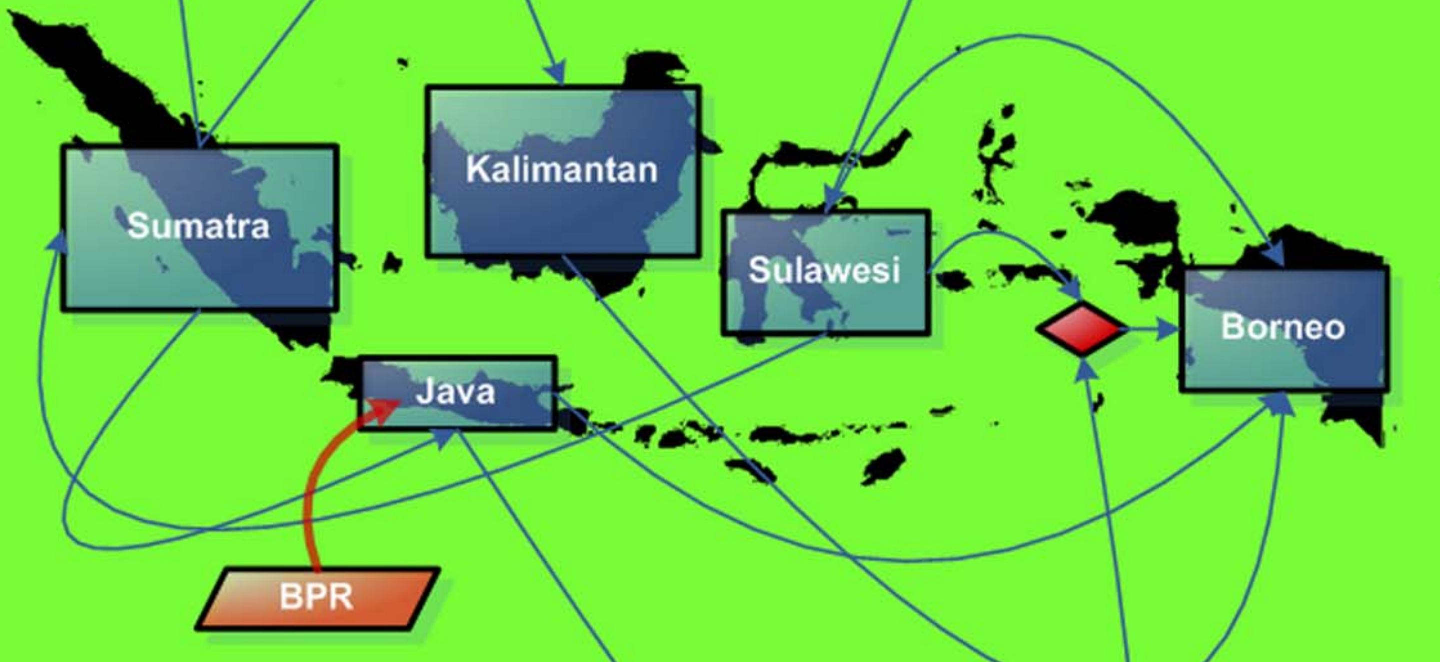
BPR at PT Sarandi

Process Innovation at a manufacturing company in Indonesia



Bachelor Assignment

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Final Report Bachelor Assignment

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Management Summary

Most of the problems at Sarandi found their roots in inefficient and ineffective processes. For this reason, process innovation was performed. The manufacturing process was selected for innovation. Business Process Reengineering (BPR) is inherent to process innovation and offered a framework for this research. The purpose of this paper is to perform a BPR cycle within the company and to make Sarandi familiar with BPR so they can apply this method to other processes later on.

Three pathologies were selected from the manufacturing process: excessive number of job cards, insufficient inherent process quality and inadequate performance measurement. In the new process these pathologies no longer exist. There are two categories for the proposed changes:

- *A new workplace environment for operators*: computers will be installed in the divisions of machining, welding, finishing, painting and assembly. New software will be developed for these computers that will enable the operators to retrieve their next job and keep track of their start and finish times. The job card on paper will disappear as a result of this. The new software makes it easy to generate performance reports.
- *A new quality control procedure*: operators will perform the quality checks by themselves. This means that the quality control department becomes redundant. A new department called quality improvement will be introduced, where the quality control employees and one employee from production administration will shift to. This new quality improvement department will have a focus towards improving quality and finding ways of more efficient producing. Besides the new tasks, quality improvement will still perform quality checks for critical areas in the manufacturing process like painting and assembly.

The changes will lead to the following improvements:

- No more time lost by production administration for manually making and adjusting job cards.
- All relevant information for the operator will be visible on the computer screen in the workplace, including drawings.
- Accurate registration of start and finish times of the jobs of operators is possible.
- Ability to generate performance reports on total process times and amount of errors by operator.
- Increased quality focus by operators, because they will be judged on the objective quality rate data from the system.

A selection of the most important recommendations that have been formulated is given below:

- *Finish the BPR cycle and measure the manufacturing process lead times when finished.*
- *Continue with the Total Quality Management (TQM) program.*
- *Apply BPR in the future to other processes when necessary.*
- *Develop an automated planning system for automatic job card generation purposes.*

Summarising, the proposed changes will lead to more efficient and effective processes for Sarandi.

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Preface

As a part of our bachelor Industrial Engineering & Management, we have done our bachelor assignment in Sukabumi, Indonesia at PT Sarandi. The company invited us to do a research on improvements in the factory. This was a great opportunity for us to bring some of our learned theories in practice and to make an actual contribution in a professional environment. We are pleased with the results of this research and hope that we have contributed to Sarandi's organisational health right now and in the future.

Doing our bachelor assignment abroad posed several challenges for us, but this was also one of the reasons for going abroad. Indonesia is a great country to work and live. As expected there were a lot of differences in both working and national culture, but because of the openness of all the people at Sarandi, this was more an opportunity to learn from each other and to exchange experiences than a problem.

The people at Sarandi welcomed us and were interested in taking part in this project. We are very thankful for all the help that we have received before, during and after the project, by all the people at Sarandi. We would especially like to thank Mr. Arief for supporting us throughout our time in Indonesia.

Besides all the people in Indonesia, we would like to thank the students who conducted researches at Sarandi in the previous years: Gerben Meutstege, Rob Golbach, Michel Bieze and Johan Jongejan. Their reports and suggestions helped during the complete process. Lastly we would like to thank Mr. Maathuis and Mrs. Iacob, our supervisors at the Twente University, for providing us with feedback and ideas during the research.

As Mr. Isep would say: “It was a good challenge!”

Enschede, October 2007,

Marcel and Mark

Part I: Introduction

The first part of the report functions as an introduction. This part contains the general introduction to the company, the research approach and the theoretical background.

1. Introduction

1.1 General overview of PT Sarandi

PT Sarandi is a manufacturing company located in Indonesia, with around 200 employees. The company exists of two offices: a production facility based in Sukabumi and a marketing office located in Jakarta. The company produces medical equipment, mostly for the domestic market. Sarandi offers a variety of products; from hospital beds to ambulance interiors and infusion stands. However, the core business is producing all kinds of hospital beds. Different hospital beds vary in, for example, type of steel, number of cranks, or electrical/manual. Almost all products by Sarandi have a basis of a metal frame, and a large part of the manufacturing process exists of machining metal. The choice for the factory in Sukabumi is not so strange, since Sukabumi is famous for its metal industry. The production process consists of only one production line, because all the products follow the same sequence of production steps. The order of the steps is: cutting, machining, welding, finishing, chemical treatment, painting and assembly. Sarandi has recently started with producing parts made of fibres instead of metal and is still in the process of improving methods to produce fibre parts. At the moment the company is in the process of seeking possibilities for selling their products internationally, like in Europe and the Arabic region. The end users of Sarandi's products are hospitals. Sarandi sometimes sells to hospitals directly, but in most cases they sell to distributors.

1.2 Previous researches

The focus of this project is partly derived from earlier researches performed by students in 2005 and 2006. Important problems that were stated by those researches are low productivity, non-reliable delivery times and insufficient interdepartmental communication. Sarandi's goal for this research was improvements in the factory in Sukabumi. Some of the internal problems that were stated in the previous researches are not yet solved, therefore the focus of this research will be internal. When the internal situation of Sarandi is improved in total, it is possible to look one step further towards investigating external factors, such as the strategies concerning customer relations and marketing. Research towards those aspects should be performed at Sarandi's marketing office in Jakarta.

The research of Rob Golbach and Gerben Meutstege[1] in 2005 defined five problem areas: no clear planning/scheduling system, purchasing method/inventory control, departmental structure, subcontractor problems and many different products. The research of Michel Bieze and Johan Jongejan[2] in 2006 states a few other problems besides those: poor interdepartmental communication, short term financial problems due to a high amount of accounts receivable and poor performance indicators.

[1] Golbach & Meutstege, "Improving planning and control systems at PT Sarandi"
[2] Bieze & Jongejan, "Supporting the company by improving their organizational performance"

1.3 Process-based approach

Both researches were successful in tackling the stated problems. However, not every implemented solution had the same impact. The poor interdepartmental communication still seemed to be an existing problem and causing miscommunication between departments.
Early observations during this research showed that besides interdepartmental communication, there are also problems with intradepartmental communication, especially within production. Next to this, an important finding was that Sarandi had grown a lot in the past few years, but the different processes have remained unchanged. These problems ask for a process-based approach. Due to the interdepartmental problems, a process based approach would lead to more benefits than improvements within a single business function.

1.4 Framework choice

Process enhancement can broadly be split up into two streams: process improvement and process innovation. Two methods are generally accepted for these streams, although sometimes slightly different names for the same methods are used. For process improvement, that is Total Quality Management[3] (TQM) and Business Process Reengineering[4] (BPR) for process innovation. A study was done on which method best fits the desired end results. TQM is a method to perform every existing process in the best way. It focuses on employee participation and empowerment to ensure quality throughout the production process. Besides that, it uses detailed statistical information to monitor the process. Implementing TQM is difficult because it needs a paradigm shift from the employees. They will have the option to influence the process more, for instance by means of quality groups, but they will also have more responsibility. Sarandi is already trying to implement TQM within production. BPR on the other hand, has a more cross functional approach than TQM. BPR is a way of investigating the current processes and redesign where necessary. Simon[5] summarises the differences between TQM and BPR, as shown by table 1.1.

	TQM	BPR
Level of change	Incremental	Radical
Starting Point	Existing process	Clean slate
Frequency of change	One-time/continuous	One-time
Time required	Short	Long
Participation	Bottom-up	Top-down
Scope	Narrow, functional	Broad, cross functional
Risk	Moderate	High
Primary Enabler	Statistical control	Information technology
Type of change	Cultural	Cultural/structural

Table 1.1 TQM versus BPR[3]

[3] Daft, "Management", pag. 667-671
[4] Daft, "Organization Theory and Design", pag. 110
[5] Simon, "Towards a theoretical framework for business process reengineering"

For Sarandi, a cross functional approach is necessary because a lot of the problems have their roots in interdepartmental miscommunication. The framework for improving processes will therefore be BPR. Performing BPR takes a long time according to Davenport[6]. Because of our time restrictions, we will only be able to perform BPR on selected areas. This will give Sarandi insight in how the method works so they can apply it to other areas where necessary.

1.5 Objective and central problem

Now that is clear that some business processes need reconsideration and that this will be done by process innovation, the objective can be formulated. The research has both scientific targets and goals for society. The most important scientific goal is to perform a BPR cycle in Indonesia. When BPR is applied at Sarandi, we serve the practical goal of improving the position of Sarandi.

<u>Objective</u>

Enhancing competitive advantages for Sarandi by performing a BPR cycle that will improve effectiveness and efficiency of business processes at the company.

Obtaining a competitive advantage can not be measured in itself. Therefore, this aspect has to be quantified. The Boston Consulting Group (BCG) has developed a cause and effect model for a BPR cycle, see figure 1.1 on the next page. This diagram shows that a competitive advantage can be obtained by a decreased cycle time.

