

"Reduced Procurement Cycle"

ABB Lummus Global B.V.

The Hague

GRADUATION REPORT

Oil & Gas

Petrochemicals

Refining

ABB

Section: **Mechanical Engineering**
Specialisation: **Technical Commercial Engineer**
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Hogeschool

recht

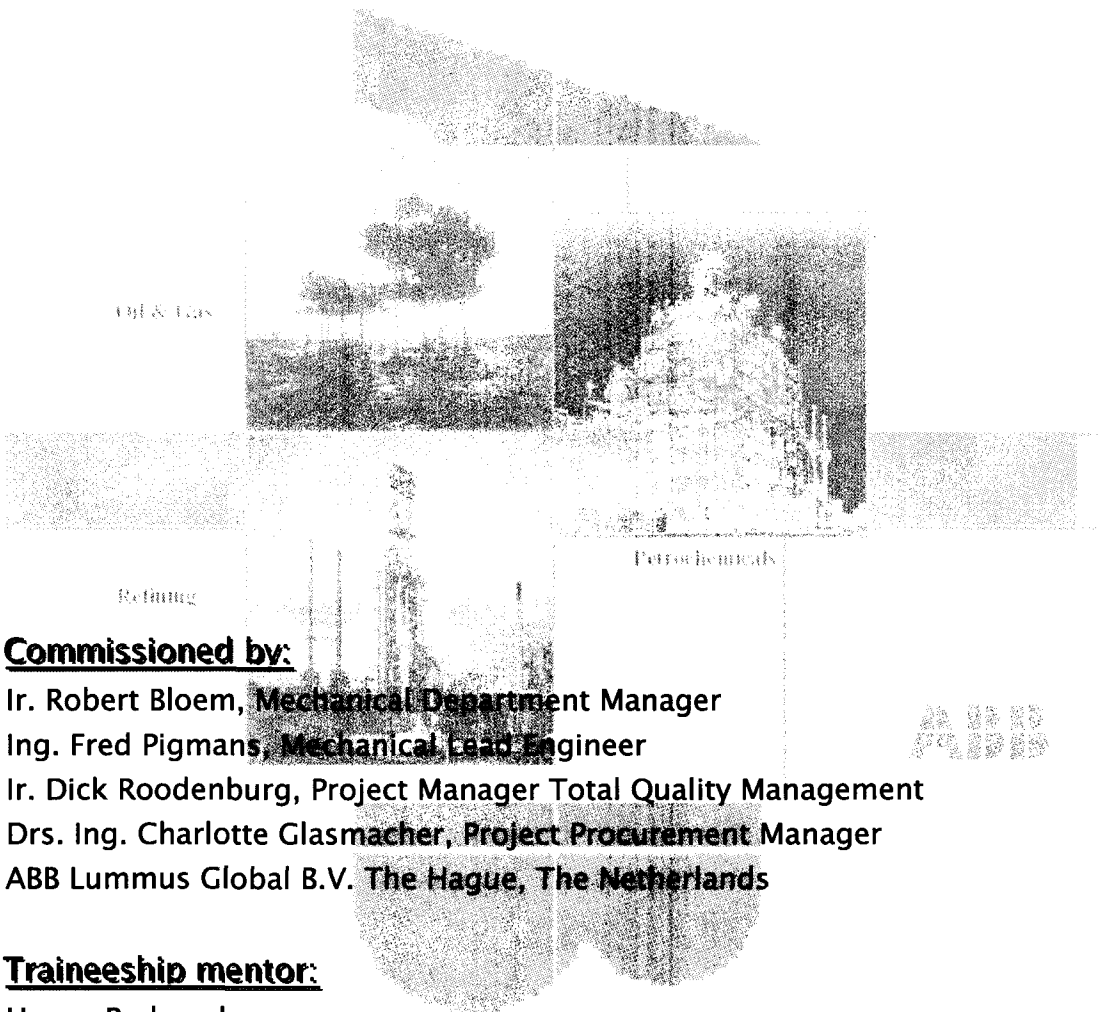
Mediatheek HvU



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“Reduced Procurement Cycle”

ABB LUMMUS GLOBAL



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I Summary

History

The subject of this graduation assignment is “Reduced Procurement Cycle”. This subject was chosen because a well-known engineering firm like ABB Lummus Global B.V. (LGN) always tries to improve their internal work processes. The primary goal of the investigation is to reduce the procurement cycle, meaning that the total time required purchasing equipment needs to be reduced. Secondly LGN would like to lower the amount of spent Man-hours. Both mentioned aims are inherent on costs.

In the past years LGN is revising the internal work processes. Within these thoughts the “Reduced Procurement Cycle” is an important part. The procurement cycle is very time consuming, so it is interesting to investigate if it is possible to make some improvements.

Problem definition

The problem definition is based on the fact that for certain projects the total purchase time is too long, which causes schedule and budget constraints.

Current position

In recent years the insight in the procurement cycle has changed and led to the plan to conduct an investigation with the primary goal to reduce the procurement cycle. This is the first time that such an investigation is performed. Especially the fact that time durations are combined with activities in the cycle. This gives a special dimension to the project.

The departments that are involved within the assignment are mainly mechanical and procurement. These are the departments who are actively purchasing equipment. Other departments are sometimes mentioned because they are also important for the realization of the final product but isn't in the scope of the assignment.

In the near future LGN plans to perform more of these investigations. It gives a clear view of how efficient LGN is working. There are more departments where this way of investigation can be applied.

Assignment

The assignment given by LGN is named “Reduced Procurement Cycle”. It shall be investigated in which ways engineering and procurement can reduce their “cycle times” between the issue of the inquiry and order placement.

This includes investigation of the cycle time process, collection of data, drawing conclusions and making recommendations. These recommendations should be easily implemented.

Method of research

The theoretical background of the project is “Lean Engineering”, a method that investigates a whole production- or information stream. The strength of this method is that it defines the activities within a process. This gives the ability to define useless or less useful activities within the procurement cycle.

At the beginning of the assignment mainly procedures and conversation with employees from LGN were used as research. With this it was possible to get an understanding on how LGN and its departments work. With the gained information, models were made which gave an overview of the activities within the procurement processes.

Since it wasn't possible to conduct an investigation for the whole process (too less time) a selection was made for the most time consuming parts of the process. This was performed by making graphs in s spreadsheet with Man-hours and total duration times of the procurement cycles. When the selection was made, the most time consuming parts were studied, by making questionnaires that cleared up the characteristic of each activity. Models were made that illustrated the effectiveness of each activity and the time consumer. These models and questionnaires resulted in conclusions and recommendations. The research methods used for the activities mentioned in the last paragraph are based on "Lean Engineering" but are developed by LGN and the trainee.

Conclusions and recommendations are presented in chapter 7.

II Preface

This report has been written within the framework of the graduation assignment, as a component of the fourth study year of Mechanical Engineering specialisation Technical Commercial Engineer.

The main purpose of this report is to give the reader a clear understanding of why it was necessary to carry out the investigation "Reduced Procurement Cycle" and to explain how the investigation was planned and conducted, the results of investigation, the conclusions and recommendations.

The report was written primarily for the mechanical and procurement departments. Not only for management- but also for interested staff of these departments. However, the report can also be read by individuals with an interest in for improvement of intern work processes.

Text arrangement

The content of this report is segmented in well-defined sections, to give a clear view how the assignment was executed. At the beginning of the report a summary is presented, to give an overview of the whole assignment and its results. Also a list of abbreviations and definitions is provided, to give support while reading the report.

The actual report begins with an introduction, which explains the problem situation and definition briefly. This to understand the scope of the assignment. The second chapter is about the history, from the total ABB Group through the activities of LGN. Chapter three explains the department structures and activities, which is essential for the rest of the report. Chapter four and five gives an in-depth view of the problem statement and methodology applied in the research. All these chapters are written to give a firm base for the execution of the assignment.

In chapter six the assignment is performed following the "Lean Engineering" method. Chapter seven provides the results of the assignment, the Conclusions & Recommendations.

The appendices are presented in a separate report, named "General Appendix". In this report the reader can find the required information that provides a deeper understanding of the material presented in the main text.

Acknowledgements

First of all I would like to express my sincere appreciation to Ir. R.J. Bloem for his help making the internship at ABB Lummus Global B.V. a reality.

A word of thanks to my company supervisors Ing. Fred Pigmans, Ir. Dick Roodenburg and Drs. Ing. Charlotte Glasmacher for providing the necessary guidance, information and feedback for both the project and report. They were always available to assist me and to answer my questions.

My thanks also extend to my colleagues of the static department, who helped me on daily basis. It was a positive experience working with LGN, which gave me the opportunity to

conduct my assignment in freedom. The transparency of the company was a big advantage during the execution of the assignment.

Finally I would like to thank H. Rademaker, my trainee mentor for his assistance during the traineeship and Drs. Ing. P. Luyten for helping me during the preparation of my graduation project.

Jan-Hein van den Brink
The Hague, May 2005

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VI List of abbreviations

Abbreviation	Description
ABB	Asea Brown Boveri
CIM	Continual Improvement Measurement
EPC	Engineering, Procurement and Construction
FEED	Front End Engineering & Design
HE	Heat exchanger
I-Pacs	Intranet - Project Activity Control System
MEG	Mono Ethyl Glycol
PO	Purchase Order
POR	Purchase Order Requisition
REV	Revision
RPSR	Requisition and Purchase order Status Report
TBE	Technical Bid Evaluation

VII List of definitions

Term	Definition
Added Value	Any step that changes the characteristic of a product or service and brings it closer to the client requirements.
Civil/Structural	Civil/Structural utilizes all the foundational and structural compartments of the plant e.g. foundation for column, pipe-rack and control rooms, platforms on columns
I Know	LGN's database which provides ready access to all relevant knowledge relating to the management and execution of projects, from Company policies to working forms, in order to maximize efficiency.
Inquiry Requisition	Invitation for bid.
I-Pacs	It is a system to measure the progress of a project. This will be done in percentages of total estimate workload. The system is chosen because it is possible to compare the completed work with the allocated amount of working hours
Marian	The procurement department uses a material management system to streamline and make material control more efficient. This system is named Marian.
Necessary Action	Any work carried out which is necessary under current conditions, but does not increase product or service value.
Piping	Piping is the department that takes care of the design of all connections between all sorts of equipment.
(Pure) Waste	All other meaningless non-essential activities.
Rotating	This sub-department is responsible for refinery services of: Compressors, Expanders, Turbines, Engines, Pumps, Agitators, Extruders, Centrifuges, Vacuum Pump Systems, Refrigeration (Compression) Systems, Generator Sets
RPSR Data system	Requisition and purchase order status report. List with scheduled/planned and actual time spent on a requisition up to the order placement.
Special	This sub-department is responsible for: package units, Mechanical handling, HVAC (Heating, Ventilation and Air Conditioning) duty Spec, Flares, Heaters & Boilers, Cooling towers, Solids handling, Fire fighting, Painting & Insulation, Subcontracts, Equipment list.
Static	This sub-department is responsible for: reactors, Heat Exchangers (HE), Air-cooled HE's, Towers & Internals, Vessels, Process filters, Tanks & Spheres.

1 Introduction

This report will describe the complete process of the assignment “Reduced Procurement Cycle” from collecting information up to results of this assignment.

2 The history of ABB

2.1 The ABB Group

Asea Brown Boveri (ABB) is a global company, which is active and operating in over 100 countries, providing several products and services in the area of power and automation technologies for different branches of industry. ABB was established in 1988, when the Swedish company Asea and the Swiss company Brown Boveri & Cie merged to form Asea Brown Boveri Ltd, one of the largest electrical engineering companies in the world. As shown in the figure below, ABB is divided into two divisions. The ABB Group employs more than 120.000 people and has worldwide revenues totalling USD 18.8 billion in 2003.

