few people do not dominate the whole group, and allows team members to build on each other's creativity while staying focused on their joint mission.

There are three common variations of brainstorming, structured, unstructured and written.

- Structured brainstorming is a process in which each team member gives ideas in turn.

- Unstructured brainstorming is a process in which team members give ideas as they come to mind.

- Written brainstorming is a process in which the team member writes down their ideas, instead of saying them out loud. (There is a obvious drawback with this variation since the group can not build on each others ideas, but it makes brainstorming possible in a large group.)

The general rules of brainstorming are listed below (written brainstorming obviously have to be somewhat different from this):

- Write down the issue to be brainstormed. Everyone should agree on it.

- Write every idea on a flipover or blackboard, to visualise the ideas to every participant.

- Record the ideas in the words of the speaker, do not interpret.

- Do it quickly, 5-15 minutes works well.

- Never criticise ideas.

- Be spontaneous, bad ideas do not exist.

- Combine ideas, the ideas do not belong to individual members, but to the group.

The ideas are not discussed until after the set time period for the brainstorming is over, or the group decides to stop the brainstorming. Firs step of the evaluation of the ideas is to go through all ideas and choose those who are obviously good. Next step is to divide the remaining ideas into groups for a closer evaluation. After the second step the group is left with a number of ideas they decided to keep working on or develop further.

Quality Function Deployment (QFD)

Quality Function Deployment is a tool for translating the customer's voice (wants and needs) into requirements throughout the design process and manufacturing process. QFD is an outgrowth of Japanese Total Quality Control and involves all employees in an organisation in the continuous improvement effort.

QFD embodies a systematic approach for assuring that the voice of the customer drives:

- Product features and characteristics;
- Product technical specifications;
- Process technical specifications.

QFD, often called the "house of quality", utilises a series of matrices to identify relationships and correlation's of the "what's" and "how's" of customer requirements (i.e., technical specifications for each stage of the production process, product planning, engineering, manufacturing, assembly and service).

Quality Function Deployment is a planning tool and a prevention methodology. QFD does the following:

- Assures that al significant requirements are identified and remembered.
- Identifies conflicting requirements (requiring optimisation) and critical characteristics.
- Identifies what is not important or critical, leading to potential cost reduction and resource savings.
- Provides the linkage allowing everyone in the company to relate his/her work to the satisfaction of the ultimate user, the buying customer.

Statistical Process Control (SPC)

The purpose of statistical Process Control is to find as many sources of variation as possible and then eliminate them. When a stable process with small variation is achieved, the target is to maintain or, if possible, improve the process even further. In these cases it is often not possible to make improvements by eliminating sources of variation. Instead, a creative change in the process structure is needed.

The total variation of a process is often dependent on several more or less independent contributors. The variance of the total variation is then the sum of variances of the different contributions

It is important to remember that a process which is in control does not necessarily mean that it is within your satisfaction. It only means that the process is consistent, but not always within the specified limits of the process. The specifications describe the perceived need, and the control limits are what the process can do consistently.

Process Capability can be used in order to determine if the process, given its natural variation is capable of meeting established specifications.

According to Bergman and Klefsjö every process, a manufacturing process as well as any other type of process, produces more or less varying results. Behind this variation there is an extensive system of causes. If enough information about the process is acquired, it is

often possible to distinguish and identify some of the sources of variation. The next step is to eliminate these causes, when this is suitable from a quality and cost point of view.

Examples of causes of variation in a manufacturing process can be in bearings or spindles, vibrations, varying lighting conditions, inhomogeneous materials etc. In a service process, information uncertainties and individual differences are important sources of variation. Since in each situation there are often many various causes of variation, it can be hard to identify the contribution of the individuals cause. If, on the other hand, there is a mal-adjusted machine, tool wear or defect in material lots, these causes may contribute so much to the variation that they become assignable causes, i.e. they can be identified and separated from the general noise. The other causes contributing to the noise are in general called common causes.

The purpose of statistical, Process Control is to find as many sources of variation as possible and then eliminate them. When a stable process with small variation is achieved, the target is to maintain or, if possible , improve the process even further. In these cases it is often not possible to make improvements by eliminating sources of variation. Instead, a creative change in the process structure is needed.

Design of experiments

Design of experiments is a statistical based methodology developed in order to solve complex problems in development and production with many variables and interaction between variables affects the final result. Design of experiments should be used in two circumstances:

- With production processes that have unacceptable fault rates or quality differences.

- With new products or production processes. Design of experiments are here used in order to prevent chronicle quality problems that occur during production.

The intention with the experiments are:

- Identification of the most important variables. These can be related to product, process, materials or components

- Separation of the most important variables. The number should not exceed four.

- Reduction of the variation of the most important variables, including effects from interaction.

Elements for Success in Total Quality Management

This list is taken from General Motors compendium Highlights of Total Quality Management Philosophies & Applications. The list is offered as a consensus view of leading quality proponents and practitioners.

- The TQM process is customer-driven, goal oriented, and created accountability in the strategic business plan.

- Leadership and commitment to TQM is a top priority of senior management.

- Through example, management is a consistent champion of the TQM process.

- All individuals, processes, and systems-both internal and external- are involved in the quality plan.

- The TQM process develops people, drives out fear, and removes barriers to productivity.

- Personal change comes before organizational change.

- Teamwork and technology are balanced and continually refined.

- Communication is timely, simple and understandable.

- Training and education are available and effective.

- Recognition and celebration.

- Change is anticipated and well managed in organizational systems.

- Measurement and information systems provide useful, uniform information for timely analysis.

- Critical measures of success encompass quality, reliability, dependability, performance, cost, delivery, safety and customer satisfaction for the life of the product.

- Statistical thinking (management by facts) is evident in processes and systems.

- Sources of waste are identified, understood and eliminated.

- TQM is treated as a continuos process.

- An attitude of continuos improvement is directed toward all processes, products and services.

- Strategic planning and Benchmarking are used as tools to ensure continuos improvement of processes, products and services.

- Customer satisfaction drives and permeates the entire process.

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