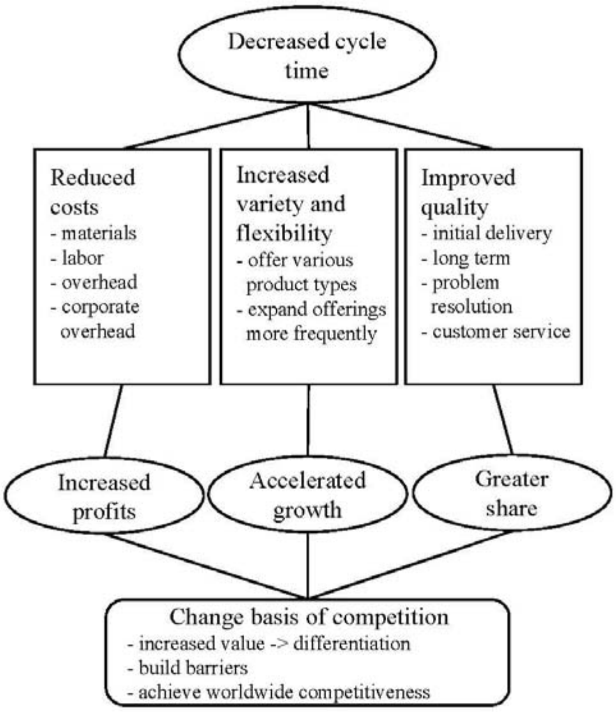

Figure 1.1 BCG cycle time focus

[6] Davenport," Process innovation: reengineering work through information technology"

When performing BPR, cycle time reduction is the basis for solving many problems. Solving these problems lead to a competitive advantage which was stated as a goal in the objective. This leads to our central problem:

Central problem
How can Sarandi's internal business processes be reengineered to realise a cycle time reduction?

Our focus area is therefore (inter)departmental processes. These processes contain information, communication and product flows. BPR focuses on information and communication flows and less on product flows. The stated problem is a multidisciplinary problem. Within a BPR cycle, Human Resource Management (HRM) and information systems are equally important to solve the problem.

In summary, a process innovation method called BPR is chosen for Sarandi for reengineering some processes. The goal is to obtain a competitive advantage. This is realised by reducing the cycle time within some yet to be identified processes.

2. Research approach

The BPR framework needs a methodology. Therefore, this chapter will first elaborate on the selection of a methodology and the detailed research steps will be described in the second part.

2.1 BPR Methodology choice

For choosing a BPR methodology for Sarandi, several methodologies have been compared. The methodologies from Guha[7], Davenport[8] and a commercial methodology by Visible Systems[9] have been the subject of further research. The methodologies contain similar steps. Therefore the choice has been made on subtle differences. A brief overview of the different phases in the methodologies is stated in Table 2.1. Five general phases in a reengineering process have been identified (Start until evaluation) and the steps of the three methods have been mapped to the general phases.

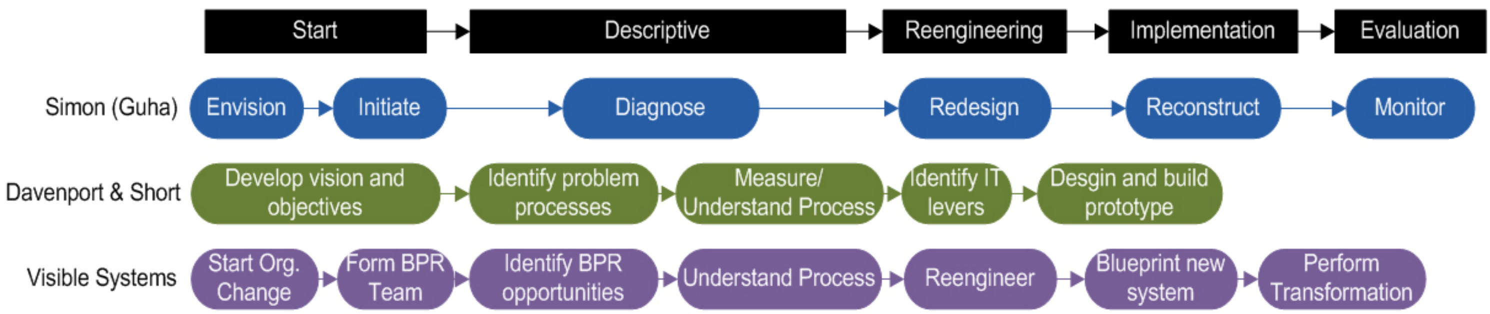

Table 2.1 Three Different BPR approaches

Both the Davenport and the Visible Systems methodologies do not contain an evaluation step to measure improvements after the BPR process. This is part of the Monitor phase in Guha's methodology. The current research will only focus on a part of all processes within Sarandi. It is important for Sarandi to have an evaluation on the results of the BPR process, to evaluate the usefulness of the methodology for the company. Based on the evaluation, Sarandi can decide whether to use BPR in the future.

Sarandi already has a focus on continuous improvement. A TQM program is being implemented. The Monitor phase of Guha's methodology contains the step "link to quality improvement". This step can link BPR to the TQM implementation that is already in progress at Sarandi.

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[7] Guha, "Business process Change: A study of methodologies, techniques and tools"
[8] Davenport & Short, "The new Industrial Engineering: Information Technology and Business Process Redesign"
[9] Covert, M., Visible Systems Corporation, "Succesfully performing BPR"

The differences between the methodologies point out that Guha's methodology has a good fit with the needs at Sarandi. From a practical point of view it is useful that Guha offers clear techniques and tools that can be used to actually perform BPR. A graphical representation of Guha's methodology is the Process Reengineering Lifeycle[10].

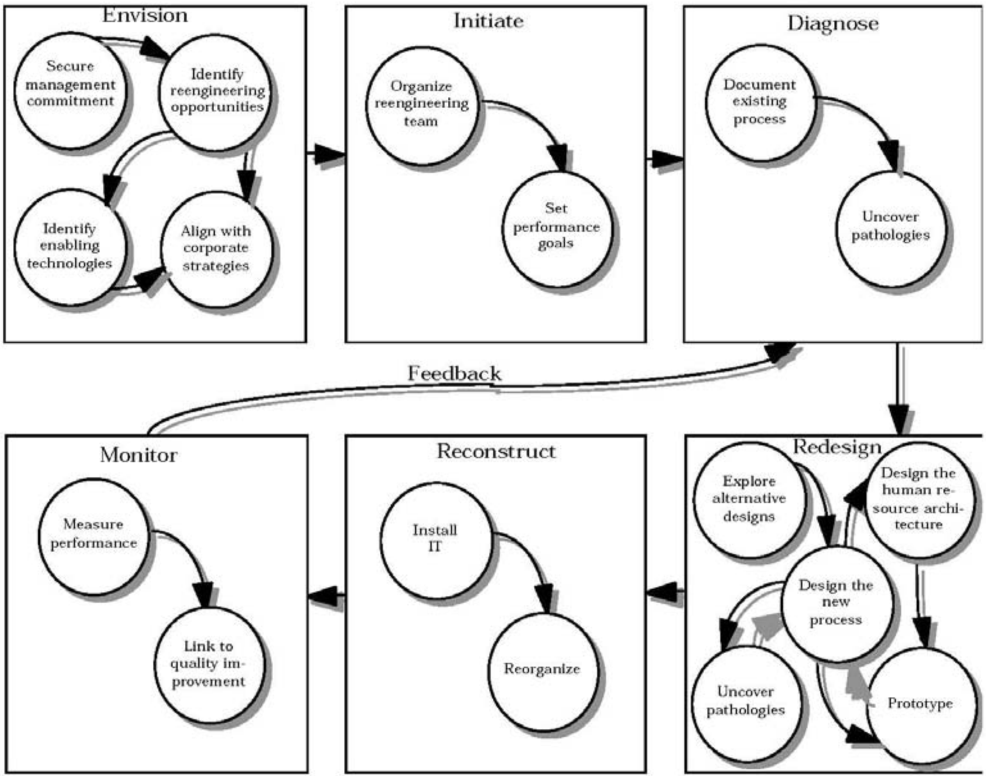


Figure 2.1 Process Reengineering Life Cycle

[10] Guha, S.; Kettinger, W.J. & Teng, T.C., "Business Process Reengineering: Building a Comprehensive Methodology"

2.2 Research Steps

1. Envision
    1.1. Ensure management commitment
    1.2. Identify reengineering possibilities
    1.3. Identify enabling technologies
    1.4. Align possibilities with corporate strategy.
2. Initiate
    2.1. Organise reengineering team
    2.2. Set performance goals
3. Diagnose
    3.1. Document existing processes
    3.2. Uncover pathologies
4. Redesign
    4.1. Explore alternative designs
    4.2. Design the new process
    4.3. Design the human resource architecture
    4.4. Prototyping
5. Reconstruct
    5.1. Install IT
    5.2. Reorganise
6. Monitor

Because of the limited time of the research and because actual development of an IT system is not our specialism, the research will fully contain the first 4 steps, until redesign. Reconstruction will be done mostly by the IT and HRM departments in Sarandi, based on the alternative chosen in the redesign phase. However, some advice about the reconstruction will be given in this report.

It is important to make sure top management is committed to the change throughout the process. It is also important to convince middle management of the importance of every decision taken and changes made throughout the process. The reengineering approach of the BCG has a name for this parallel process: manage transformation. Constant communication is necessary besides the steps in the process of redesign.

One of the most important findings in the earlier researches is the difficulty to design a solution that will be used in the company practically. Besides the scientific goals, it is important to strive for a pragmatic, useful solution.

3. Theoretical background

In this chapter, the different theories that are used for investigating the research steps regarding the BPR approach will be presented. The techniques and tools used for the BPR will be explained. Section 3.2 evaluates the success factors for BPR that are relevant for Sarandi. The chapter concludes with an evaluation of cultural aspects that are important to consider throughout the project.

3.1 Phases in Business Process Reengineering

In this part of the theoretical background, the different techniques and tools that will be used for the BPR approach will be described. The steps are:

3.1.1 Envision

Secure Management Commitment

There is a need for some kind of persuasion technique. Guha does not propose any tool for persuasion. At Sarandi, meetings have been organised with top en middle management to present the plan.

Identify reengineering opportunities

When identifying reengineering opportunities, the different processes of Sarandi have been mapped. Brainstorming and a semi-structured interview technique have been used to select a process. A semi-structured interview is an interview with partly predetermined questions and partly open for suggestion.

Identify enabling technologies

At the identify enabling technology stage, the different information technologies that Sarandi uses are described. The goal is to find out if Sarandi will be able to develop the new software or is able to develop it as an extension of the old software system.

Align with corporate strategies

Aligning with corporate strategy is done by reflecting the company's strategy against our plans.

3.1.2 Initiate

Organise reengineering team

For organising the reengineering team, the relevant departments are determined and the heads of those departments have become member of the reengineering team. Periodic meetings are used to keep all the members of the team up to date and to ensure commitment throughout the process.

Set performance goals

The second activity in the initiate phase consists of setting performance goals. The most important performance indicator for this research is the decrease in cycle time. Therefore, the lead times of the sub processes in the manufacturing process have been calculated to act as comparison with the lead times after the research. As was mentioned in the introduction, Sarandi has a wide variety of products.

Sarandi has a few products with relatively very high sales numbers compared to the other products. The decrease in lead time for those core products is the indicator for general improvement. To identify the most important product(group), a Pareto analysis has been performed. Pareto's theory states that around ten to twenty percent of the products account for sixty to eighty percent of the sales.

3.1.3 Diagnose

Document existing process

For documenting existing processes the tool BiZZdesigner has been used. This tool is loosely based on the Business Process Modelling Notation (BPMN)[11]. This tool makes it possible to visualise business processes in a structured way. BiZZdesigner also uses Unified Modelling Language[12] to model class diagrams.

The PRLC does not contain an investigation of the current situation on the areas of HRM and IT in the Diagnose phase. When BPR is performed with a completely clean slate (IT and HRM systems are designed from scratch), thorough research on the current situation of IT and HRM is not necessary, because there will be no adjustments to the old systems, but completely new systems. This research is a 'dirty' slate approach, because it is not possible to completely replace the existing systems with new ones. The risk involved in such a clean slate approach would be high, due to high development costs and the lack of knowledge about BPR within the organisation. BPR cycles performed by Sarandi in the future could use a clean slate, to make more radical improvements possible. The dirty slate approach requires an investigation of the current HRM and IT systems in the diagnose phase, because these systems have to be modified in the redesign and reconstruct phase. Therefore two subchapters have been added: Current HRM situation and Current IT situation.