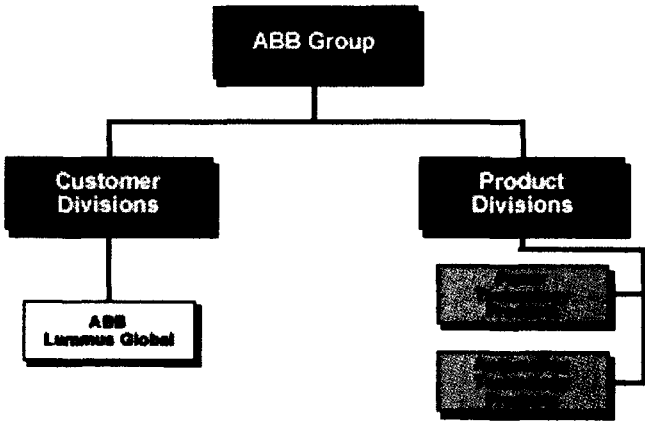


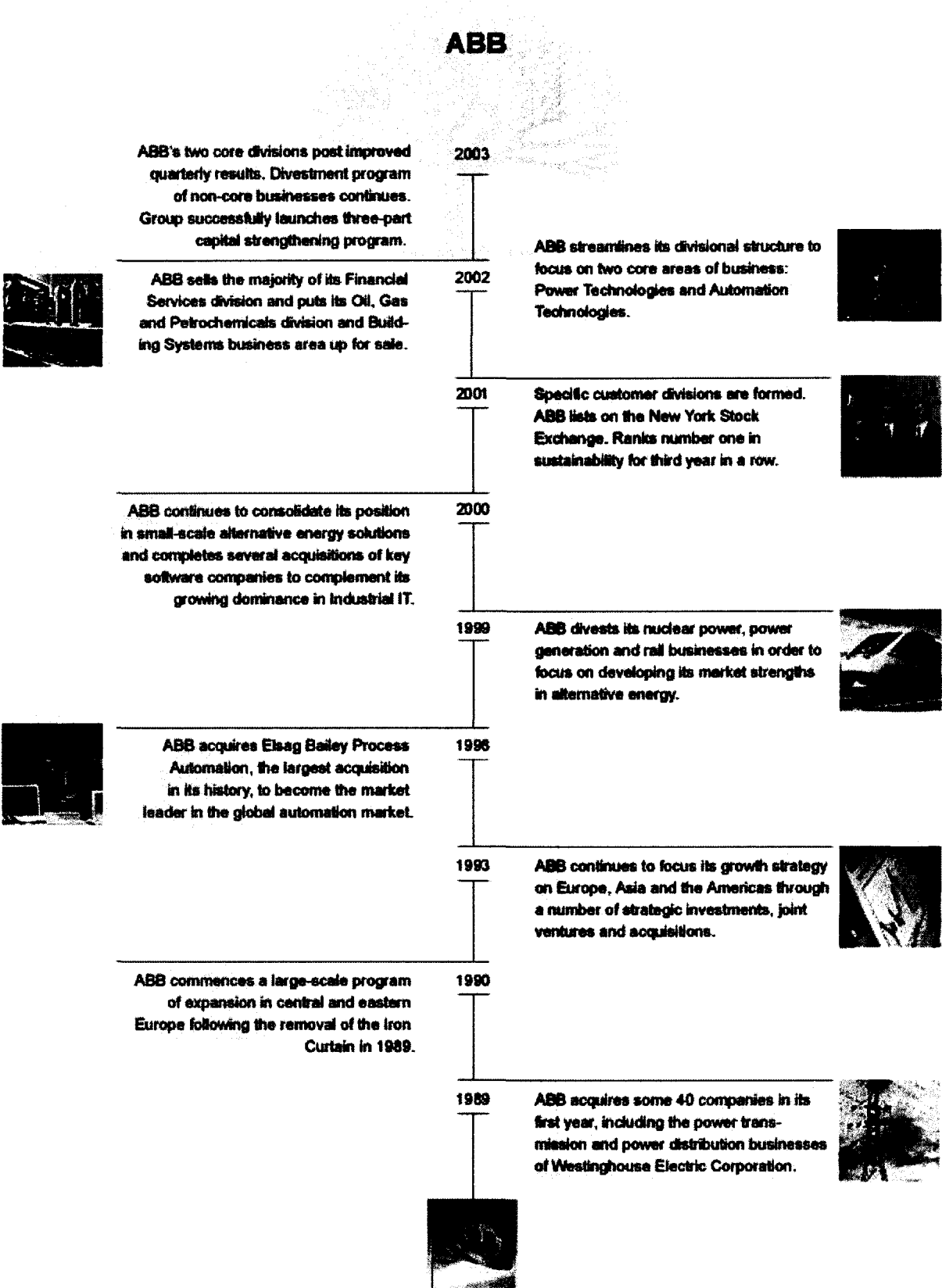
Figure 1: The ABB group divisions

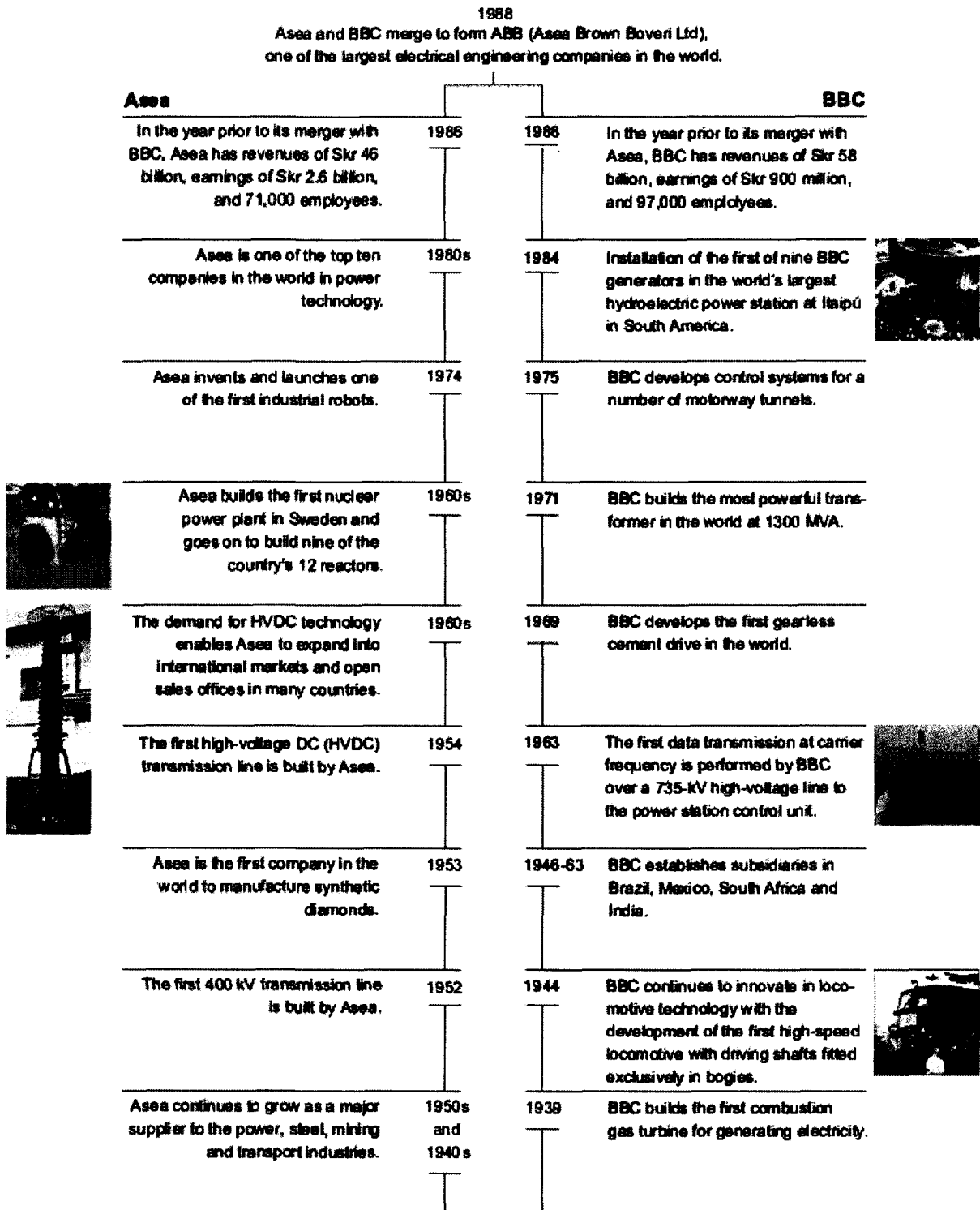
The history of ABB goes dates from to the late nineteenth century, and is a long and illustrious record of innovation and technological leadership in many industries.

Having helped countries all over the world to build, develop and maintain their infrastructures, ABB has in recent years gone over from large-scale solutions to alternative energy and the advanced products and technologies in power and automation that constitute its Industrial IT offering.

In the following figure it is possible to see a few of the many innovations that ABB has brought to the world in the past 120 years.

ABB





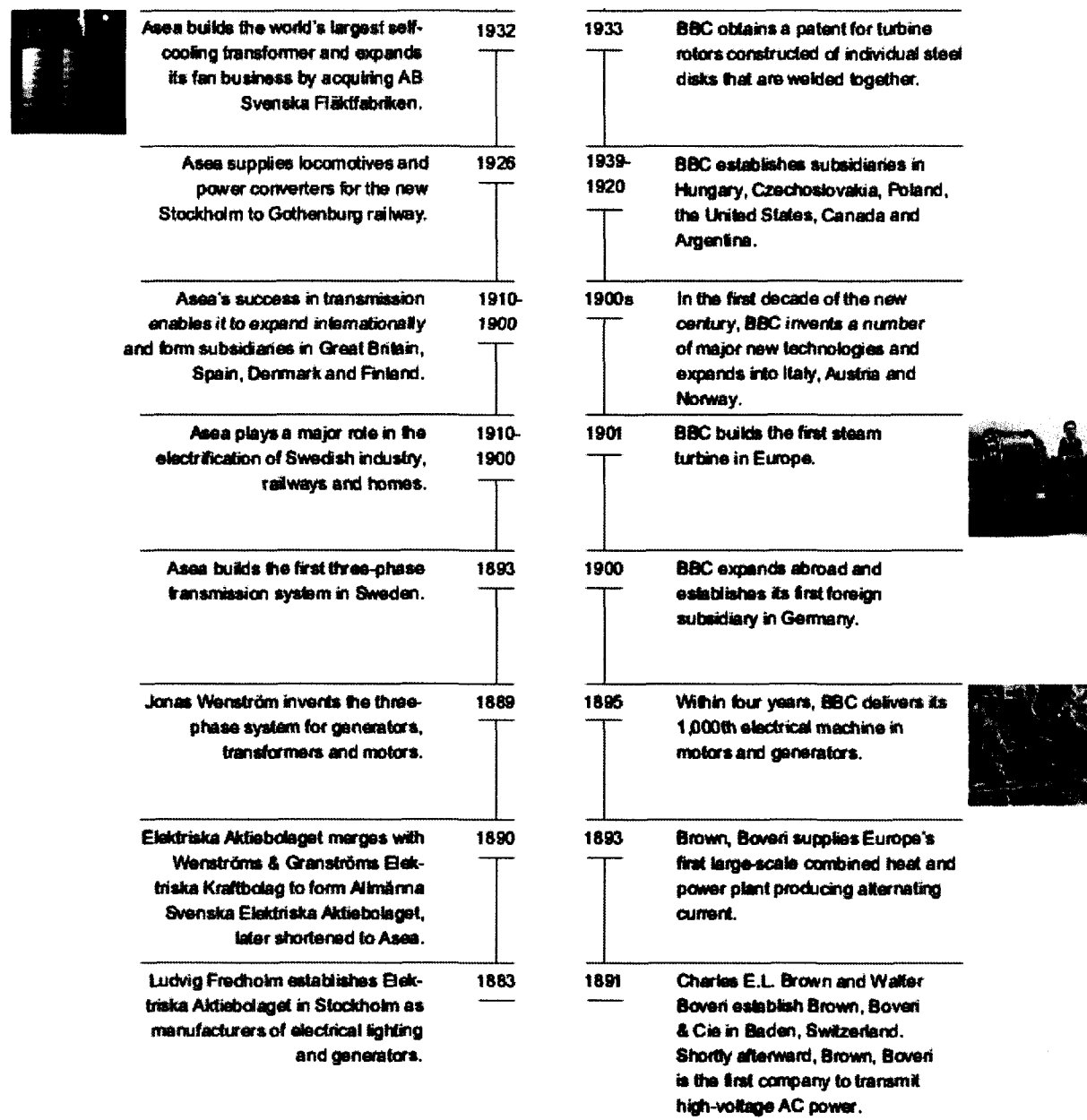


Figure 2: Timeline ABB

2.2 ABB Lummus Global

ABB Lummus Global is a 100% subsidiary of the ABB Group. ABB Lummus Global is an international EPC (Engineering, Procurement and Construction) company that provides a wide range of services to the oil and gas, petroleum refining and petrochemical industries around the world.