Document existing human resource architecture

This step and the next step are added to the PRLC. The necessity of adding these steps was explained in the previous paragraph. There are several methods to evaluate the human resource management (HRM) situation within Sarandi. The first method is analysing the organisational structure within the company. An organisational chart will give insight in the way the company is set up. From this chart it is possible to derive whether Sarandi has a functional, divisional or other structure. This top-down approach gives insight in whether the individual task responsibilities fit with the organisational structure.

[11] White, IBM corporation, "Introduction to BPMN"
[12] Odeh, Beeson, Green and Sa, "Modelling processes using RAD and UML activity diagrams: an exploratory study"

Afterwards it is possible to analyse the HRM situation with the model of strategic human resource management by Daft[13].

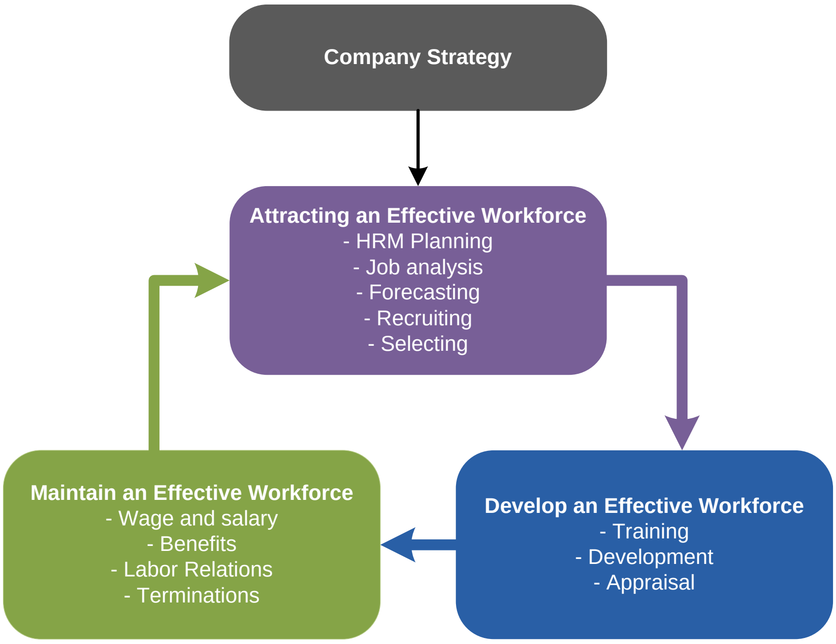


Figure 3.1 Strategic Human Resource Management

The focus of the research will be on the areas ‘job analysis’, ‘training & development’ and ‘labour relations’, because these areas are important for further research on job description, willingness for change in the organisation and the possible responsibilities for employees.

Document existing IT

Laudon & Laudon propose a model for analysing the information systems within an organisation. They define six levels of information systems.

1. Executive Support Systems (long term strategy and planning)
2. Business Information Systems (provide management with reports)
3. Decision-Support Systems (data analysis systems that support management in decision making)
4. Knowledge Work Systems (help employees to find and integrate new knowledge)
5. Office Systems (word processors, e-mail etc. to increase productivity)
6. Transaction Processing Systems (perform routine operational tasks)

Mapping the information systems within Sarandi in these categories, provides an overview of the systems that are present and how they are related.

[13] Daft, “Management, pag. 407”

Uncover pathologies

Uncovering pathologies has been done with the BiZZdesigner tool and with meetings with the reengineering team. The uncovered pathologies will be prioritised using a Multi Criteria Decision Analysis (MCDA). Examples of MCDA are the Simple Multi-attribute Rating Technique[14] (SMART) and the Analytical Hierarchy Process[15](AHP). AHP is a precise, comprehensive but complicated framework. Sarandi does not have a lot of experience with MCDA. Therefore SMART is chosen as the MCDA, because the technique is easier to understand for the end users than AHP, with a relatively small loss in accuracy. The pathologies will be rated by employees of Sarandi. It is too complicated and unnecessary to spend a lot of time learning them AHP, with the risk of misunderstandings and incorrect entries.

SMART consists of eight stages:

1. Identify the decision maker
2. Identify the alternative courses of action
3. Identify the attributes which are relevant to the decision problem
4. Assign values to measure the performance
5. Determine a weight for each attribute
6. Take the weighted average of the values assigned to every alternative
7. Make a provisional decision
8. Perform sensitivity analysis to see how robust the decision is to changes

3.1.4 Redesign

Explore alternative design

BiZZdesigner is used to explore alternative designs.

Design the new process & Uncover pathologies

The new process will be designed with BiZZdesigner. During the design, pathologies that come up will be handled.

Design the new human resource architecture

The new human resource architecture will be designed using the diagnose about the current human resource situation, combined with the new process.

Prototyping

Prototyping will be done using the UML diagrams. The models from those diagrams will be transferred to a working application using Microsoft Access. This application functions only as an example of how the final system will work.

[14] Goodwin & Wright, "Decision analysis for management judgment", p. 7-26
[15] Harker, "The art and science of decision making: the analytic hierarchy process"

The new requirements for the IT system will be designed. This will be done by constructing class diagrams and sequence diagrams. The language used for these techniques is Unified Modelling Language (UML).

UML is developed to replace the different modelling languages that are not compatible with each other. UML is widely used and makes inter organisational communication possible. Several tutorials for using UML can be found on the Internet, we have used Practical UML: A Hands-On Introduction for Developers[16].

UML exists of several types of diagrams. This BPR cycle uses a structure diagram, UML Class Diagram and an interaction diagram, a UML Sequence Diagram.

UML Class Diagrams

Class Diagrams are used to model objects in an IT system. Class Diagrams are static, this means they model the classes that interact, but do not model the actual steps when they do interact. The different classes contain attributes and operations. Attributes are variables in the classes and operations allow changes to attributes.

Different associations are possible between the classes, as stated in Table 3.1.

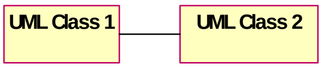
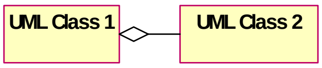
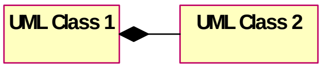
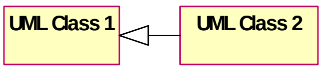
Association Type	Visual representation	Description
Standard association		This indicates a relation between two classes at the same level
Aggregation relation		Class 1 has a collection of classes 2, but class 2 can also exist without the parent class 1.
Composition relation		Class 2 is completely dependent on class 1. If class 1 disappears, class 2 does too.
Generalisation relation		Class 1 is a superclass of class 2

Table 3.1 Class diagram associations

The interaction between classes is done using multiplicities. A multiplicity indicates the number of instances of the class associated with one instance of the class on the other end of the association. Table 3.2 states the four most used multiplicities.

[16] Miller, R. (Dec 1, 2003) "Practical UML: A Hands-On Introduction for Developers", retrieved June 30, 2007, from http://dn.codegear.com/article/31863

Multiplicities	Meaning
0..1	Zero or one instance
0..* or *	Zero until an infinite number of instances
1	Exactly one instance
1..*	One until an infinite number of instances

Table 3.2 Class diagram multiplicities

UML Sequence Diagram

Modelling dynamic interactions between classes is done using a sequence diagram. It uses a vertical timeline to display the activated classes. Figure 3.2 gives a short overview of the meaning of the different elements of the diagram, which can be found on the next page.

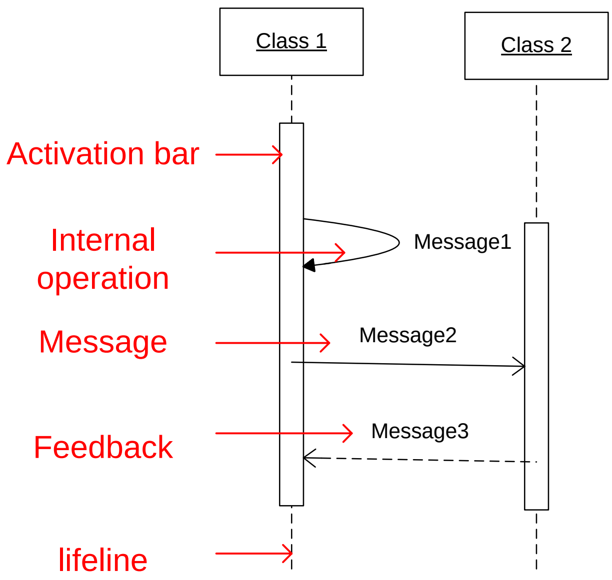


Figure 3.2 Modelling sequence diagrams

3.1.5 Reconstruct

The steps in this phase will mainly be done by the HRM and IT departments of Sarandi. The reconstruct chapter will focus on practical implementation and timelines to guide Sarandi's management in the implementation process. In the 'Install IT' part requirements and necessary output for the new system are formulated. 'Reorganise' consists of new job and task descriptions.

3.1.6 Monitor

Measure performance

Sarandi can monitor actual improvement by comparing both the old and new situation. Sarandi has to collect data of the new realised times and compare these times with the old situation, as described in the step 'Set performance goals'. Also the IT system performance has to be measured afterwards.

This can be done by interviewing the persons working with the system and determining the usability and questioning if there are any new or old unsolved problems.

Link to quality improvement

The final step is the link to quality improvement. Both BPR and TQM focus on processes. While BPR is concerned with abrupt changes and improvement, TQM is concerned with continuous improvement. After the BPR project is completed, the program of TQM can be continued.

3.1.7 Summary of the research steps, techniques and tools

Research steps	Techniques	Tools
Envision		
Secure management commitment	Meetings	
	Trainings	
Identify reengineering possibilities	Brainstorming	
	Semi-structured interviews	
Identify enabling technology	IT analysis	
Align with corporate strategies	BCG model for BPR approach	
Initiate		
Organise reengineering team	Teambuilding	
Set performance goals	Lead time analysis	
	Pareto analysis	
Diagnose		
Document existing process	Flow diagramming	BiZZdesigner
	Semi-structured interviews	
Document HRM situation	Strategic human resource management	
Document IT situation	Six levels of Information Systems	
Uncover pathologies	Flow analysis	BiZZdesigner
	Semi-structured interviews	
	Brainstorming	
	SMART analysis	
Redesign		
Explore alternative designs	Flow diagramming	BiZZdesigner

Design the new process	Flow diagramming	BiZZdesigner
Design human resource architecture	Job design	
Prototype	UML diagramming	Microsoft Visio
	Simulating	Microsoft Access
Reconstruct		
Install IT	Requirements analysis	
Reorganise	Job design	
Monitor		
Measure performance	Collecting actual times	
	Structured interviews	
Link to quality improvement	TQM program	

Table 3.3 Methodologies, techniques and tools applied at Sarandi

3.2 Success factors BPR

The methodology for BPR that is used in this research does not state the critical success factors or failure factors for BPR implementation. Therefore it is necessary to define those factors and keep them in mind during the BPR cycle, both to obtain good results and to prevent mistakes. It is possible to draw conclusions on which factors need more attention during and after the implementation.

Defining the success and failure factors has been done by Al-Mashari and Zairi[17], who reviewed the literature on success and failure in BPR implementations. They defined five dimensions of success factors (and corresponding failure factors):

- Change management, systems and culture
- Management competence factors
- Organisational structure factors
- BPR Project management factors
- IT Infrastructure factors

The five dimensions contain the different factors. The full list of these factors is given in Appendix B. The most important factors for Sarandi are obviously those on which the company scores low at the moment. Two dimensions for Sarandi that will be troublesome are ‘Change management, systems and culture’ and ‘Organisational structure factors’. The first dimension will be troublesome because

[17] Al-Mashari, M., Zairi, M. (1999), “BPR Implementation process: an analysis of key success and failure factors”

Sarandi has difficulties with some success factors in this dimension. These success factors are: Effective communication, Empowerment and Creating an effective culture for organisational change. Organisational structure factors that can undermine the results are problems with job definition and responsibilities, also areas in which Sarandi has difficulties at the moment.

During the BPR cycle the focus will be on the two dimensions of success factors mentioned above. After the complete BPR cycle it is possible to conclude which factors contributed to the success or failure of the project.

3.3 Cultural aspects

When implementing organisational changes, it is important to keep in mind the cultural aspects. The two researchers are from the Netherlands, while the company is located in Indonesia and the employees are Indonesian. Clearly there are differences between Dutch and Indonesian people, and certain behaviours will be accepted by one culture while this would not be appropriate with the other. Hofstede proposes five cultural dimensions that should be considered: power distance, individualism, masculinity, uncertainty avoidance and long-term orientation. The scores for each dimension for Indonesia are displayed beneath in figure 3.3. No data was available for long term orientation for Indonesia, so this variable was not considered when comparing with scores of The Netherlands.

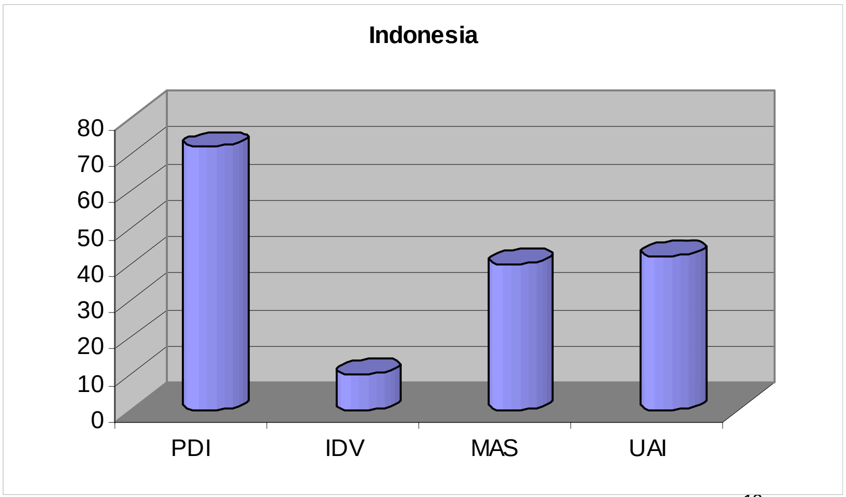


Figure 3.3 Scores on cultural dimensions for Indonesia[18]

To see which dimensions need attention when implementing the changes, a comparison can be made with the scores of The Netherlands, for the reason given above. The scores on dimension for The Netherlands are shown in figure 3.4.

[18] Hofstede, G., (n.d.) Retrieved August 2, 2007, from http://www.geert-hofstede.com/hofstede_indonesia.shtml

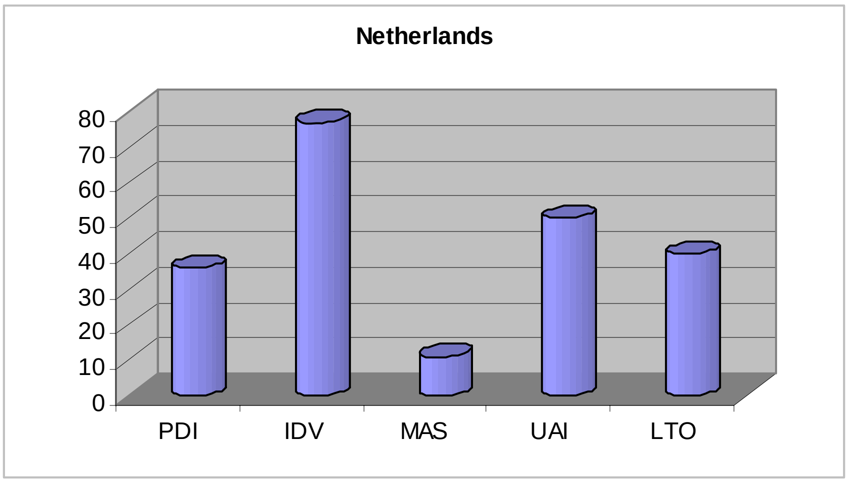


Figure 3.4 Scores on cultural dimensions for The Netherlands[19]

The graphs show big differences. The large distance of power and high collectivism (low individualism) will have to be kept in mind during the research. Those aspects are especially important during the actual implementation phase, the reconstruct phase, because then the actual changes in the organisation have to be made. Therefore a further investigation of cultural aspects regarding the solutions from this research can be found in the chapter about reconstruction.

[19] Hofstede, G., (n.d.) Retrieved August 2, 2007, from http://www.geert-hofstede.com/hofstede_netherlands.shtml

Part II: PRLC steps

Part two contains all the steps of the Process Reengineering Life Cycle (PRLC). The chapters four to eight all describe the execution of a step of the PRLC.

4. Envision

The Envision phase consists of four steps: Secure management commitment, identify reengineering possibilities, identify enabling technologies and align with corporate strategies. The outcomes on all of these stages are described in chronological order.

Envision is the first step of the PRLC. The main goal of this phase is to select a specific process that will continue the reengineering process.

4.1 Secure management commitment

Sarandi has a focus on continuous improvement. Top management is the idea champion for this attitude. It is most important to convince top management of the necessity of BPR. Top management at Sarandi consists of three persons: The CEO, the General Director and the Director Finance & Marketing. The CEO and the General Director work in Sukabumi, the Director Finance & Marketing is head of the office in Jakarta.

Both The CEO and the General Director propagate continuous improvement in the factory in Sukabumi. The method of improvement is TQM. Process Innovation instead of process improvement is relatively new within Sarandi. A presentation about the advantages and risks of BPR and a comparison with TQM has been given to top management to clarify the possibilities of reengineering and process innovation.

Afterwards a presentation has been given to top management and the heads of relevant departments including a workshop about successful reengineering at Ford. The attendants of the meeting also explained their vision about the opportunities for reengineering.

4.2 Identify reengineering possibilities

The first step in identifying possibilities for reengineering is to map the different processes, to analyse where information and communication flows are not optimal. This has been done by semi-structured interviews with the department heads. The tool BiZZdesigner has been used to give a broad description of every process. The crucial position of both the production and production planning and inventory control (PPIC) departments became clear after the interviews. Both departments communicate intensively with almost all other departments.

The next step after mapping the processes was a meeting and brainstorm session with Sarandi's management, to combine the insights from mapping the different processes with their vision. The focus of improvement within Sarandi is on the production department. According to top management most of the problems occur within production or at the communication moments with the different other departments. An example is unclear communication between production and engineering about drawings. The production department is the main actor for the manufacturing process. Both top management and the researchers concluded after a brainstorm session that only applying process improvement techniques like TQM on manufacturing is insufficient because of Sarandi's growth in the past years, and when companies grow their processes are likely to change. According to the research of Grover[20] et al. BPR is seldom performed on the manufacturing process, even in manufacturing companies. There are a few reasons for this phenomenon. The most important one is that a manufacturing process also exists of a physical stream (the physical product), which is difficult to reengineer. This research is therefore an opportunity to investigate the possibilities of business process innovation and specifically BPR techniques in a relatively new context, namely the manufacturing process.

4.3 Identify enabling technologies

The primary enabler of BPR is IT. The current IT system in Sarandi is developed in-house. Sarandi has a general scheduling system, which allows departments like warehouse, purchasing and production to view the production planning and stock levels. It also allows production administration to enter manufacturing times for the different divisions and Quality Control (QC) can enter repair and reject rates. The system does not allow automatic resource planning after order entry. Planning is therefore done manually.

The complete system is developed in-house and has been modified continuously by the IT department. This means that there is a lot of knowledge about the structure of the system and that it is relatively easy to change the system in-house.

The general system is closely linked to the manufacturing process. The primary enabling technology for improvements in the manufacturing process is therefore the general system.

4.4 Align with corporate strategy

Sarandi has stated both the mission and strategy in the company profile[21].

4.4.1 Mission and Strategy

Sarandi's mission consists of two parts:

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[20] Grover et al., "The implementation of Business Process Reengineering", page 17
[21] PT Sarandi Karya Nugraha, *Company Profile*

- To advance in technology, production process, and to enhance human resource skills
- To provide the best possible profit for the employees, shareholders and community

The best possible profit can be described as the most added value for employees, shareholders and the community.

Sarandi's strategy is also stated in the company profile: The company's main concern is to serve customers by enhancing the quality of production and admit as a trustworthy business partner.

4.4.3 Alignment

Both the mission and strategy of Sarandi mention improvements in the production process as a main focus for Sarandi. This also follows from the interviews conducted with the management of the company. A BPR track focused on the manufacturing process will improve the IT that supports the production process. Besides this, there will also be changes in the human resource area, that will acquire new skills from operators and possibly from management. This ensures that the first element of Sarandi's mission is covered by this research, namely advancement in technology, the production process en enhancement of human resource skills.

Sarandi has also included improvements in the production process in their strategy. The focus of this BPR cycle will be on improvements in the manufacturing process, which also includes the production process. Therefore, this BPR project is aligned with the corporate strategy of Sarandi.

5. Initiate

The Initiate phase consists of two steps: Organise reengineering team and Set performance goals. This phase within BPR takes relatively little time. It is important to maintain management commitment ensured in the Envision phase throughout this phase.

The manufacturing process was chosen for reengineering. The end result of this phase will be a selection of quantitative variables that can be used for reflection and performance measure after the completion of the BPR cycle.

5.1 Organise reengineering team

After the Envision phase it became clear that the focus of this BPR cycle will be on the manufacturing process. Besides the production department, PPIC plays a major role in planning and monitoring production. Specific knowledge of IT is necessary to ensure that the implementation plan for IT can actually be performed. Therefore the reengineering team will exist of the following persons: CEO (director production), the head of the production department, the head of production planning, the head of IT and both researchers.

5.2 Set performance goals

The central problem placed cycle time reduction in a central role. For this to happen, measurements of the times of the different steps in the manufacturing process are needed. It is too extensive to measure the lead times and the duration of all the sub processes for every product. Therefore a Pareto analysis has been performed to choose the products for which all durations of the sub processes will be measured. The sales numbers of the main 20% of the products in 2006 are analysed. They add up to account for 74,57% of total sales revenue.

Name Product	SubTotal	Percentage
Hospital Bed	5,221,446,075	27.24%
Instrument Cabinet	1,227,518,967	6.40%
Bedside Cabinet	1,150,570,085	6.00%
Ambulance	973,250,000	5.08%
Gynaecological Chair	971,234,364	5.07%
Operating Table	926,450,900	4.83%
Examination Table	741,028,647	3.87%
ICU – Iccu Bed	692,602,501	3.61%
Instrument Trolley	628,288,086	3.28%
Emergency Stretcher	619,610,534	3.23%
Verlosbed	573,061,946	2.99%

Infusion Stand	568,515,680	2.97%
Total		74,57%

Table 5.1 Pareto Analysis

The analysis makes clear that hospital beds are by far the most important product. Measurement of the duration of every sub process within manufacturing will be done by measuring the times of the process for hospital beds. This will provide a way of measuring achieved results. Next to the lead times of the sub processes, reject rates of quality control will be mapped. The choice for reject rates is because these rates are indirectly responsible for variability in the lead times.

5.2.1. Lead times of sub processes of hospital beds

Data regarding stainless steel and painted hospital beds were collected. The difference between the two types is that the head and foot unit of the stainless steel beds are polished and that these units of the painted bed are painted. This results in a slight difference in finishing time and painting time for these types of beds, but not a difference that affected the results. For these types, data of all beds produced and finished in 2007 were collected. The total data amount consists of 23 orders and a little over 300 beds. For each sub process, the earliest start dates and latest finish dates are calculated to determine the total time the sub processes take.
Next to comparing the before and after lead times for the project, it is also convenient to use the data for estimating future delivery times. Therefore, the lead times were calculated per hospital bed. At the moment Sarandi does not know how long the different sub processes take, they only estimate that, for example, machining/KB takes five days for an average order. The real lead times are very different. There was found that is takes 3.55 days per hospital bed to complete the whole manufacturing process. The average order quantity used to get this result is 20 hospital beds. In this average of 20 hospital beds, there are also some outliers included. Because the order amount of around 10 beds is the most common amount for ordering, and the expectancy that producing 10 beds will take a longer time per bed, it is useful to also know the average producing time per bed for an order amount of 10 beds. The result for this order amount was a lead time of 4.25 days.
The lead times of the manufacturing process and individual lead times of the sub processes are shown beneath for the average order amount (20 beds) and order of 10 beds.