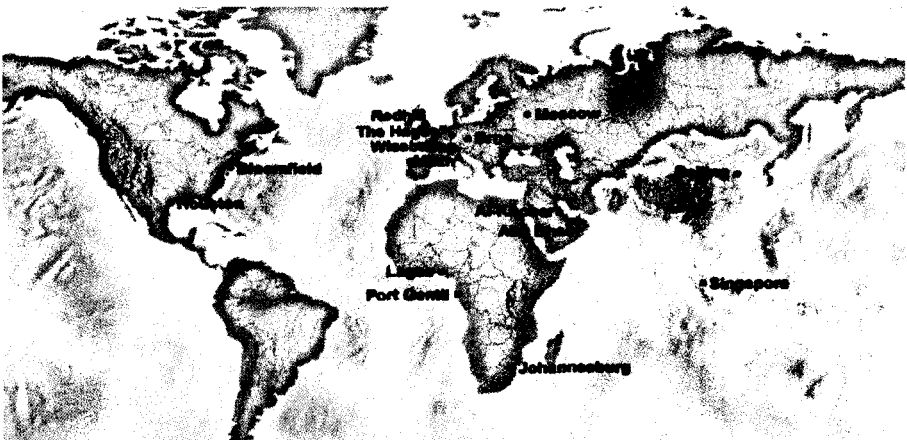


Figure 3: Locations of active ABB Lummus Global offices around the world

ABB Lummus Global offers a vast resource pool to industries in the oil and gas; chemical and petrochemical; and refining sectors, which comprises of; various technical disciplines, project management and project control, together with the relevant expertise for all projects. Additionally, Lummus Global provides a strong technology base of different process technologies, which are offered to clients.

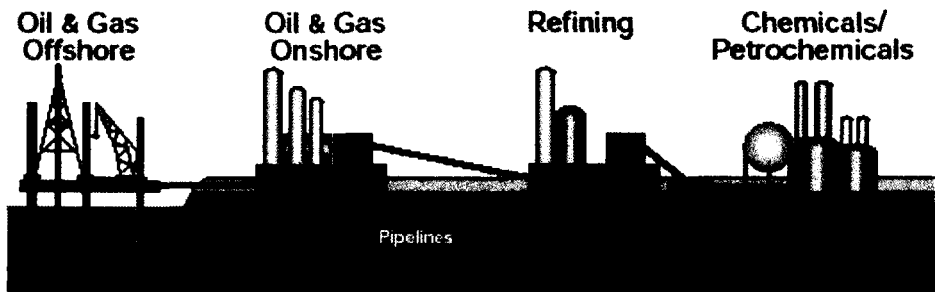


Figure 4: An illustration of the major industries ABB Lummus Global are involved in

ABB Lummus Global is also world renowned in a full range of engineering projects and services including:

- Process evaluations
- Conceptual design
- Studies
- Front End Engineering and Design (FEED) packages
- Procurement
- Construction
- Start-up/Training
- Financial service
- Project management
- Heat transfer technology
- Detailed engineering
- Project controls/Planning

The worldwide staff is approximately 3440. In nine decades, ABB Lummus Global has completed more than 6350 major projects in 70 countries. Revenues for ABB Lummus Global in 2003 were in excess of USD 2.0 billion.

2.3 ABB Lummus Global B.V.

ABB Lummus Global B.V. in The Netherlands (LGN) is a full scope engineering office of the ABB Group, located in The Hague. The office was established in 1954 and has currently a total home office staff of about 800. Since its inception, ABB Lummus Global B.V. has carried out more than 500 major EPC (Engineering, Procurement and Construction) projects throughout the world and has gained an international reputation in conceptual engineering, detail engineering, design, procurement and construction of all types of refineries, petrochemical process plants, offshore platforms and onshore gas and oil handling and production facilities.

Over the years LGN has gained worldwide experience in all the industries LGN has worked in. Recently LGN has enhanced its responsiveness to customers` needs and continuously improved the company`s capacity to offer quality performance. This has resulted in work being carried out with the most sophisticated systems, including the verification and control of projects in the most effective manner. As a result of international experience, coupled with the clients` need for accurate control of all projects variables, LGN continuously updates its planning, estimating, procurement and control methods. LGN`s experience is more than a reference list of completed projects, it is also built from the expertise of LGN`s staff with many years of service with ABB Lummus Global. Figure 5 is showing division structure of the engineering, IT (Information Technology) and procurement divisions. These departments are the most important within the project "Reduced Procurement Cycle". Other departments are not shown in this figure.

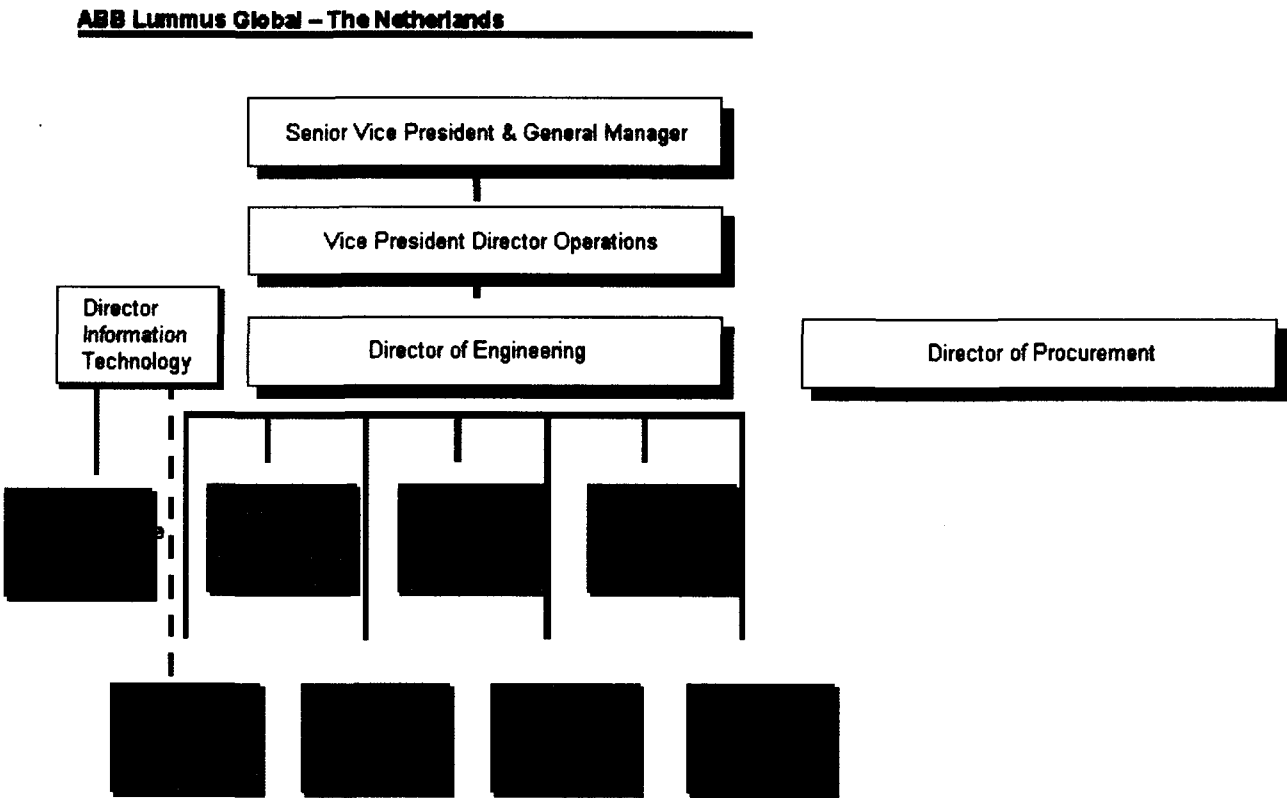


Figure 5: Part of division structure

3 Department structures

3.1 Mechanical department

The mechanical engineering department is sub-divided into the following three sections:

- 1) Static equipment
- 2) Rotating equipment
- 3) Special equipment

The mechanical equipment engineers have:

- Primary responsibility for the engineering and design activities for all equipment, including package units and special engineering services related to authority coordination, fire fighting, fire protection, painting, insulation, heating ventilation and air conditioning.
- Secondary responsibility for the procurement and construction for the above mentioned activities. For procurement this means a proactive participating role in the work processes and for construction an advisory role.

The primary project objective for mechanical is to provide the Plant Design disciplines (Piping and Civil/Structural) with proper equipment design data. The mechanical task force will assure a timely issue of the required deliverables in order to meet the requirements of the project schedule and execution plan. The mechanical engineers provide the basic designs and/or specifications for all engineering equipment. Each makes the most economical selection, taking into account the equipment cost and quality, operating and maintenance costs. The engineers prepare detailed purchase order specification and drawings. All requested vendor documents are reviewed for conformity with the specifications; technical integrity and interfaces are checked for implementation into the plant design. The engineers assist with shop inspections where necessary and performance testing of compressors, boilers and other complex equipment.

3.2 Procurement department

The specialists of the procurement department have knowledge and expertise in all aspects of procuring equipment and materials worldwide. To the projects, procurement render services on purchase orders, inspection, expediting, transportation, import and export and delivery of all necessary materials and equipment. The specialists know international markets and can take advantage of the combined purchasing leverage not only of ABB Lummus Global, but also of the entire ABB Group.

For each project, the procurement services are customized to meet the project requirements. These services may include any of the following:

- Undertake procurement on either a fixed price or cost reimbursable basis
- Procure, expedite, inspect all types of equipment, complicated packages and bulk supplies
- Develop alliances with suppliers
- Involve suppliers, at an early stage, into the LGN engineering and procurement cycle
- Combine quantities of materials and equipment of several projects worldwide to increase leverage

- Encourage continuous quality improvement in both LGN and suppliers
- Fulfil full logistic requirements for transportation of equipment and materials from the suppliers to final destination

The procurement department uses a material management system to streamline and make material control more efficient. This system is named Marian and offers the following:

- Seller data base of over 25.000 vendors, product ranges and performance experience
- Bid activities of requisitioning and commercial conditions
- Evaluation of sellers' bids on "Best Value" basis, including "Life Cycle Costs"
- Purchase Orders issue with technical specifications and commercial conditions
- Monitoring and reporting the progress of the seller.
- Shipping and tracking of materials/equipment through to destination
- Evaluating sellers performance for future projects
- Cost control of all expenses involving vendors

The procurement group has access to a global network of local inspection and expediting services, which can be allocated to plants from sellers. In addition, specialized engineers are available for witnessing activities.

4 Problem statement

In the following section the problem statement is interpreted. This is done by explaining how LGN performs projects and how each department is involved in this process. Then the assignment is defined by explaining what have to be done to make the project a success. Finally an introduction is made how to execute the assignment.

4.1 Problem definition

The main activity of LGN is to carry out EPC projects throughout the world. These projects are performed in the oil and (petro) chemical industry. The company has gained an international reputation in conceptual engineering, detail engineering, design, procurement and construction of all types of refineries, petrochemical process plants, offshore platforms and onshore gas and oil handling and production facilities.

The first step is to gain the order from the customer. Making a conceptual plan does this. In this conceptual plan, the feasibility, technical needs, contents and performance, office hours and cost estimates, planning etc. are investigated. When the client accepts this conceptual plan the actual work begins. Engineers finish the design of the equipment and evaluate with the procurement department which seller they choose. In the meantime several other departments such as: the civil/structural, piping, and instrumentation are working along. They designed; foundations, connections between equipment and the instrumental/electrical parts. Other important activities are logistics and construction. The equipment has to arrive in time on the construction area. For the construction of the facility a subcontractor is needed. All these departments and activities are supervised by LGN.

Within these types of projects the procurement cycle is one of the most important parts from the “production process”. All equipment designed by the various mechanical sub departments, needs to be acquired via procurement. This is performed in an extensive process, where the technical specifications are made and potential suppliers will be selected. Due to the technical complexity of most of the equipment, each step of the process needs to be performed with great care and quality. Each mistake/alteration made in the process can cause delays. Every delay can lead to the exceeding of schedule, which involves a cost overrun. The client may fine LGN when delays occur.

Not only is the threat of a possible claim itself important, also the general duration of the process itself. The process takes a lot of time from several departments, it can take up to 5 months till the purchase order is submitted. During this time there are a lot of “breaks” in the process. Staff that is shifting work in their planning, and sometimes to colleagues, causes this. Also a factor in these delays is contact with other departments and potential suppliers. Especially the last group takes advantage of their unique position in this specialized industry. They try to influence certain subjects into their advantage. All these developments lead to more time consuming activities, such as: Far more communication with potential suppliers/departments to get things done; start up work after breaks etc. In the first place LGN trying to improve this situation in order to save costs. Secondly to enhance the “happiness” of staff within the process. The saving of costs is dependent from the execution duration of a project and the Man-hours spent (See table 1).

Cost:	Depend on:
Cost of risk	Reducing financial risk by shortening durations
Cost of Man-hours	Reducing Man-hours by increasing efficiency.

Table 1: Costs

4.2 Assignment

The assignment given by LGN is named “Reduced Procurement Cycle”. It shall be investigated in which ways engineering and procurement can reduce their “cycle times” between the issue of the inquiry and order placement.