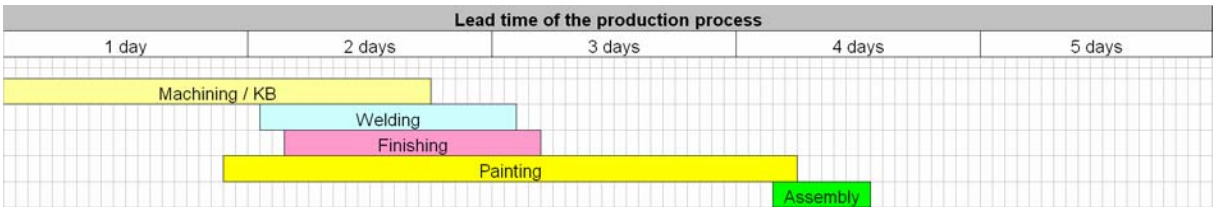


Figure 5.1 Lead times of manufacturing process of the average order amount (20 beds)

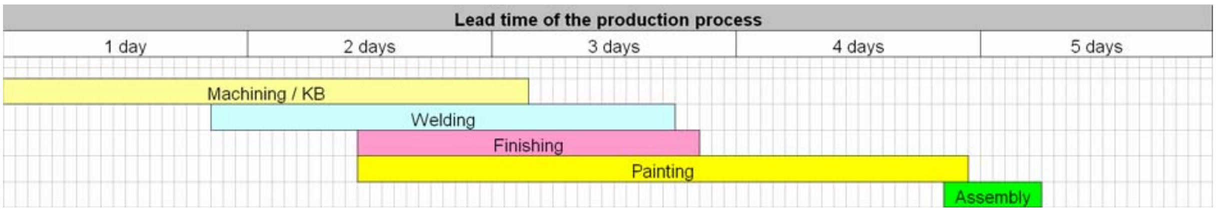


Figure 5.2 Lead times of manufacturing process of the most common ordering amount (10 beds)

As can be seen in the above two figures, the different sub processes are not in a full sequential order. The percentage of overlap was calculated using the production data, and applied at the average lead times.

5.2.2 Reject rates of the quality control procedure of hospital beds

The quality control procedure can be split up into two different moments of quality check. The first is the quality check by the production operators themselves and the second is the quality check by the quality control department. Production checks their own jobs after finishing it, and quality control checks batches of products. There is no standard procedure for the total quality control procedure; the quality control department performs checks depending on their available capacity.
The first step in finding the data is getting relevant reports. The quality control department did provide some reports, but when calculating the exact data, those numbers did not seem to reflect the reality because of double registration with the production department. The separate reject rates were calculated for every process. The results are presented in the table below.

Machining		Welding		Finishing		Painting		Assembly	
Production	QC dept.	Production	QC dept.	Production	QC dept.	Production	QC dept.	Production	QC dept.
0.3%	0.4%	1.2%	3.4%	0.4%	0.4%	10.4%	4.7%	0.7%	1.1%

Table 5.2 Reject rates of the quality control procedure

So for example, the welding operators check their own work, and in 1.2% of the cases they find a mistake, make a note of it on the job cards and repair it themselves. After a batch of welding is finished, the quality control department checks it again and in 3.4% of the cases they find mistakes, which have to be repaired again by the operators.

6. Diagnose

The Diagnose phase consists of two steps: Document existing process and Uncover pathologies. The 'dirty slate' approach makes documenting the existing processes very important. Therefore two steps have been added: Document existing human resource architecture and Document existing IT.

Up until now, the manufacturing process was chosen for reengineering and lead times and reject rates of hospital beds were selected for performance measure. In the diagnose phase, the manufacturing process, current HRM and current IT situation will be documented. Next to this, pathologies in the manufacturing process will be uncovered.

6.1 Document existing process

This step of the BPR cycle at Sarandi is the most time-consuming because of a lack of process documentation. Quantitative research on the lead times, repair and reject rates has been done in the phase about setting performance goals. This already gave insight in the manufacturing process. More in-depth research has been done by interviewing the heads of departments and drawing the process in the tool BiZZdesigner.

6.1.1 Manufacturing process flows

The manufacturing process is documented by investigating the physical product flows and the information and communication flows. The BiZZdesigner tool was used for this research step. BiZZdesigner is a useful modelling tool, because the graphical representation of the process also includes information and communication flows. This is important, because the focus of this BPR project is redesigning the information and communication flows and not physical product flows. After the documentation was finished, interviews with the relevant departments were organised again. The purpose of these interviews was to check if the modelled process is the same as the real process within Sarandi. This is an important step because continuing the BPR process with an incorrect model would obviously lead to unreliable results. Some adjustments were made after the interview sessions on the section about wet painting in the quality control procedure.
A concise summary of the manufacturing process can be described as follows: after an order, PPIC makes the production planning, SPK and DKK (Indonesian abbreviations). The SPK is the document that states that Sarandi will deliver the product to the customer. The DKK is the document that states that a certain order will be fulfilled by production in-house. The remaining orders are produced by subcontractors. Engineering refreshes the bill of material, and checks the drawings. After both are finished, warehouse administration checks inventory and makes the job card for the cutting process. After the cutting process, production administration makes job cards for the other production sub steps. The process of making these job cards is not necessarily sequential, but is dependent of the

production schedule. After most of the production sub steps, quality control checks samples of the semi-finished products. There is a special department for painting repair. Also, if after assembling quality control finds damages, the product returns to painting repair where also packaging and storing take place.

The graphical representation of the manufacturing process is presented on the next page.

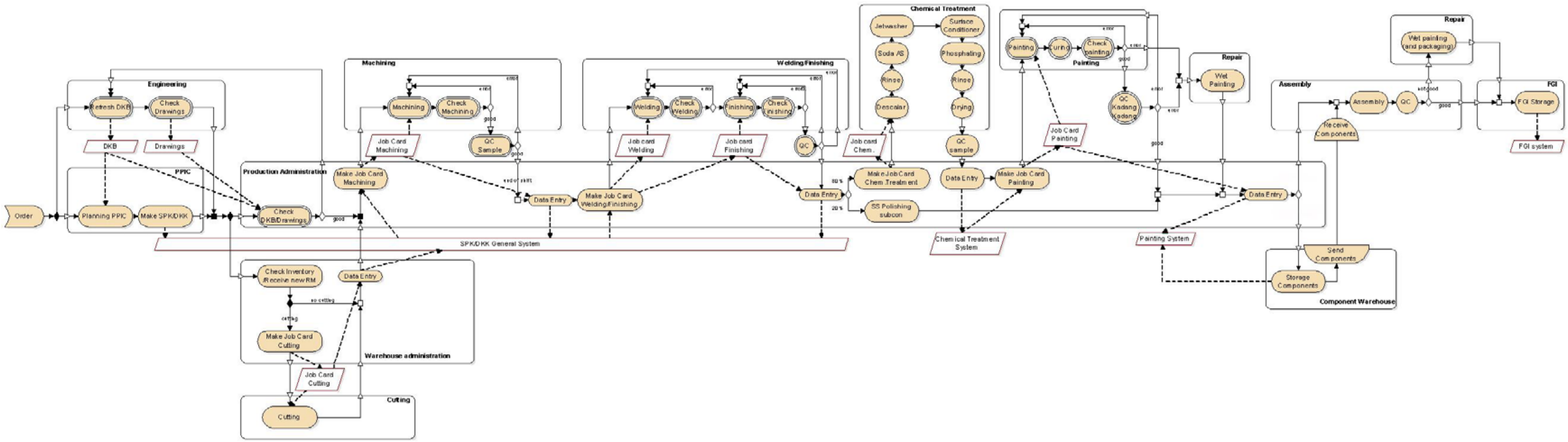


Figure 6.2 Model manufacturing process

6.2 Document existing Human Resource architecture

Within BPR, redesign is also done on the human resource process. The PRLC does not contain this step. The necessity of this step comes from an important difference in the PRLC approach, which is ‘clean slate’, and this approach, which is ‘dirty slate’. The goal of this BPR cycle is not to completely design the HR architecture from scratch, but to make improvements to the current situation. Therefore it is necessary to map the current human resource situation. A graphical representation of the company, in the form of an organisational chart can be found in Appendix A. The figure is based on the chart made during the previous research by Golbach and Meutstege[22].
The evaluation of HRM is done by analysing the different aspects of the model of strategic human resource management. The summary of this model can be found in the theoretical background. A systematic approach is followed to determine the policy of Sarandi on the different aspects.

The first part is ´Attracting an Effective Workforce´. Sarandi uses a strict procedure to attract new employees that consists of several sequential steps:

1. Departments communicate the need for new employees to the HRM department.
2. The approval of top management is needed to determine whether to hire new employees and the number of new employees for the department.
3. The necessary skills of the new employee are determined.
4. An advertisement in the local newspaper is placed. Recruitment is also done by radio, internet and internal communication.
5. 1st Job interview (only with the head of HRM).
6. Writing test
7. 2nd Job interview (HRM, Head of the relevant division, one of the directors).
8. Informing the candidate about the contents of the labour contract.
9. Signing of the contract.
10. A test period of three months including training skills necessary in that department.
11. Contract for one year.

All the steps of the recruitment process have to be completed successfully to continue to the next step. Surprisingly, forecasting is a step that is not performed by Sarandi.

Developing an Effective Workforce is done at Sarandi by organising trainings. The initiative for organising trainings comes from the departments themselves. The heads of departments let the HRM department know if they need trainings for their department. Permission for actually organising trainings has to be given by both the head of HRM and the general director. Examples of trainings that already have taken place are a powder coating training (painting division), a 5S training (Japanese method for clean workplaces) and a customer training (sales department).

[22] Golbach & Meutstege, “Improving planning and control systems at PT Sarandi”

The last element in the strategic human resource management model is maintaining an effective workforce. Sarandi evaluates every employee each six months. This is done by an evaluation team, consisting of the relevant head of department, the HRM head and one of the directors. Every employee is scored on several criteria. An absence penalty is deducted from the added scores to calculate the final score. There are four score categories:

- A: one year extension of the contract and a bonus
- B: 6-12 months extension and a special skills training
- C: three months extension with training and an extra evaluation
- D: termination or replacement to another department

In practice, termination never occurs. Every year Sarandi adjusts salary for the inflation rate and performance bonuses if applicable. The existing HR structure at Sarandi is relevant for this research in the sense that it functions as a framework in which the proposed solutions have to fit.

6.3 Document existing Information Technology

The decision to add this step to the methodology is based on the same logic that is used in the previous section on human resource architecture. This research also starts with a dirty slate for IT, improvements will be made on the current situation. To make sure these improvements and adjustments are possible and compatible with the other already existing systems, an investigation of the current information technology that is being used in the company is necessary.
The PRLC does not contain this step, so there are also no techniques and tools directly available to use. This research therefore proposes a technique to perform this step in the BPR cycle. Information technology is split up in two main parts: Information systems and Information architecture. Information systems gives a description on what kind of systems, or software, are used in the company. Information architecture describes what kind of hardware is used.

6.3.1 Information Systems

Laudon & Laudon[23] propose a model that consists of six levels of information systems (IS). Sarandi's systems have been mapped to those six categories. This is done on the two processes of manufacturing and HRM because those systems are subject for redesign. It is possible to draw the relations between the systems in an UML Component Diagram[24]. This showed not to provide extra clarity and therefore Table 6.1 shows the mapping of Sarandi's systems to the six levels of IS.

[23] Laudon & Laudon, "Bedrijfsinformatiesystemen" p.43
[24] Bell, D. (Dec 15, 2004) "UML basics: the component diagram", retrieved November 21, 2007, from http://www.ibm.com/developerworks/rational/library/dec04/bell/

Types of IS	Manufacturing	HRM
Executive Support Systems (ESS)	-	-
Business Information Systems (BIS)	Lead time reports Quality Control reports	-
Decision Support Systems (DSS)	-	-
Knowledge Work Systems (KWS)	Quality control system Computer aided design (CAD)	-
Office Systems	Production planning spreadsheets	Employee feedback spreadsheets
Transaction Processing Systems (TPS)	Planning system Purchasing system Warehousing system Quality control system	Employee database Employee presence system

Table 6.1 Information systems

There are three other systems that are slightly linked to production and HRM besides the systems mentioned in table 6.1. Those are the research and development and the financial system. The relationships with these systems have to be kept in mind, while redesigning the production and HRM systems.

The four TPS within manufacturing are compatible. They store data in the same general system. The department of engineering uses a separate CAD system.

Table 6.1 makes clear that there are little high level information systems used in Sarandi, especially because the reports that function as a business information system often can not be generated from the production data. This leaves management with little knowledge about the process and performance.

6.3.2 IT architecture

Sarandi makes limited use of IT hardware. The office functions make extensive use of computers. Also the engineering and research and development departments are computer intensive. The use of computer technology in the actual manufacturing process is very limited. Research and development is in the process of designing a automatic cutting machine (computer numerical controlled (CNC)). At this moment however, operators perform their tasks purely manually.

6.4 Uncover pathologies

After diagnosing the current situation at Sarandi, the reengineering team defined several pathologies in the manufacturing process. The pathologies were located both in the production department itself, as in the communication flows with other departments. Some of the pathologies were derived directly from the BiZZDesigner flowchart, others were mentioned by the head of departments in the interviews and from the pathologies brainstorm session with the head of departments (also including the reengineering team).

The pathologies brainstorm session was performed using the brainstorming process outline by Hicks[25]. A pre-meeting with the problem owners, the heads of the relevant departments was already done in the form of the semi-structured interviews. A warm-up session on a different subject (in this case: things in life that annoy you) was performed to make the attendants familiar with the brainstorming framework and to stimulate creativity. The acquisition of on-topic ideas resulted in a list of pathologies.

Selection of the pathologies to be tackled within this BPR cycle has been done using the SMART technique, a multi criteria decision analysis (MCDA). This selection step is further explained in section 6.4.2.

6.4.1 Pathologies definition

All identified pathologies are stated in Table 6.2. A description of the pathology is added and the source is given. Three different sources have been identified. The largest part of the pathologies originated from the interviews with the heads of departments. In the table, the pathologies from the interview source became clear after an interview with the head of the department of the specific category. So the production pathologies were uncovered by an interview with the head of production, the production-engineering pathologies were uncovered by an interview with the head of engineering and the production-QC pathologies were uncovered by an interview with the head of quality control. Some of the pathologies follow directly from the BiZZDesigner process flow chart, as described in section 6.1. The other two pathologies were ideas from the pathologies brainstorm session.

Pathology	Explanation	Source
Production		
Inadequate performance measurement	Incorrect and incomplete data make performance measurement incomplete	Interview
No employee feedback system	Employees are not motivated to excel, the current bonus system is subjective	Interview
Excessive number of job cards	Making job cards and data entry of the results takes a lot of time.	Process
Production – Engineering		
Bill-of-Material & drawings change too frequently	Engineering and Production use different or non-updated drawings	Interview
Not enough time for drawing new products	Engineering does not have enough time to make the drawings for new products	Interview
Production – Planning & Inventory Control(PPIC)		
Production does not follow PPIC's schedule	Production changes schedule due to	Brainstorm

[25] Hicks, M.J, "Problem Solving in business and management" p.88

	problems or delays in manufacturing, which messes up PPIC`s planning	
Production – Warehouse		
Incorrect data from warehouse to production	The IT system for warehouse is not working flawless. In practice, manual data is mostly used	Brainstorm
Production – Quality Control (QC)		
Procedures are not clear (inconsistent QC)	Not enough manpower to perform consistent QC, QC is done sometimes and less in high season	Interview
Insufficient inherent process quality	No quality focus by employees, QC checks after almost every step	Process

Table 6.2 Pathologies

6.4.2 Pathologies choice

The decision maker for this choice is the reengineering team. The members of the reengineering team represent the different departments and interests of the company and will all have an equal vote. This ensures an objective choice, instead of a possibly subjective choice based on the vision of one person or department. The alternative courses of action are the pathologies subject to improvement.

SMART has been used to prioritise the pathologies and to choose a limited number of pathologies to tackle. The members of the reengineering team were asked to rate the pathologies on three attributes. Covert states these attributes are general attributes that are often used to prioritise BPR alternatives[26].

Feasibility – the easiness to redesign and solve the problem. Feasibility is important, especially in the first BPR cycle, to create positive momentum for BPR. A high rating on feasibility also implies that it is possible to solve the pathology in relatively short time, which is especially important in this BPR cycle, due to the limited amount of time.

Impact on process time – the amount of extra time added to the process caused by the pathology. The core target of the research is to decrease the manufacturing process time and therefore this criteria is the most important. The weight of this criteria is double, relatively to the other two.

Dysfunction – ineffectiveness. The relative amount of errors that are caused by the pathology. Pathologies that score high on this criteria cause a lot of quality problems and are disruptive for the process.

[26] Covert, M., Visible Systems Corporation, "Succesfully performing BPR"

Because shortening cycle time is the focus of this BPR cycle, impact on process time is the most important attribute. It is weighted twice as important as the other two attributes, that are considered to be of equal importance.

The criteria were rated individually (0-100). Afterwards, the individual ratings were added and weighted to calculate the total score. Table 6.3 states the highest scoring pathologies and their SMART scores. The complete table can be found in Appendix C.

Please rate on 0-100	*Feasibility*	*Normalised factor 0,25*	*Impact on process time*	*Normalised factor 0,5*	*Dysfunction*	*Normalised factor 0.25*	*Total*
Production							
Inadequate performance measurement	570	142,5	440	220	450	112,5	475
Excessive number of job cards	540	135	590	295	565	141,25	571,25
Production - QC							
Insufficient inherent process quality	595	148,75	550	275	450	112,5	536,25

Table 6.3 SMART Table

The provisional decision contains the three highest scoring pathologies:

• Excessive number of job cards: from the BiZZDesigner model it becomes clear that there are job cards for every sub process and that those are made separately and manually. This takes a lot of time from production administration. This pathology finds its roots in the cooperation with the production planning department (PPIC). Production administration gets a scheduled start and finish date from PPIC and their task is to manually make job cards from this information. After every workday production administration collects all the job cards again and enters the start and finish times of the jobs of the operators in the system. These two activities obviously take a lot of time and next to this, it does not even provide optimal job cards (schedules) and no functionality for performance reports.

• Insufficient inherent process quality: The department for quality control (QC) is fully responsible for quality and checks after almost every step. There is no focus on quality by the employees. In the last decades in manufacturing companies around the world, there is a shift towards quality control by the operators themselves. Sarandi should also start implementing this, because this method has proven to lead to less errors and a decrease in time for quality control.

• Inadequate performance measurement: the current IT system can supply various raw data, but the information is often incorrect due to mistakes in manual entry and there are no summarising reports available on the duration of sub processes or errors made.

Sensitivity analysis has been performed to see how robust the priorities are to changes. Impact on process time is the most important criterion and has therefore been chosen for the analysis. In this way it is possible to see if the priorities for the different pathologies change if the weight for this criterion is altered. The sensitivity analysis can be found in figure 6.3.

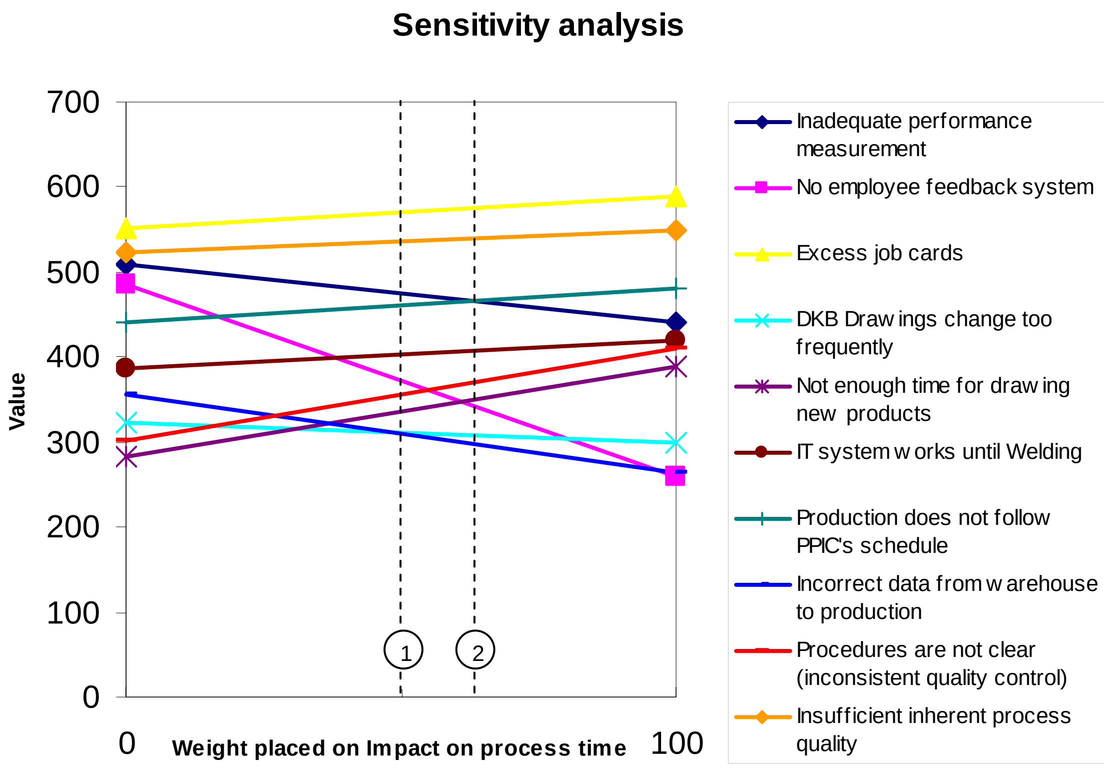


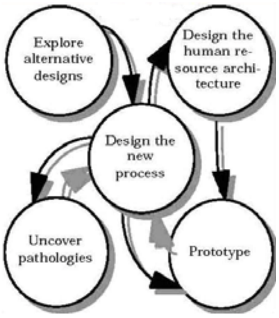
Figure 6.3 Sensitivity analysis

The graph shows that the top two pathologies are constantly valued higher (despite changes in the weight). Line one represents the chosen weight for impact on process time, fifty percent. When the weight is 64 percent or higher, priorities three and four switch. 'Production does not follow PPIC's schedule' becomes number three then. This occurs because this pathology scores low on feasibility. It will take a lot of time to tackle this problem and therefore it is not suitable enough for this BPR cycle. The focus will stay on the top three pathologies given by line one:

- Excessive number of job cards
- Insufficient inherent process quality
- Inadequate performance measurement

The three main pathologies are tackled by redesigning them in the next phase of the BPR cycle.

7. Redesign



The Redesign phase is the step in which the process and the human resource architecture are changed to solve the pathologies found in the Diagnose phase. The pathologies for this research are: Excessive number of job cards, Insufficient inherent process quality and Inadequate performance measurement.

After documentation, the manufacturing process is ready to be redesigned in this phase. This will be done by exploring alternative designs and redesigning the process. Also, a new human resource architecture will be designed and a prototype of the new process will be developed.

7.1 Explore alternative designs

In the previous section many pathologies were discovered and three of them were selected to continue the process of reengineering. The next step is to design new processes that will translate these pathologies into more effective and efficient processes. The result is a standard design and an extended version of this design. The choice for one of these will depend on the preference of Sarandi and the willingness to put available resources in the change process. The first paragraph in this chapter will explain the steps of how the new process designs were developed. Then, the two designs will be described.

7.1.1 Road to the alternative designs

The steps of designing the new process will now be explained. In the diagnose phase a model of the manufacturing process flows was developed and the most important pathologies were identified. In the redesign phase a more in-depth process flow diagram was developed, which can be found in figure 7.1 at the end of this section. This diagram was developed by investigating the departments related to the three pathologies and modelling the current process. When the current sub process is clear, new optimised processes can be described.
Summarised, the new process that will be designed is a sub process of the total manufacturing process. This process will include the departments that share a relation with the identified pathologies. Next, the graphical representation of the current process will be shown and explained. After that, the different new designs will be described.