This includes investigation of the cycle time process, collection of data, drawing conclusions and making recommendations. These recommendations should be easily implemented and “Down to earth”. The outcome of the assignment will result in a report, written in English, which will be reviewed by LGN prior to submission to the “Hogeschool van Utrecht”.

Following this a presentation will be given to LGN management in the Dutch language. The duration of the assignment is ±3 months.

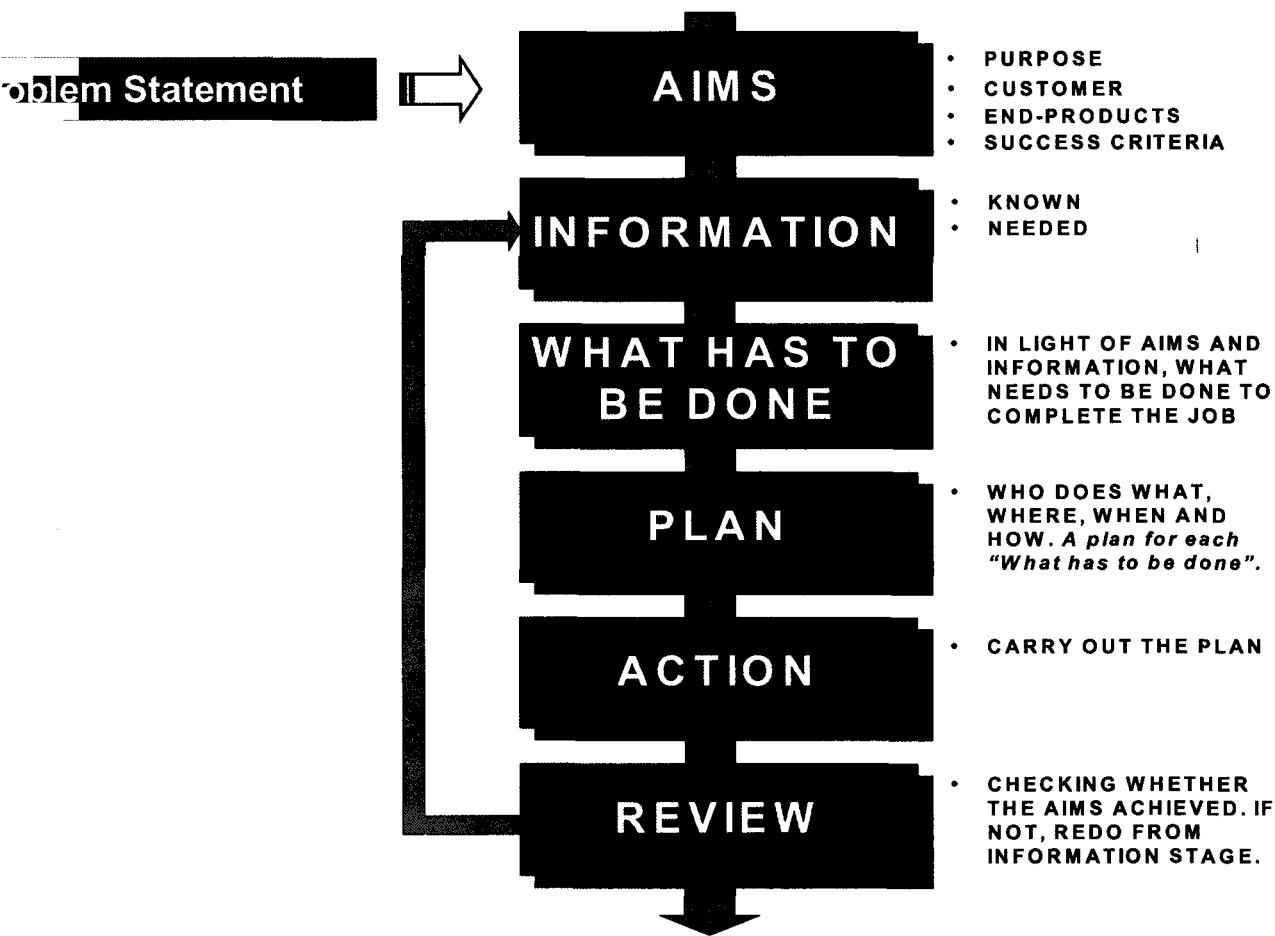
4.3 Introduction of executing the assignment

The execution of the assignment will be completed by following a clear plan. This plan starts with learning how LGN and its departments work. This can be done by reading procedures and talking to employees. The work processes, from the departments that are involved with the assignment, have to be mapped. This will be the basis of the project. Next to the mapping, times have to be allocated to the activities of the work processes. This makes clear how much time which activity takes. Then it is advisable to make a selection of which part of the process the investigation will focus on. It is difficult to investigate the complete process in such a short time. The selected parts are going to be studied in detail. Herewith figures and practical knowledge will be combined. This will lead to conclusions & recommendations.

4.4 Overall execution method

In the following section the “Problem definition” and “Assignment” will undergo a more detailed explanation. The main objective from the following method is that the “problem definition” and the “need for streamlining the procurement cycle” are coupled to the planning and execution. This generates a clear view of the assignment with its aims, planning and subjects. It is possible to describe it as a work plan/schedule.

1) Overall Execution Method



2) Problem statement

Problem definition:

■ Within the activities from LGN the purchase process is very important. A more effective process in this area will positively affect the whole work process of the company. To obtain this ideal situation the plan was formulated to analyze the so-called procurement cycle. This procurement cycle is built up out of a mechanical- & procurement work process. The cycle analysis will be done from starting Inquiry issued up to Purchase order stage. The purchase order process can be divided into three categories of work processes:

- Seller designed: The equipment is designed by the vendor.
 - In house designed: Equipment that is designed by LGN.
 - Catalogue items: Items that can be bought of the shelf.
- What is the problem? What goes wrong in the PO placement process in mechanical?
- To sort out the problem it is necessary to focus on; time, hours and quality.
- Is it too time consuming, too many man-hours, too risky in terms of quality or too risky in terms of time?
 - Is it the wrong work process altogether? → Seller design/In house design/Catalogue.
 - Not one process but 2 (mech. /procurement) → Interface problems?
 - Are the correct choices made?
 - Is the path forward clear?

Need for streamlining the procurement cycle:

■ In the recent years LGN has realized that a good functioning work process will benefit the results of the company. To obtain this situation LGN would like to analyze its purchase process. This is because it's one of the longest, most complicated and thus one of the most expensive processes. This assignment will be the first of its kind within the organization. When it proves to be successful LGN will perform more of this "investigations" in the near future. The assignment will be fulfilled with the "Lean Engineering" theory where the Value Flows will be defined with "Waste, Necessary Action and Added Value". So it is possible to streamline the process via these Value Flows. In the table 2, the definitions of these activities are explained.

Type of activity:	Definition:
Added Value	Any process that changes the characteristic of a product or service and brings it closer to the client requirements.
Necessary Action	Any work carried out which is necessary under current conditions, but does not increase product or service value.
(Pure) Waste	All other meaningless non-essential activities.

Table 2: Definitions of "Lean Engineering"

■ Answers ABB should pose to themselves are e.g.:

- Overrun in time? Why is time a problem?
- Budget overrun? Why is budget a problem?
- Lack of quality? (Changes & vendor performance) Why is quality a problem?

This should be replied to ABB during evaluation of applicable data.

3) Quadrant of Aims

Within the “Quadrant of Aims” the problem statement will undergo a more specific definition. A parallel will be drawn from the “purpose” to the “stakeholders”, “products” and “success criteria”. This gives a clear view how and who is involved with the project.

Purpose • The purpose of this investigation is to improve the purchase process. - To investigate whether we can improve the PO placement process for mechanical with respect to time (effective), quality and Man-hours (efficient).	Stakeholders •The customer will be ABB Lummus Global B.V. department “Mechanical”. •Procurement dept. •ABB Lummus Global projects. •Hogeschool van Utrecht (College in Utrecht). •Customers from LGN.
Products ▪Detailed analysis of the procurement cycle and recommendations for improvement. This will be performed in a report and a presentation. ➢A value stream map of the current processes. - Activities and purpose (budget + actual) - Time durations & man hours (budget + actual) - Recycles + external information + purpose ▪RPSR data analysis → data → information ▪List of attention areas in the process based as an analysis of the map, data, input from engineers and lessons learned. ▪Improvement ideas based on: - Making the value flow - Eliminating waste - Reducing Necessary Actions	Success criteria <i>How can we measure our achievement?</i> •Time; this can be obtained in two different possibilities. The first, to remove “waste” from the process, so the cycle can be reduced. Secondly to decrease the time that the procurement cycle is “waiting” for information, personnel etc. ➢RPSR durations go down (increased effectiveness) - Durations goes down - No missing of planned dates •Quality; the goal is to reduce the cycle, without effecting the quality of the procurement process ➢ Quality is in line with contract, minimum difference inquiry requisition/PO requisition (minimum changes on requisition log) •Costs will be reduced when the “cycle time” is shortened ➢ Man hours goes down (increased efficiency): - No overruns of allocated Man-hours on projects. - Budgets can go down in the future.

4) Information

Known information:

- Procedures, standards, schedule and budget information, relevant workflows and fact sheets, lessons learned by means of CIM's (Lessons learned system).
- Procedures; LGN 06-1905 REV. 6 and LGN 06-4600 REV.7 (See Appendix VIII).
- List the lessons learned (CIM's), if any.
- RPSR data (actual & budget).
- Budget man-hours.

Needed information:

- Also a lot of information has to be obtained in conversations/discussions with personnel from the involved sub departments from "Mechanical" (Rotating, Static, Special) and procurement.
- RPSR "information" + requisition durations (budget + actual) based on RPSR fixed points.
- Man-hour data + actual man-hours spent on req. with Mechanical and Procurement.
- Work flow req. with RPSR dates in it.
- Where to focus attention; duration/hours.
- Waste categories.
- Internal/external interfaces in the workflow chart.
- Changes.

5) Has to be done

What to do to get the job done:

- 01) Study structure of requisitions (Understand the process, talk to people)
- 02) Make "Value flow" models (For mechanical, for procurement and for special/rotating)
- 03) Define purpose and nature of value, per step in 1 or 2 sentence(s)
 - Identify & describe external information and recycles.
- 04) Calculate "Value flow" on several subjects (RPSR + Man-hours).
- 05) Make an analysis of the duration of periods.
- 06) Analyze the selected parts for:
 - Make the value flow
 - Removal of waste
 - Minimizing Necessary Actions
- 07) Make "Conclusion graphs" where conclusions & recommendations can be easily drawn from.
- 08) Conclusions & Recommendations

09) Writing report & presentation

6) Detailed planning to approach assignment within LGN

Action	What	When	How
1	Study structure of requisitions (Understand the process, talk to people)	Week 05	Reading procedures and searching on I-know for additional information.
2	Make "Value flow" models (For mechanical, for special/rotating and for procurement)	Week 06	The models will be created with information given in the procedures. After this, checking contents with personnel from involved department.
3	Define purpose and nature of value, per step in 1 or 2 sentence(s) - Identify & describe external information and recycles	Week 06 and 07	The definition can be made in association with personnel from the divisions.
4	Calculate "Value flow" on several subjects (Time + hours, budget + actual)	Week 08 and 09	This will be done with the help of RPSR program and help from the departments.
5	Make an analysis of the duration of periods.	Week 10 and 11	With this analysis a selection of most time consuming periods can be selected. Then it is possible to focus on these periods.
6	Analyze the selected parts (Asking questions).	Week 11 and 12	The information flow needs to be analyzed, by asking various questions for each activity.
7	Make "Conclusion graphs" where conclusions & recommendations can be easily drawn from.	Week 13 and 14	Make graph where all data is visually summarized.

8	Conclusions & recommendations	Week 15	Everything is now analyzed. It is possible to draw conclusions and recommendations.
9	Write report & presentation	Week 16 through 21	-

7) Action

Execute the plan:

- Perform the actions as listed in the plan.

5 Methods

5.1 Lean engineering

The ideas behind “Lean Engineering” were originally developed by Toyota’s manufacturing operations in Japan. Toyota itself spread the principles through its supply base in the 1970’s, and its distribution and sales operations in the 1980’s. After various publications the term “Lean Engineering” became very popular in the western world. This was because the publications proved that there was a significant performance gap between Japanese and western automotive industries. It became obvious that this Japanese business method used less of everything: human effort, capital investments, facilities, inventories, time, product development, parts supply and customer relations.

Type of activity:	Definition:
Added Value	Any process that changes the characteristic of a product or service and brings it closer to the client requirements.
Necessary Action	Any work carried out which is necessary under current conditions, but does not increase product or service value.
(Pure) Waste	All other meaningless non-essential activities.

Table 3: Lean thinking

The starting point is to recognise that only a small fraction of the total time and effort in any organisation actually adds value for the end customer. By clearly defining the Value for each product or service (from the end customer’s perspective), all the necessary actions or waste can be removed from the process (See table 3). For most production operations only 5% of activities add value, 35% are necessary actions and 60% add no value at all. Eliminating this waste is a great potential source of improvement in each company.

When applying the Lean Thinking theory, the organisation must view itself as just one part of an extended supply chain; it follows that it needs to think strategically beyond its own boundaries. It also contends that because value streams flow across several departments and functions within an organisation, it needs to be organised around its key value streams.

In the beginning of this section it became clear that the origin of the theory was the automotive industry. This is not the only sector or activity where it can be used. The techniques are transferable, with a little adaptation to every type of production “stream”. So it is very useful for analyzing the information streams within the assignment “Reduced Procurement Cycle”. This type of “Lean Engineering” is called Lean Office.

Within the office environment it might be shocking to realize how much waste there is in a process, from a customer’s point of view. In figure 6 an example of the progress due to Lean Office can be seen.

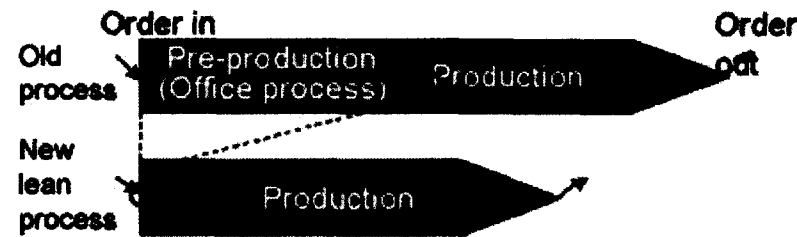


Figure 6: Lean Office
ABB Lummus Global B.V.

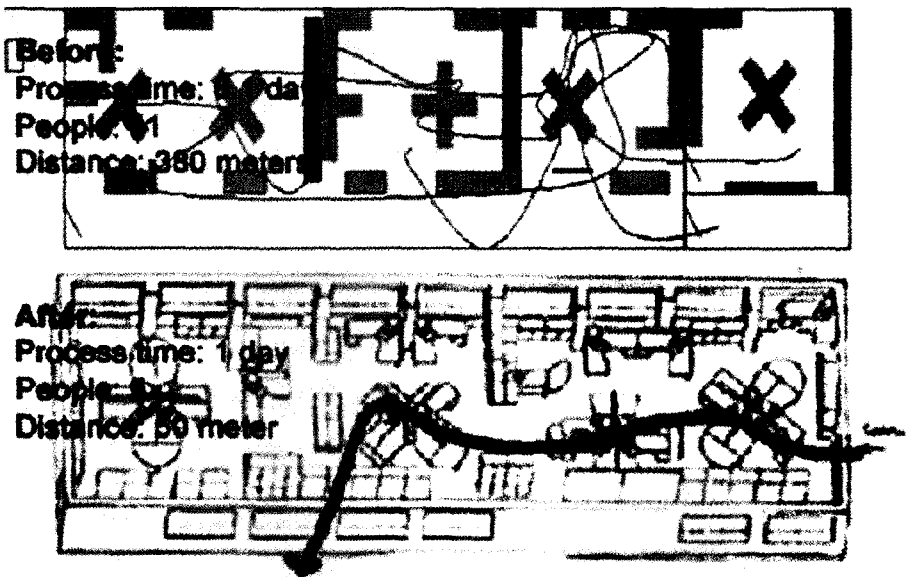


Figure 7: Example of Lean Office

In general there are a number of benefits with a Lean Office. Major order processing time reductions can be obtained while reducing costs. A lean streamlined process:

- improves overall customer service
- reduces lead times
- reduces customer complaints
- reduced office space needed with a lean office layout, that supports the flow

In the following figure the main wastes in an office environment is shown. This is notably the information stream within an office.

Waste	Definition	Example	Action in administration
Overproduction	Generate more information than the customer needs right now	More info than the customer needs More info than the next process needs Creating reports no one reads Making extra copies	Reduce work batch sizes Reduce mental Setup time: - Shorter search routines - Easy access to information - Eliminate unnecessary data - Simplify processing
Waiting	Idle time created when the material, information, people or equipment is not ready	Waiting for faxes, the system to come back up, the copy machine, customer response, a handed off file to come back	Combine work at one workstation Collocate sequential work Cross-train to balance workloads One-touch information access Cues from visibility systems
Transport	Movement of information that does not add value	Retrieving or storing files Carrying documents to and from shared equipment Taking files to another person Going to get signatures	Paperless or reduced paper processes One-stop workstations On-line suppliers
Processing itself	Efforts that create no value from the customers point of view	Creating of reports, repeated manual enter of data, use of outsourced standard and inappropriate software	Simplify - eliminate unnecessary parts Establish system of standard work Fail-safe process to eliminate rework
Inventory	More information, project, material on hand than the customer needs right now	Files waiting to be worked on Open projects Office suppliers E-mails waiting to be read Unused records in the database	Reduce batch sizes for processing Minimize checks and reviews Synchronize work flows (system for immediate prioritizing) Minimize flow interruption Create capacity to handle peak loads
Motion	Movement of people that does not add value	Searching for files Extra cliques or key strokes Clearing away files on the desk Gathering information Looking through manuals and catalogs Handling paperwork	Eliminate searching - on stop access rather than running around Organize layout with 5S principles Visual management systems
Defects	Work that contains errors, rework, mistakes or lacks something necessary	Data entry error Pricing error Missing information Missed specifications Lost records	Logical quality standards Disciplined but flexible documentation Standard work Fail-safe process

5.2 Methods developed within LGN

The Lean Office theory itself cannot be used without adaptation. To benefit from this theory, it is necessary to adjust it to the standard of LGN and to the assignment. The trainee did this with feedback from the quality department. This way a path was developed to investigate the possibility of eliminating/reducing “Necessary Actions and Waste”. This path will be used to complete the assignment. In figure 8 this path is explained in detail.

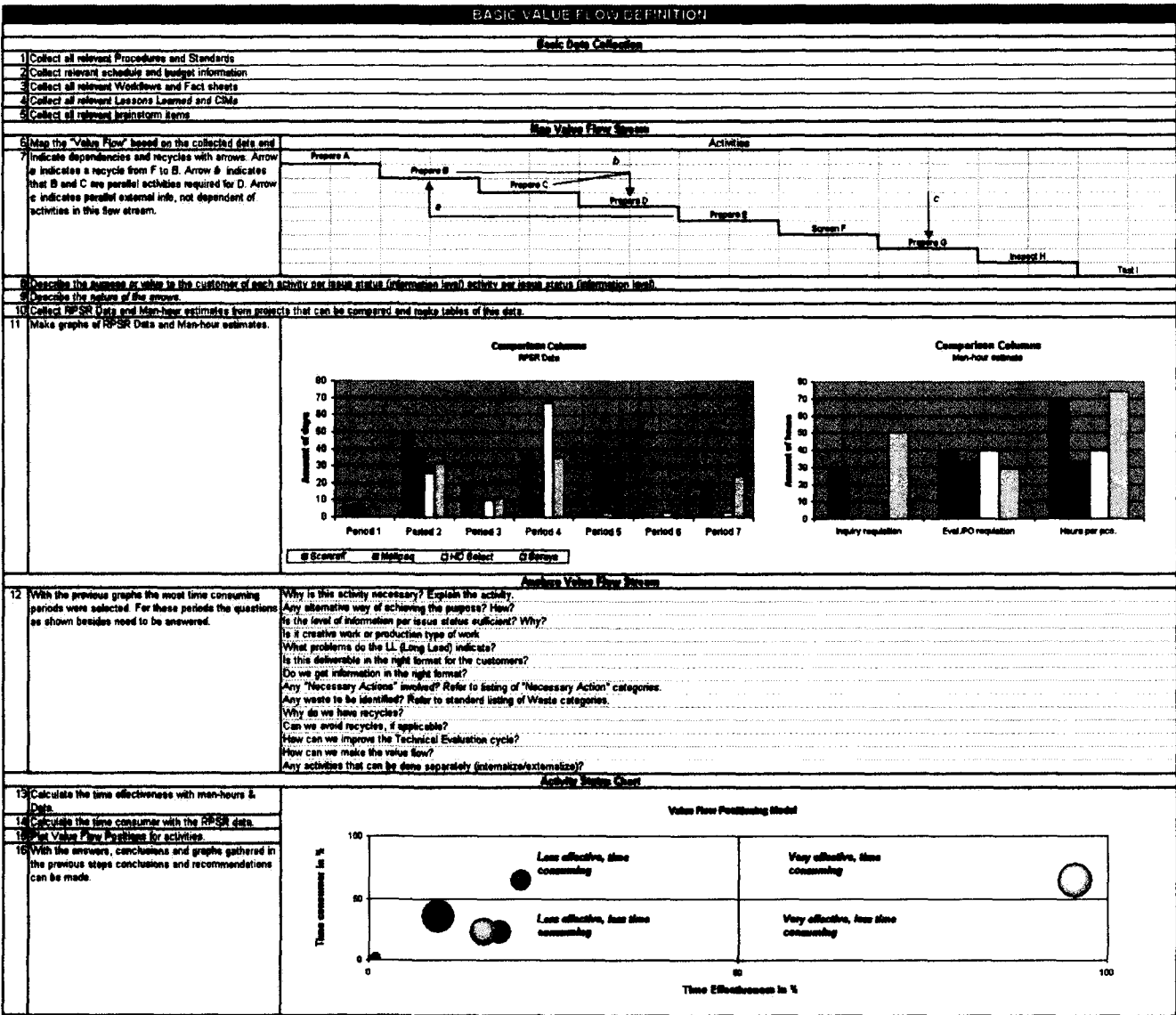


Figure 8: Basis Value Flow Definition

6 Execution of assignment

6.1 Analysis of department structures

When the project started there was little knowledge about the assignment in particular and the industry where LGN was working. So the logical first step was to investigate how the equipment was bought by the involved departments (Mechanical and Procurement). This was done by making Value Flow models for the departments. For mechanical two value flow models were made. One for the "Seller designed equipment" and one for the "In house designed equipment". These models were made the first time with the internal procedures. After that, these were reviewed in a brainstorm session with the involved departments. The brainstorm session was performed to find out whether LGN really works according to the procedures. An analysis in this way was never done within LGN, so it gave a good overall view of the processes.

The three models can be found in Appendix III. In these models all activities from inquiry requisition through issue purchase order are reflected. Additionally all information streams can be seen. Altogether a complete image is given how all purchase processes work. It is interesting to see how many activities and information streams there are. The periods that are shown above the value flow models, are going to be used/explained later in the report.

Next to the clear image these models gave, it was very useful to learn something about the industry, the vocabulary and the technical equipment. The models are an important base of the project.

The following step in the project was to describe the various steps in the processes. For each activity in the Value Flow models the purpose was described. This is important for one of the last phases of the project. The statement of each activity can be considered as: Added Value, Necessary Action or Waste. Also for the trainee it is a good support to understand the activities in the Value Flow Models. This explanation can be seen in the column "Explanation"

6.2 Collection of data

In the previous paragraph something was explained about the Value Flow models. The greatest benefit from these models is that there is an obvious image about how the procurement of equipment takes place. The following step is to collect data that gives the duration of activities in time. The most important criteria to select projects is that they are comparable, in order to avoid incorrect conclusions at the end of the project. Because of this the following EPC projects were selected: Scanraff, Molipaq, Veba Oil, Seraya and HD Select. More information about these projects can be found in Appendix VII. The collection of data was done for the period of time of each inquiry requisition, with the RPSR data (See table 4 and Appendix V) and for the Man-hours (See Appendix V). If the data is complete the amount of Man-hours spent within a requisition can be calculated.

Project number	Discipline	Requisition	Supplement	Short description	Scheduled	AS	Planned	AP	Actual	AA	Department	Total proc. time
4050	MECHANICAL	300	0	ISSUEINREQ	2002-10-03	-	2002-10-10	-	2002-10-10	-	120.211	
4050	MECHANICAL	300	0	INOISSUED	2002-10-08	5	2002-10-10	0	2002-10-10	0	120.211	
4050	MECHANICAL	300	0	BIDSOPEN	2002-11-05	26	2002-11-05	26	2002-11-05	26	120.211	
4050	MECHANICAL	300	0	SHORTLIST	2002-11-12	7	2002-11-15	10	2002-11-15	10	120.211	
4050	MECHANICAL	300	0	FINTECHEVAL	2003-01-20	69	2003-01-20	66	2003-01-21	67	120.211	
4050	MECHANICAL	300	0	RECOMFPUR	2003-01-21	1	2003-01-24	4	2003-01-24	3	120.211	
4050	MECHANICAL	300	0	APPREVAL	2003-01-21	0	2003-01-27	3	2003-01-27	3	120.211	
4050	MECHANICAL	300	0	ISSUEPOR	2003-01-30	9	2003-01-30	3	2003-01-30	3	120.211	112

Legend:

ΔS = duration in scheduled days between two activities e.g. issue inquiry req. through inquiry issued, 5 days.