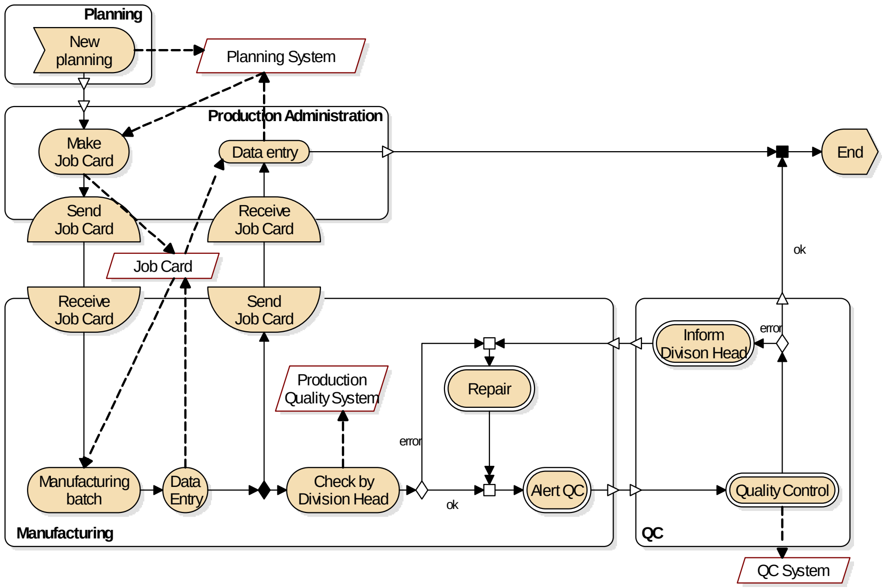


Figure 7.1 Current sub process flow chart

Explanation of the flow chart

In the current situation, the planning department makes a planning for the new incoming order. This planning only includes a scheduled start en finish date for the total order. The result is a list of start and finish dates for the current scheduled orders. This list is passed to the production administration. Then production administration makes job cards for the new order. This is done manually, by searching in the system for the earliest available operator. This is done for every division separately, so for machining, welding etc. This obviously takes a lot of time and is not very effective. Next the job card is given to the operator, who starts working on the next scheduled job and writes down the starting time on the job card. After finishing the job, the operator writes down the finish time. At the end of the working day, the operator brings the job card to the production administration and they enter the data from the job card into the IT system.

When the operator finishes a job, he calls the division head who checks the finished work for visual errors. If an error is found, the operator repairs it and the QC department is alerted. When no error is found, also the QC department is alerted. QC performs the full quality control and when errors are found, the division head is informed. The division head then makes sure the job will be repaired.

7.1.2 Alternative designs

Alternative 1 (standard version)

This process will let operators retrieve their own next scheduled job. The job cards are still made manually by production administration. While operating the job, the operators have to repair errors when they see them during the operation. When they are finished, the operators enter the data on a computer in their own workplace. In the beginning the QC department will still check every job finished by operators, but they will gradually shift to a new department for prevention of errors, working more efficient and finding causes of errors made by operators. This design will lead to the improvement of all of the issues related to the three pathologies mentioned in section 6.4, except for the large amount of time of making the job cards manually.

Alternative 2 (extended version)

In this second alternative the job cards will be generated automatically from the production planning. The rest of the process will be equal to the first alternative. With this extension of the previous design, also the final issue of the big amount of time for making the job cards is solved.

7.2 Design the new process

The standard version was chosen for implementation. The reengineering team agreed that implementing this version would make the change still comprehendible for Sarandi. This is very important, since this is the first time BPR is implemented and a successful change will result in a positive momentum. But because the extension of the second design will at some time in the future be inevitable for an optimal process, a process flow diagram has been developed for the second design. The only difference in the standard version diagram would be a separate planning system. The diagram is presented in figure 7.2. Next, a more thorough description of the new process will be given.

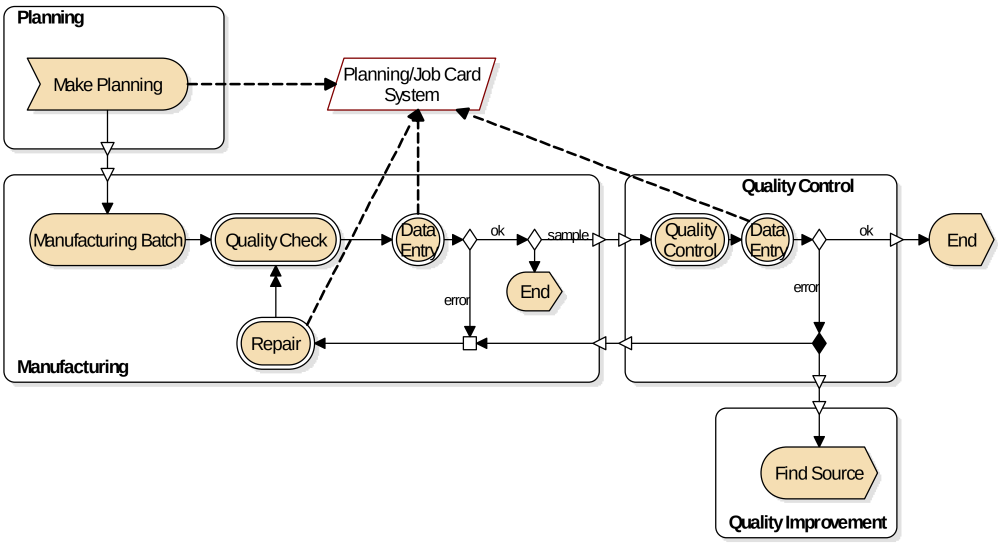


Figure 7.2 New sub process flow chart

<u>7.2.1 Detailed description of the new process</u>

The new sub process from figure 7.2 will have the functionality of automatically generating the job cards from the production planning. In current sub process, PPIC enters the scheduled start and finish date of an order in the system and production administration makes job cards from this manually. For automatic job cards generation, a new information system has to be developed for production planning and assigning operators to the jobs. This should be well possible, because the only variables needed

for such a system are the order amount, available capacity and the amount of time each activity takes. Only the time each activity takes is not known for every activity, but this can quite easily be calculated. The IT department can develop this new production planning and job card system in-house, together with PPIC and production. Again, the solution that will be implemented does not have this functionality because the standard version was chosen to continue the BPR cycle.
When an operator is ready to start his job, he moves to the computer in the workplace and clicks on his name. This will be a newly installed computer, because at the moment there are no computers on the work floor. Then the interface shows some relevant information about the next scheduled job. The time is started and at the same time the relevant information about his next job rolls out of the printer. While operating on his job, the operator has the responsibility to check his work for quality and repair when necessary. When the operator is finished working on the job, he moves again to the computer, clicks on his name and clicks on “finished”. Now the next job automatically appears on the screen, the time starts again and the operator receives his next job from the printer. At this point in time, the IT system has received all these data. The IT system should be adjusted so that the relevant information can be extracted from the system. The same data input will be used for adjusting the production planning and job cards.
Then the QC department will check the work again for quality and enters the information in the improved QC part of the IT system. The improved QC system will have the functionality to generate performance reports for every operator.
Gradually, the operators will get more responsibility for their own quality check, and the QC department will only check problem areas like the painting procedure and after assembly. Gradually, personnel will shift to a new department called quality improvement. This department is responsible for sampling production, prevention of errors, working more efficient and finding causes of errors made by operators.

7.2.2 Performance of the new process

The result of this new process is that production administration does not have to make job cards and enter the data from the job cards manually anymore. Next to this, there will be more inherent process quality because of the shift from quality control by the QC department to the operators themselves. Thirdly, the new process will have the functionality to generate performance reports per operator regarding the time they take to finish their jobs and the number of errors they make. A reward system will be implemented for short times and little errors. In a previous research, Bieze and Jongejan already introduced some performance indicators. These can be combined with the time and error indicators.
It is difficult to predict by how much time the cycle time will reduce. This is because of overlap in processes within the manufacturing process. However, it is possible to strive for a certain amount of error reduction within the quality control procedure. Given that operators will be trained for quality check, the implementation of a reward system for little errors and the introduction of the new quality control procedure, a 50% reduction would be a challenging but realistic goal.

These mentioned improvements can be reflected against the stated problems of the three pathologies described in section 6.4. As can be seen, all of the problems related to the pathologies will be tackled with this new design.

7.3 Design the human resource architecture

The changes in the process have an effect on the tasks and responsibilities of the employees of different departments. The departments that are most affected are production, production administration and quality control.

7.3.1 Organisational Changes

In the current situation, production operators only perform quality checks on a very superficial level. The new process design requires more from the operators. Their responsibility will be extended with the responsibility of checking the quality of their own work. The management of Sarandi made clear that this kind of job enrichment, extra responsibility, will only be possible if there is a clear, objective and transparent feedback system for the operators. Therefore this organisational shift will be accompanied by an IT system, that actually makes it possible to assess quality delivered by the employees and reward them for good results. Giving operators more responsibility is currently a part of Sarandi's TQM efforts, therefore this organisational change fits with Sarandi's strategy. The shift towards a quality-oriented workforce will be difficult and will be discussed further in the Reconstruct chapter.

In the current situation, the quality control department does not cooperate with the production department, but only checks finished jobs when requested. In the new design production administration and quality control will merge to form the new department quality improvement. The production department will also be more involved in the new quality control procedure. Broadly, two tasks can be identified for the new quality improvement department:

1. Prevention of errors in the manufacturing process and investigating ways for more efficient ways of producing, using both BPR and TQM techniques. The opinion of operators will be used in quality circles, preventive discussions between operators and the members of quality improvement. Input for these discussions will be the data on process durations and quality rates as provided by the IT system.
2. Sampling production for errors and retrieving underlying causes of mistakes. If an error is found, a small task force will be initiated. The task force will exist of the relevant operator(s), the head of the division and members of the quality improvement department. Their task is not only to correct, but most important to prevent failures in the future.

Quality improvement will eventually sample twenty percent of the total amount of products produced in manufacturing and one hundred percent quality check after painting and assembly. The reengineering team stated the time for this shift to a new quality control procedure to be three months. A detailed plan for this shift can be found in the reconstruct phase. A graphical overview of the gradual change is given in Figure 7.3.

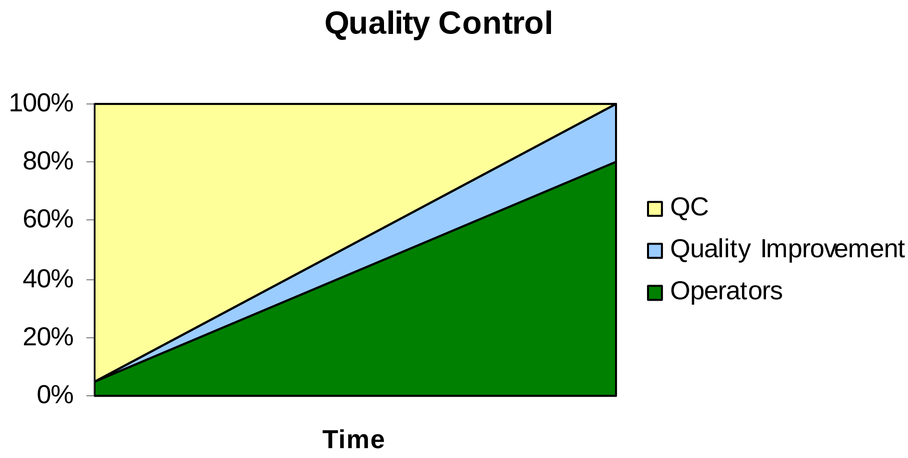


Figure 7.3 Percentages quality control

7.3.2 Reward System

In the current situation every employee is evaluated every six months based on scores by an evaluation team. Scoring is done on subjective criteria. The only objective criterion in the total score is the absence penalty, which is derived from data from the automatic absence system. With the new system, feedback and appraisal will be given on more objective criteria. The two most important performance indicators for every operator are the total delay in raw process time and the repair/reject rate for quality. The data can be derived directly from the new system. An extra indicator that can be added to the primary two is the number of implemented ideas per employee as stated by the Bieze en Jongejan[27] research. This encourages ideas for quality improvement and cycle time reduction by the operators.

7.4 Uncover pathologies

During the steps of designing the new process and designing the new human resource architecture, extra pathologies can be identified. During this research, there were no clear new pathologies identified that were more important than those already identified in the diagnose phase.