ΔP = duration in planned days between two activities.

ΔA = duration in actual days between two activities.

Total proc. Time = the total procurement time in days.

Table 4: Example of RPSR Data

6.3 Analysis of the different periods between Inquiry & issue PO requisition

With the RPSR Data and the Man-hour estimates from comparable projects a period analysis can be made. To perform this, it is necessary to make a format where the comparison between RPSR Data and the Man-hours easily can be made. The format that was created is shown in Appendix V. In the table the RPSR Data is compared with the Man-hour estimates per requisition. For the RPSR Data, the amount of days spent are shown per period and in total. The division of the periods are pictured above the Value Flow models (Appendix III). Note that the times are measured per piece of equipment (Normally a requisition contain more than one piece of equipment).

The division of the Man-hours was more difficult because it was different to the periods of the RPSR Data. The best possibility was to divide it in "Inquiry requisition" and "Evaluation/PO requisition". With these figures the graphs in Appendix II (See example in figure 9). It gives a clear view how much time each period or activity takes within a project.

After analyzing the tables and graphs one obvious conclusion can be drawn. In general, period 2 and 4 are the most time consuming periods (See figure 9). Because this is such an obvious conclusion, period 2 and 4 will be investigated more precisely during the last phases of the project. This is because these two periods consumes the most time of the whole process. In essence, relatively the most time can be saved during these periods.

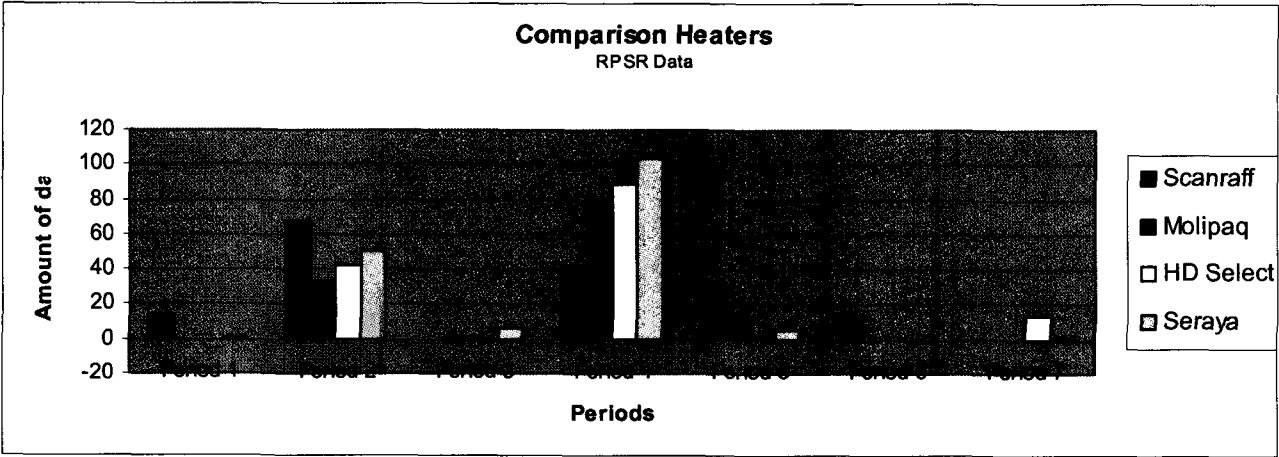


Figure 9: Period analysis graph "Comparison Heaters"

6.4 Questionnaires

After analysis of the RPSR and Man-hour graphs from procurement and mechanical it is obvious that period 2 and 4 are the most time consuming periods. In this perspective it is advisable to investigate these periods more closely because relatively the most time can be saved. This can be done with the Value flow models that were made for these departments. The following activities need to be included:

Mechanical, in house designed equipment			Mechanical, seller designed equipment		
Period:	Activity:	Information flow:	Period:	Activity:	Information flow:
2	Handle changes	- Change seller info to seller via procurement - Change data	2	Handle changes	-
2	Attend inq. clarification meeting with sellers before bid received	-	2	Attend inq. clarification meeting with sellers before bid received	-
4	Preselect bids	- Bids	4	Preselect bids	- Bids
4	Evaluate bids	- Setup/prepare technical bid evaluation form - Send out via procurement questionnaires to individual bidders, incorporate replies in T.B.E.	4	Evaluate preselected bids	- Setup/prepare technical bid evaluation form - Send out via procurement questionnaires to individual bidders, incorporate replies in T.B.E.
4	Attend bid clarification meeting	-	4	Attend bid clarification meeting	-
			4	Prepare conference notes	-
			4	Replies from bidders & answer to bidders (if applicable)	-

Procurement		
Period:	Activity:	Information flow:
2	Prepare inq. status report	- Inquiry status report - Inquiry bidders list + Marian
2	Expedite receive quotation	- Update inquiry status report
4	Detailed evaluation (Tech./Comm.)	-
4	Coordinate bid clarification meeting	-

The following questions will be used to analyze the various activities. Each question needs to be answered for each activity. The answering of these questions will lead to the elimination (if possible) of the so-called "Waste" & "Necessary Actions" and increases the "Added Value" criteria.

Period analysis "Mechanical, in house designed equipment"

The questions:

- 01) Why is this activity necessary? Explain the activity.
- 02) Any alternative way of achieving the purpose? How?
- 03) Is the level of information per issue status sufficient? Why?
- 04) Is it creative work or production type of work?

- 05) What problems does the Long Lead (LL) indicate?
- 06) Is this deliverable in the right format for the customers?
- 07) Do we get information in the right format?
- 08) Any "Necessary Actions" involved? Refer to listing of "Necessary Action" categories.
- 09) Any waste to be identified? Refer to standard listing of Waste categories.
- 10) Why do we have recycles, if applicable?
- 11) Can we avoid recycles? How?
- 12) How can we improve the technical evaluation cycle?
- 13) How can we make the value flow?
- 14) Any activities that can be done separately (internalize/externalize)?

Activities:

▪ ***Handle changes:***

- 01) To receive quotations, with the latest up to date information.
- 02) No, there aren't any better alternative solutions to achieve the purpose. The handling of changes is performed via telephone and confirmed by E-Mail or just by E-Mail contact.
- 03) Yes, the inquiry requisition was first checked by the originating discipline itself and then routed to other departments. Then the comments will be collected and incorporated. After issuing the inquiry requisition the changes can be handled. All these steps are necessary because changes need to be made early as possible and with great care. The costs of changes rise dramatically when the project makes progress.
- 04) Production
- 05) Not applicable
- 06) Not applicable
- 07) The information is given in the correct format.
- 08) This action is necessary for the realization of the project in time and of good quality. However this action is of no direct value to the customer. The activity can be stated as "Waste". This activity will bring the product/service closer to the client's requirement.
- 09) No
- 10) There are no recycles in this process, but they can occur when this activity is performed poorly. This causes bad quality, due to minimal information when the process starts. When not all alterations are made in the beginning of the process, they will occur later on. This is involved with (often) unnecessary costs.
- 11) Recycles can be avoided when the internal routing and implementation of comments are done with great care.
- 12) Not applicable
- 13) Perform the routing process carefully within various involved departments. Don't cut time in this process.
- 14) The routing through the several departments can be done simultaneously. When the routing is completed, organize meeting so that all departments are aware of other departmental comments.

Conclusion:

This activity is the best way to achieving the handling of changes. Although it is very important to avoid recycles by giving enough time for the internal routing and the implementation of comments. If this is not performed with sufficient quality, changes occur later on in the project. This causes unnecessary extra costs and probably delays in project delivery. This activity can be considered as "Added Value".

- ***Attend inq. clarification meeting with sellers before bids received (Only for very complex execution, if required):***

- 01) To receive the right technical standard between seller and buyer.
- 02) Yes, it is possible to perform this contact via E-Mail, telephone etc. There is a big disadvantage in executing this; the period of time of this action can be very long. With the meeting it is possible to make all agreements in a short period of time.
- 03) Yes, it is not possible to attend a meeting without sufficient information.
- 04) Creative
- 05) Delivery time, the right information at the right time, all the departments involved.
- 06) It is attended for clarification between LGN and vendor of equipment; customer can be invited or individual case by case.
- 07) The right format will be discussed during the meeting.
- 08) This activity is only necessary for complex equipment packages. The clarification meeting can be stated as a "Necessary Action". The clarification meeting is a "Waste" activity when this is performed for small equipment/projects.
- 09) No, if the meeting is only applied on equipment packages. Then it is a necessary action.
- 10) Recycles can occur when the meeting was not well prepared or problems existed with the vendor. When this happens recycles can occur further on in the project.
- 11) It is possible to avoid recycles when the meeting was well prepared.
- 12) Pre-filled out technical bid forms to be sending to sellers/bidders with inquiry package.
- 13) To keep the value flow it is necessary to perform this meeting only on complicated equipment packages.
- 14) Not applicable

Conclusion:

For not complex equipment/projects there is another possibility to perform this activity, namely via E-Mail, telephone contact etc. Unfortunately there is one big disadvantage; the period of time of these actions can be very long. This often happens with complex equipment/projects. So it is advisable to maintain the clarification meeting for complex equipment and use the proposed E-Mail, telephone contact etc. for non-complex projects. Recycles can exist, when the meeting was not well prepared. If this action is performed in the proposed way, this action is a "Necessary Action".

- ***Preselect bids (by means of quick scan on technical completeness of scope):***

- 01) The reduction of potential suppliers will direct to a lower amount of man-hours (man-hours estimates are based on evaluation of 2 bids!). It is now possible to compare apples with apples because the bidders are technically scanned. This saves some time.
- 02) No

- 03) Yes, if the information level is not sufficient it is not possible to reduce the amount of vendors.
- 04) Production type
- 05) For Long Lead (LL) equipment the schedule is very critical, so the time spent on preselection of bids must be kept to a bare minimum.
- 06) Yes, a spreadsheet with all bidders will be created where the customer can see the bids. These bids are compared with each other. This document will help the customer to choose a vendor, together with LGN.
- 07) No, each vendor make it's own bid, in his own format. It is advisable to create an LGN format and sent this empty to the vendors. They can use the format to fill in their bid. For ABB it is then easier to preselect the bids.
- 08) This is a "Necessary Action" activity, to minimize the man-hours spent on technical bid evaluations.
- 09) No
- 10) Usually there are no recycles in this activity. Although sometimes LGN search for more vendors, when the majority of the vendors are rejected or vendor declined to bid. In this case this is a recycle because some activities has to be performed again.
- 11) In case of searching for new bidders after rejecting the majority of the first "search", it is obvious that the best vendors where selected first. So it is not necessary to perform a new selection, when there is a least one bidder in competition.
- 12) Send out pre filled technical bid evaluation to sellers/bidders.
- 13) The value can flow when not necessary activities as stated above can be eliminated.
- 14) No, all the bids need to be received by ABB before a defined date.

Conclusion:

The preselection of bids is a time saving activity because the amount of vendors to be evaluated is going to be reduced. This activity can be considered as the best way to achieve the purpose. An improvement that can be made is to create a LGN format for vendors. On this format the vendor have to make their bid. When these bids are returned to LGN for evaluation, a lot of time can be saved because the bids can be compared easily. During the performance of this activity there are no recycles. Nevertheless they can originate when LGN search for new vendors after rejection/declining of the majority of the bidders. LGN should select the remaining vendor. The preselection of bids can be stated as a "Necessary Action".

▪ ***Evaluate bids (Technical & Commercial):***

- 01) Procurement and mechanical will make an agreement, to level the bids technically and commercial.
- 02) To improve the effectiveness of the bid evaluation, the mechanical- and procurement department need to work closely together and simultaneously. This is not always the case. In essence, the process itself is working fine.
- 03) Yes, to evaluate bids it's necessary to collect all the information gathered in the previous activities and to make sure that equipment with the right design will be bought.
- 04) Productive type
- 05) For LL equipment the schedule is very critical, so the time spent on evaluation of preselected bids must be kept to an absolute minimum.
- 06) There is no specific "Product" for the customer in this activity. The customer is well involved in the vendor decision, so the generated documents are very important.

- 07) Yes, the information gathered in the previous activities is the latest information from the departments and vendors. This is crucial for the evaluation.
- 08) No, the vendors are preselected so there is no unnecessary evaluation of vendors. So the waste was already removed. This activity can be stated as "Necessary Action".
- 09) No
- 10) There are no recycles planned regarding to evaluating bids.
- 11) Not applicable
- 12) Send out pre filled technical bid evaluation to sellers/bidders.
- 13) The way the bids are being evaluated is sufficient. The only thing that can be improved is the communication/cooperation between the mechanical- and procurement department.
- 14) Yes, as mentioned before, the mechanical- and procurement department should start simultaneously with the evaluation of bids.

Conclusion:

The purpose of the evaluation is to see if the bids are technically and commercially sound. There is no better alternative way to evaluate bids. Also there are no recycles during the evaluation of bids. One remark that can be made is that the communication between the procurement- and the mechanical department is not always optimal. This situation need to improve, this will benefit in the effectiveness of the evaluation. The evaluation of bids can be stated as a "Necessary Action".

▪ ***Attend bid clarification meeting:***

- 01) By attending a bid clarification meeting it is possible to select the most attractive seller. This will be done both technically and commercial.
- 02) No, other alternatives would be far more time consuming.
- 03) The information level must be sufficient. A clarification meeting without enough information would be impossible, not wise/not preferred.
- 04) It's a creative work because the negotiations with vendors are a dynamic event.
- 05) Not applicable
- 06) Not applicable
- 07) Not applicable
- 08) This is a "Necessary Action".
- 09) No
- 10) Not applicable
- 11) Not applicable
- 12) Not applicable
- 13) The value can flow by performing the bid clarification meeting with precision and quality.
- 14) Not applicable

Conclusion:

The bid clarification meeting is the most effective option to achieve the purpose, other alternatives would be far more time consuming. This activity is a "Necessary Action".

Period analysis "Mechanical, seller designed equipment"

▪ **Handle changes:**

See "Mechanical, in house-designed equipment"

▪ **Attend inq. clarification meeting with sellers before bids received (If required):**

See "Mechanical, in house-designed equipment"

▪ **Preselect bids:**

See "Mechanical, in house-designed equipment"

▪ **Evaluated preselected bids:**

See "Mechanical, in house-designed equipment"

▪ **Attend bid clarification meeting:**

See "Mechanical, in house-designed equipment"

▪ **Prepare conference notes*:**

01) The preparations of the conference notes are made because the results from the bid clarification meeting need to be reported.

02) There are no better alternative ways of achieving the purpose.

03) The information level should be sufficient after the bid clarification meeting.

04) Conference notes can be considered as production work.

05) Not applicable

06) In project format.

07) See point above.

08) This is a "Necessary Action".

09) No

10) Not applicable

11) Not applicable

12) Not applicable

13) Not applicable

14) Not applicable

Conclusion:

The conference notes are made on the most effective way possible. This activity can be considered as a "Necessary Action".

* = Also applicable for "In house designed equipment"

▪ **Replies from bidders & answer to bidders*:**

- 01) After the clarification meeting and the preparation of the conference notes, there can be questions between seller and buyer. These can be solved during this activity.
- 02) No alternative ways to achieve the purpose.
- 03) Not applicable
- 04) Solving questions can be a creative activity.
- 05) Not applicable
- 06) Not applicable
- 07) Not applicable
- 08) It can be a "Waste" when it is used due to poor quality of work or other mistakes. In normal situations this activity is a "Necessary Action".
- 09) Not applicable, see answer 8.
- 10) Not applicable
- 11) Not applicable
- 12) Not applicable
- 13) Try to avoid this time consuming activities.
- 14) In case of more questions, ask them the same time.

Conclusion:

This activity is done in most effective way, if it's not a result of poor work. In case of poor work, it is a "Waste". In a normal situation it is a "Necessary Action".

* = Also applicable for "In house designed equipment"

Period analysis "Procurement"

The questions:

- 01) Why is this activity necessary?
- 02) Any alternative way of achieving the purpose? How?
- 03) Is the level of information per issue status sufficient? Why?
- 04) Is it creative work or production type of work?
- 05) What problems does the Long Lead (LL) indicate?
- 06) Is this deliverable in the right format for the customers?
- 07) Do we get information in the right format?
- 08) Any "Necessary Actions" involved? Refer to listing of "Necessary Action" categories.
- 09) Any waste to be identified? Refer to standard listing of Waste categories.
- 10) Why do we have recycles?
- 11) Can we avoid recycles? How?
- 12) How can we improve the technical evaluation cycle?
- 13) How can we make the value flow?
- 14) Any activities that can be done separately (internalize/externalize)?

▪ ***Prepare inq. status report:***

- 01) The inq. status report informs the project once a week on the status/replies of vendors on each inquiry.
- 02) There is no better alternative way of achieving the purpose.
- 03) The level of information is sufficient; all bids are received, if the vendor is interested to make a bid.
- 04) This is a production type of work.
- 05) Not applicable
- 06) The "format" created during the preparation of the inquiry status report is not meant for the customer, it is only an activity that contributes to the bid tab.
- 07) The received information is not always up to date, sometimes procurement does not inform the Quotation Desk that they sent out inquiries. If the vendor confirms the received inquiry, the Quotation Desk doesn't know where it is about.
- 08) The preparation of the inquiry status report can be considered as a "Necessary Action".
- 09) This activity is not a "Waste".
- 10) Not applicable
- 11) Not applicable
- 12) Not applicable
- 13) Not applicable
- 14) Not applicable

Conclusion:

There is no better alternative way of preparing the inquiry status report. Although sometimes communication problems exist. There were situations that procurement didn't inform the Quotation Desk that they sent out inquiries. As a result the Quotation Desk received bids for unknown inquiries. The preparation of the inquiry status report can be considered as a "Necessary Action"

▪ ***Expedite receive quotation:***

- 01) This activity is to assure that the quotes will be submitted by vendors to LGN before the bid due date. The quotation desk expedites the vendors on the timely submission of the quotes.
- 02) There are no other better solutions to achieve this purpose.
- 03) Not applicable
- 04) This is a production type of work.
- 05) For LL equipment it is important to make a requisition with great care and quality. When this isn't done, there will occur recycles in the remaining project. This will lead to unnecessary delays. Another remark can be made for the time given to the vendor for making a bid. These times are often too optimistic. For good quality sufficient time is crucial.
- 06) Although the customer is involved in the bidding phase, this specific moment is not an important "product" for them. This does not mean that the activity is not important for the process at all.
- 07) As said in the mechanical part, it is advisable to oblige the vendor to use a LGN format for their bids. This gives a huge advantage when comparing the bids from different vendors/bidders.
- 08) If this activity can be performed as advised above there are few recycles. Also the analysis afterwards is less time consuming. This activity is a "Necessary Action".

- 09)Not applicable
- 10)There are a few recycles due to different formats from bids; this gives delays with the evaluation. Also there are often technical alterations, which lead to (partly) new inquiries, to be changed by vendors. LGN and/or the customer can suggest the technical alterations.
- 11)If the method of working is changed as stated above, much recycles can be removed.
- 12)The technical evaluation cycle can be improved by creating a qualitative good inquiry requisition and by giving the vendor enough time to make a bid.
- 13)Adopt the proposed method of working.
- 14)Not applicable

Conclusion:

The way the received quotations are expedited is the best solution to achieve the purpose. For this activity in general it is important to make a requisition with great care and quality. This will lead to less recycles in the remaining project. Another important remark is that LGN have to give the vendor enough time to make a good bid. This is to guarantee sufficient quality and reduce recycles. Just like the mechanical department there should be a format for making bids, this will save time in the evaluation phase. To achieve more effectiveness LGN should reduce the amount of technical changes. If there are necessary changes, they should be made as early as possible in the process because of extra costs. This activity can be considered as a "Necessary Action".

▪ ***Detailed evaluation (technically/commercially):***

- 01)Detailed evaluation assures that you are comparing apples with apples. Purpose of the meeting is to assure that all details/questions have been discussed and clarified.
- 02)How the detailed evaluation is performed is the most effective way.
- 03)Without all necessary technical and commercial information, it isn't possible to make a correct evaluation. So the information level needs to be outstanding (for complex packages only). In case of simple products it is advisable not to conduct too much study time, less information is needed.
- 04)It is a creative type of work.
- 05)For LL equipment it is important to make a precise planning for engineers. This to ensure the quality of the equipment.
- 06)The detailed evaluation is not a defined product for the customer, although it is an important activity for the end product. This is contract dependent, for lump sum project it is not applicable for the customer. For reimbursable contracts it is, because the customer has to pay each hour worked by the engineer.
- 07)Not applicable
- 08)This can be considered as a "Necessary Action".
- 09) It isn't possible to identify a direct "Waste", although there are some processes that can be improved.
- 10)There can happen some recycles when the bid tab isn't of sufficient quality. This leads too much unnecessary contact between LGN and vendor. Also the communication between the mechanical and procurement department needs to optimally, this can save some recycles.
- 11)Yes, see previous point
- 12)As mentioned before, create a good bid tab.
- 13)See point 10.

- 14) The evaluation can be done simultaneously by the mechanical and procurement department, of course in cooperation with each other.

Conclusion:

In general the technical and commercial evaluation is performed in the most effective way. One of the few remarks that can be made for this activity is that the mechanical and procurement department should work closely together, this to save recycles. Also the planning for engineering needs to be accurate. This provides clarity and thus good quality. The last improvement is more general than specific. Sometimes the technical and commercial documents are sent separately to the vendor, this can be done in the same time. This will save time for the vendor and also for LGN. The vendor has fewer questions for LGN because all information arrives at the same time. This activity can be considered as a "Necessary Action".

▪ ***Coordinate bid clarification meeting:***

- 01) To assure that at the end of the meeting the evaluation can be completed and final selection of the vendor can be made.
- 02) Yes, it is possible to perform this contact via E-Mail, telephone etc.. There is a big disadvantage in executing this; the period of time of this action can be very long. With the meeting it is possible to make all agreements in a short period of time.
- 03) Yes, it is not possible to attend a meeting without sufficient information.
- 04) Creative
- 05) Not applicable
- 06) The "format" for the customer is contract dependent, for lump sum (fixed price) project it is not applicable for the customer. For reimbursable contracts it is, because the customer has to pay each hour worked by the engineers.
- 07) Yes, the bids are received, the MOM (Minutes Of Meeting) and Document of Agreement. The vendor signs all these documents, so they are legally obliged to follow these agreements.
- 08) It can be a "Waste" activity when this is performed for standard/non complex equipment. It is only necessary for complex equipment. The activity can be stated as "Necessary Action".
- 09) No, if the meeting is only applied on complex equipment. Then is it a necessary action.
- 10) Recycles can occur when the meeting was not well prepared or problems existed with the vendor (documents mentioned in previous point not signed by vendor). When this happens recycles can occur further on in the project.
- 11) It is possible to avoid recycles when the meeting was well prepared and minuted.
- 12) The value can flow when the preparation of the meeting is sufficient. Attending a premeeting with all disciplines can do this.
- 13) To keep the value flow it is necessary to perform this meeting only on complicated equipment.
- 14) Not applicable

Conclusion:

There is another option to perform this activity. It is possible to clarify the bid via E-Mail, telephone etc.. This is not an ideal option because the period of time of this action is too long. With a meeting all agreements can be made in a short period of time. It is advisable to

use the clarification meeting only for complex project execution (Necessary Action). If the meeting is also attended for other less complex projects, it can be considered as a “Waste”. Also important is the preparation of the meeting, when the meeting was not well prepared/minuted there can exist some recycles later on in the project.

6.5 Bubble Models

After analyzing period 2 and 4 more closely, it is interesting how effective each of this activities are. Maybe there is a connection between the answers gathered in the questionnaires and the figures. So, by combining the theory and the figures, an accurate conclusion can be drawn.

To investigate the effectiveness of the activities, Bubble models where made. These models give the effectiveness in percentages and time consumer of the period in percentages over all periods. The size of the “Balls” gives the amount of equipment in each requisition. The models are divided in 4 squares, which illustrate the ratio of effectiveness and time consumer. So the position of each ball tells how effective and how the time consumes are. This in combination with the conclusions of the questionnaires gives a clear image how LGN is working in these periods. The Bubble models and the tables, where they are made with, can be found in Appendix IV.

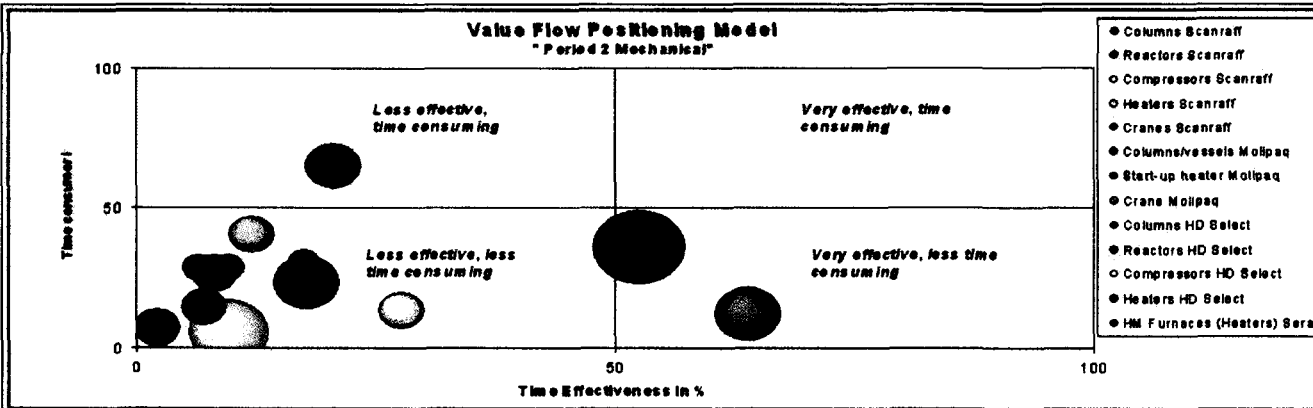


Figure 10: Example of Bubble model “Period 2 Mechanical”

7

Conclusions & Recommendations for mechanical & procurement

In the following section the conclusions and recommendations are drawn. This will be done by making a combination from the questionnaires and the Bubble models. The advantage of the method is, that the figures (tables & graphs) are combined with practical knowledge (questionnaires). This will give a complete overview. The contents of this section are divided in the: mechanical conclusions of period 2 and 4 and the same periods for procurement. This is followed by conclusions for the handling of information and conclusions in general.

7.1 Conclusions

Mechanical, in house and seller designed equipment:

After studying the Bubble models from “period 2 mechanical” it is obvious that the majority of the equipment is purchased “Less effective, less time consuming”. If this is rephrased, it can be described as a procurement cycle where the work is done inefficiently, while the period in time is not time consuming in the whole procurement process. This can be explained as an extreme poor situation. One remark has to be made before making hard judgements; is that the procurement cycle is not effective doesn’t mean no work is carried out. Various other duties are performed when the normal work has delays. Nevertheless, the most important goal of the project was to reduce the total time of the procurement cycle. Out of the questionnaires the following conclusion can be drawn regarding period 2. Although there are no “Wastes” involved in this period, some recommendations are made in paragraph 7.2.

Activity:	Status:
Handle changes	Added Value
Attend inquiry meeting	Necessary Action

For period 4 the image is not totally similar as for period 2. More bubbles are located in square “Less effective, time consuming”. So it can be said that in period 4 the activities are more time consuming. Unfortunately the effectiveness in general is as low as period 2. Out of the questionnaires the following status report was made. Hence that for period 4 the activities from “In house designed” and “Seller designed” equipment are not similar. Seller designed equipment has two more activities. For period 2 the situation is unaltered.

Activity:	Status:
<i>In house designed</i>	
Preselect bids	Necessary Action
Evaluate bids	Necessary Action
Attend bid clarification meeting	Necessary Action
<i>Seller designed</i>	
Prepare conference notes*	Necessary Action
Replies from bidders & answers to bidders*	Necessary Action

*= Also applicable for “In house designed equipment”

Procurement:

While studying the Bubble models from “procurement, period 2” it was surprising to see that the effectiveness was as low as for mechanical. Also the same characteristic can be seen when it was compared with period 2 and 4 from mechanical. Period 2 was less time consuming than period 4. Out of the questionnaires the following status report was made.

For period 2:

Activity:	Status:
Prepare inquiry status report	Necessary Action
Expedite receive quotation	Necessary Action

For period 4:

Activity:	Status:
Detailed evaluation	Necessary Action
Coordinate bid clarification meeting/pre-award meeting	Necessary Action

7.2 Recommendations

Out of the conclusions that were drawn in the previous paragraph, the recommendations can be made. These recommendations are a result of an extensive study that was performed with great care. Within a big company as LGN there are so many parties and opinions involved, that it is difficult to make a correct judgement. That is why the project was planned and performed so carefully. The recommendations are presented in the same order as paragraph 7.1.

Mechanical, in house and seller designed equipment:

In period 2 there are two activities, namely “Handle changes” and “Attend inquiry meeting”. “Handle changes” is an Added Value because the changes affect the end product. “Attend inquiry meeting” is a Necessary Action because it is an activity that is important in the whole process but not direct increasing the service value. The ineffectiveness that was found in the Bubble model, can partly be cleared up by the fact, that between the moment that the inquiry requisition is issued and the moment that the bids are received by LGN, much time was lost by the seller while making a bid. Especially when there exist a number of changes, which must be submitted to the vendor. When the vendor receives a requisition, he often needs to forward it to his subcontractor. This takes a lot of time. So by the time LGN receives a bid much time was lost. This causes partly the huge ineffectiveness. Next to this “possible cause” there are some recommendations that can be made:

- Give enough time for internal routing and the implementation of comments
- Use the inquiry clarification meeting only for complex equipment, in case of non-complex equipment this activity becomes a “Waste”.
- When changes exist, submit as fast as possible to the vendor.
- Probably the most important advice is, that sufficient time is needed for making an inquiry requisition. This is an activity where time cannot be saved. If this is not performed with sufficient quality, changes occur later on in the project.

In period 4 the following activities are performed: “Preselect bids”, “Evaluate” bids and “Attend bid clarification meeting”. This for both “In house designed” as well for “Seller

designed" equipment. All these activities are "Necessary Actions". This means that the work carried out is necessary under current conditions. They don't add direct value to the end product. The ineffectiveness that can be seen in the Bubble models is partly caused by the contact between LGN and the vendor after evaluation. There are often questions that need to be solved before making a final decision. This activity is in most cases performed via E-mail contact, which results in considerable delays. But there are of course a couple of recommendations:

- To reduce preselection and evaluation time it is advisable to create a LGN standard format for vendors. On this format the vendor have to make their bid. This is not always the case; the vendor chooses most of the times the format he will use.
- When during the preselection the majority of the vendors reject or decline themselves, it is useless to search for new vendors. The remaining vendors are probably still better. This would be a "Waste" activity.
- During the evaluation of bids the communication between the technical and procurement department need to be optimal. This will improve the effectiveness because the amount of recycles reduces dramatically.
- Reduce E-mail contact to bidders to the minimum and combine questions in fewer mails during period 4.

Procurement:

In period 2 from procurement the following activities exist: "Prepare inquiry status report" and "Expedite receive inquiry". Both activities are "Necessary Actions" because these activities do not add a direct value to the customer. Just like the mechanical department the effectiveness of the work is very low. This can partial described to the delays that occur due to the amount of time that vendors need to make a bid. The vendor has in most cases contractors that also have to make a bid. By the time LGN receives the bids, much time have been lost. This is sometimes more worse, when alterations are made by LGN. There are although some remarks that can be made:

- Normally the inquiries are expedited to vendors by the Quotation Desk, but in some cases by the procurement department. When this is the case, procurement has to inform the Quotation Desk that they sent out inquiries. This is important because the Quotation Desk need to know which inquiries are out. This will benefit the handling of bids and the preparation of the inquiry status report.
- It is important to make the commercial part of the PO with great care and quality. This will lead to fewer recycles in the remaining project. Don't cut time in this process.
- LGN have to give the vendor enough time to make a good bid. This to guarantee sufficient quality and to reduce "unnecessary contact" with vendors.
- Just like the mechanical department there should be a format for making the bids. This would save much time during evaluation. Unfortunately this is not always the case; the vendor chooses most of the times the format he will use.
- As said before, reduce the amount of technical changes. In case of necessary changes, submit them as soon as possible. When a necessary change exists, the shortest route has to be taken intern LGN. Then it can be submitted to vendor.

During period 4 there are various activities performed. These activities are: "Detailed evaluation" and "Coordinate bid clarification meeting". Both activities are "Necessary Actions" because they don't add direct value to the end product. For these activities, just

like the mechanical department, the effectiveness is low. This can partly be described to the contact between LGN and the vendor before the final decision is made. Especially with procurement there can be conditional and commercial questions. These have to be solved first, which takes some time. The following recommendations can be made:

- The mechanical and procurement department should work closely together to improve the effectiveness. More effectiveness means less recycles.
- Accurate planning for engineering. This for clarity and thus good quality.
- Sent out technical and commercial documents together. This to ensure optimal cooperation between LGN and vendor. The vendor receives all information at once, which reduces the recycles because of missing information.
- Use the clarification meeting only for complex equipment execution. For less complex projects telephone, E-mail etc. can be used.
- Accurate preparation and minuting of the meeting is important, to save recycles later on in the project.

Information handling:

In the assignment "Reduced Procurement Cycle" time information plays a crucial role. After finishing the Value Flow models it was necessary to collect RPRS Data and Man-hour estimates. With this data, it was possible to investigate how much time activities took. Later on it was also possible to make effectiveness calculations. With these calculations valuable conclusions & recommendations can be drawn.

Unfortunately the collection of information was not optimal. With this kept in mind, and looking to future plans of LGN this was not a positive situation. LGN would like to conduct more of these studies in the near future. The RPRS Data and the Man-hour estimates are vital parts of these projects. It is extremely important that this information is easy accessible. For this study the collection of information took far too long. To improve this situation the following recommendations are made:

- All RPRS Data and Man-hour estimates (especially actual Man-hours), should be collected and saved for each project for a reasonable period of time.
- In the contract with the client the milestones should be set the same way as for other projects. In the investigated projects the milestones were set differently which resulted in complex period division (see figures above the Value Flow models in Appendix III).
- All RPRS Data should be collected in one system. When looking at the period division in the Value Flow models from Appendix III, it is easy to see that the beginning part was not included in this assignment. This due to the fact that the activities from that part were collected in the I-Pacs system. The rest of the data (RPRS Data) in Marian.
- The RPRS Data should be collected in a format where the time that each period took, automatically can be calculated. The format could be the excel format that was created by the trainee (see Appendix V).
- The format of the Man-hour estimates from the departments should be the same. At this moment every department has its own format.
- All the RPRS Data and Man-hours should be stored in one place. Preferably on the intranet. The accessibility could be protected with a password.

General conclusions:

The current work process within ABB is not efficient as it could be. Main cause is multitasking (Too many activities outstanding at the same time without priority setting, by the same person/department) and schedule pressure. There is a tendency that Project Management is addressing items after the fact and not proactively.

General recommendations:

During the execution of the assignment much brainstorm sessions were attended with several employees from different departments. These sessions resulted in several suggestions. These suggestions are translated into general recommendations that are not directly linked to the scope of this study.

- Sometimes new inquiry requisitions are sent out because the already received bids are too expensive regarding the determined budget. This could be prevented when the budgets were made more realistically.
- Within LGN the collection and availability of actual Man-hours for certain steps or parts of processes, appears to be a cumbersome activity. Overruns on budgets are discovered too late. It is recommended to investigate if it's possible, to implement the "Bubble Models" easily within LGN in order to get more control.
- The assignment was only based on the mechanical and procurement department between Inquiry issued and PO. It recommended performing this also for the pre inquiry phase and other departments.
- The fabrication of an inquiry is a multi discipline exercise. Each department has their own procedures, e.g. the piping department and process department would like to work on an area bases (vertical). This while mechanical likes to have all the same equipment in one inquiry (horizontal). Other departments like instrumentation are sometimes not even "on board" while output is required for the inquiry. The recommendation is to streamline this process up front and not after the inquiry is issued. This leads to delays and increased costs.
- Take more time to deliver quality in the beginning, to avoid changes, recycles and needless communications.
- Avoid multi tasking, causing all activities to be late.
- The tasks themselves are useful, but organized in a wrong manner. Organize tasks better to increase performance.

8 Literature

Source:	Author:
http://www.cf.ac.uk	Cardiff Business School
http://inside.abb.com (Intranet)	ABB Group
ABB lummus Global B.V. Company Profile 2005	-
Company procedures LGN 06-1905 and 06-4600	LGN

9 Epilogue

This epilogue will end my graduation report for ABB Lummus Global B.V. In the short period of time I have learned a tremendous amount of new things. Not only from my assignment but also from the association with other employees and the industry LGN is working in. I never realised that such sort of projects caused so much work and knowledge.

Especially the attitude of my colleagues and the transparency of the company made me feel at home. Everybody was available and took time to answer my questions or help me with my report.

I think that the assignment “Reduced Procurement Cycle” was a success and I hope that LGN can benefit from the results in the near future.