7.5 Prototyping

After designing the new process and the human resource architecture, the actual IT system that supports those new processes has to be developed. Sarandi is not using a model language for designing IT systems, actual IT development is done more on feeling. Therefore an easy to understand model language has to be used to ensure that the design can be used by Sarandi's IT department. Unified Modelling Language (UML) is most suitable for Sarandi, because it is relatively

[27] Bieze & Jongejan, "Supporting the company by improving their organizational performance"

easy to understand and widely used. The BiZZDesigner process model will be the guideline to draw a static UML class diagram, which represents the underlying database. Only a class diagram is not sufficient to build the system and therefore a UML sequence diagram will show the different sequential operations that have to be performed. The final modelling part is an example of the Graphical User Interface (GUI) that will be use by the end user, the operator. Prototyping has been done in cooperation with the IT department, to give two-way feedback about requirements and limitations of the IT system.

7.4.1 UML Class Diagram

Class diagrams are used to model the different steps of the sub process in an object-oriented style. This style makes it easy to build the underlying database. The sub process Job card and quality control has been divided in to 5 main objects: Order, Job Card, Operator, Part and Bill of Material (BOM). A sixth class is added to make clear to the IT department how the end user (the operator) can access the job card. In the actual design this class may be deleted. Figure 7.4 shows the UML Class Diagram

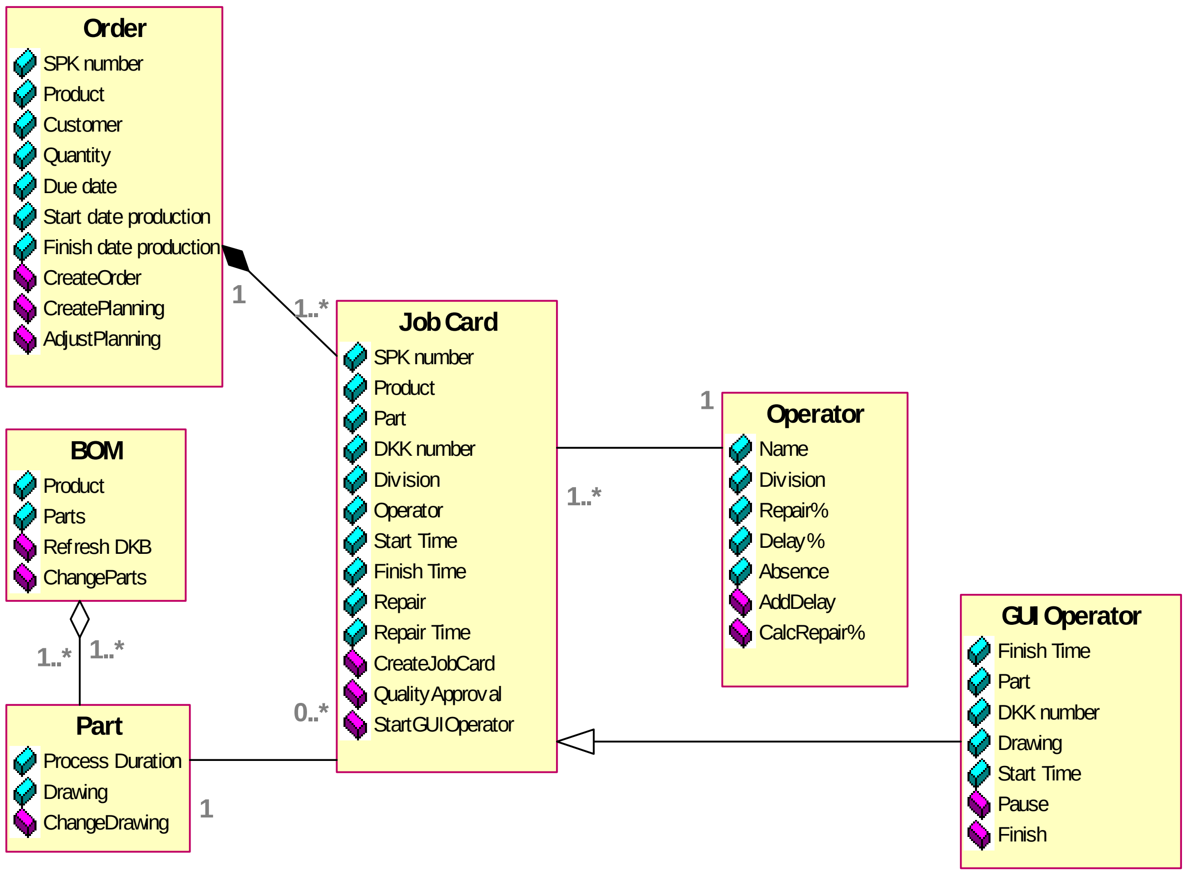


Figure 7.4 UML Class Diagram

The process starts with an order. The order exists of several attributes and operations that can be performed on the class. After initiating the order, the CreatePlanning operation adjusts the planning and creates new job card instances for the different divisions. The Job Card is the central object, data is edited by operators using the GUI Operator. Part data is retrieved from the class Part, a sub class from the BOM. The BOM and Part classes can be edited by Engineering, in case of new drawings or changes in for example dimensions. Data about delay and repair percentages are send to the class Operator after finishing the job. At some point afterwards, Quality Improvement can sample and check the quality of the part and edit the attribute Repair if repair has to be performed on the part.

An explanation about the multiplicities between the classes can be found in the theoretical background.

7.4.2. UML Sequence Diagram

The class diagram shows associations and some relations between the different classes, but it does not show the sequence of operations performed. A UML Sequence diagram has been used to model the communication between different classes. Figure 7.5 shows the UML Sequence Diagram.

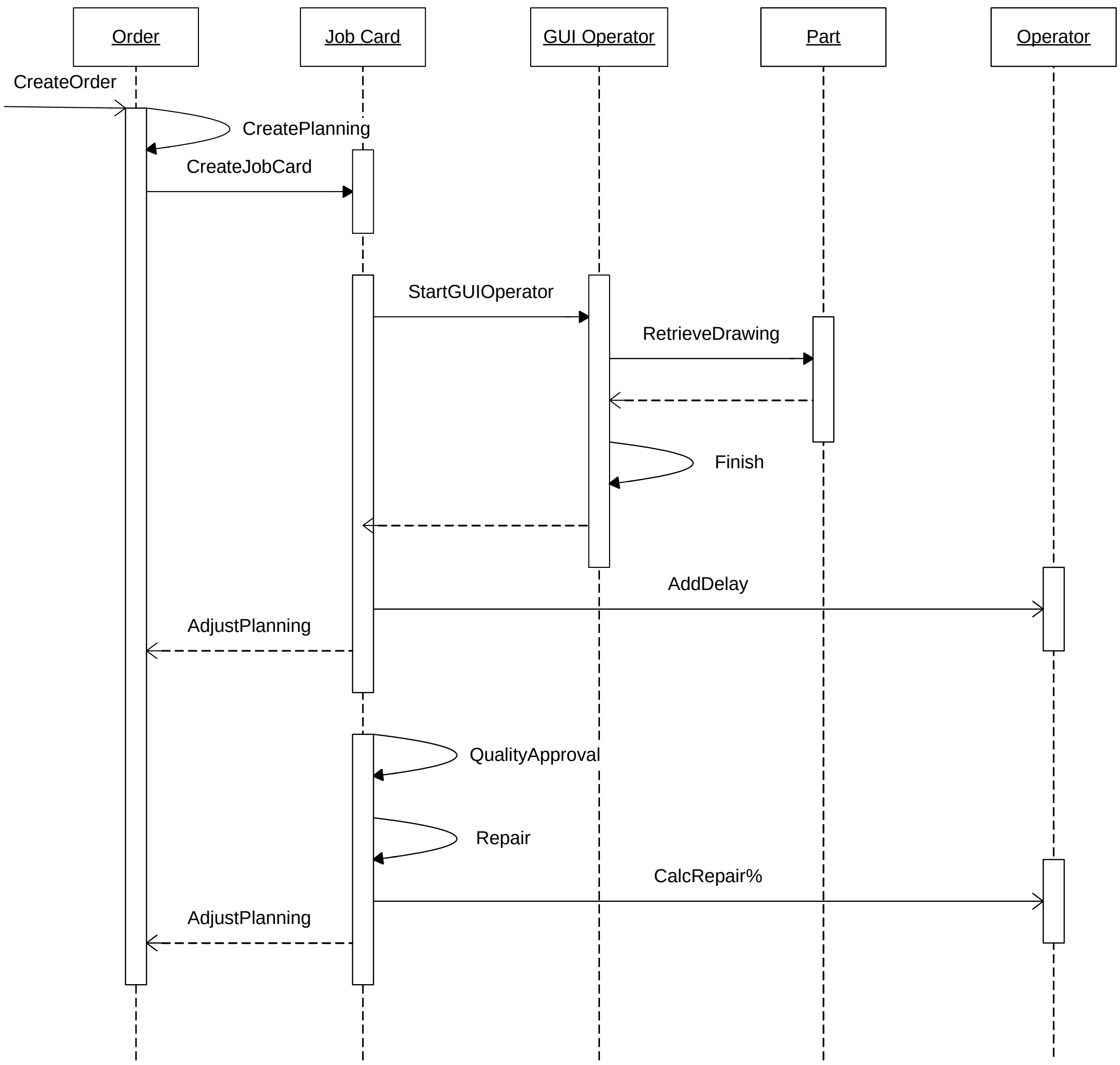


Figure 7.5 UML Sequence Diagram

The diagram shows that the Job Card class is active during three periods:

1. Initiation of the job card instance after the order has been entered into the system.
2. When the operator starts with the actual manufacturing, the class becomes active again and creates the user interface for the operator. Afterwards it communicates the results back to the order class and the operator class.
3. When the part is selected in the sample for quality control, the Quality Improvement department can give their approval or determine that the part has to be repaired. Data about repairs are also send to the operator class.

7.4.3 Graphical User Interface (GUI) Operator

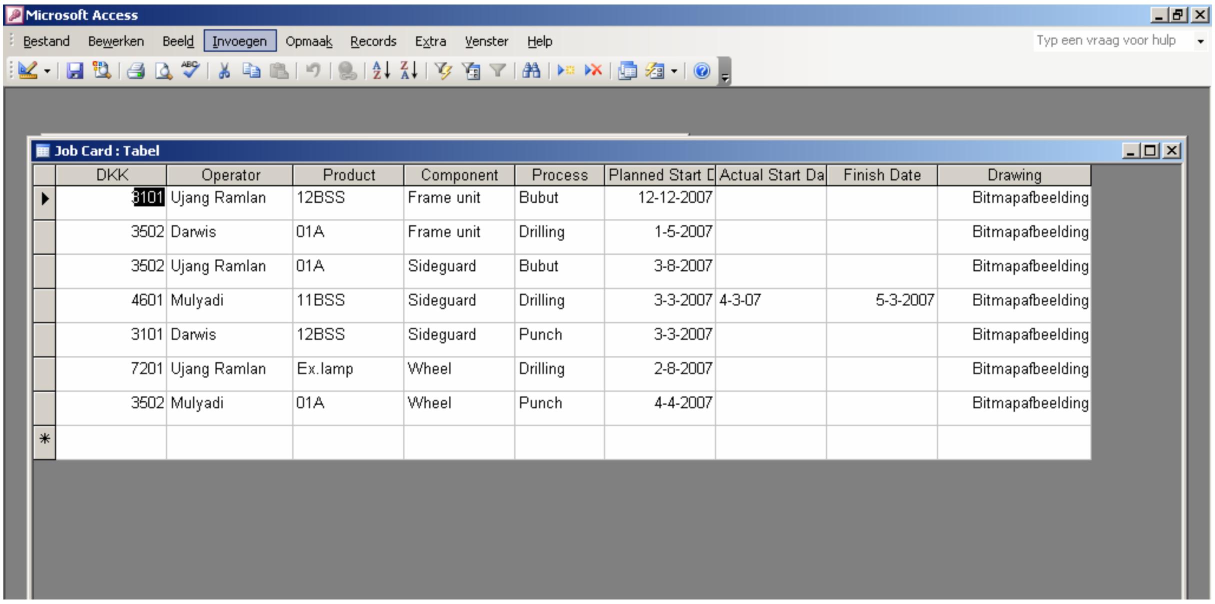
The system has to be used by the operators in manufacturing. There has to be a clear user interface that allows them to work as efficient as possible. Besides that, operates should have limited access to system variables to minimise errors in data gathering. There are a lot of problems with the input of start and finish time by operators at the moment because of the manual, paper, job card system. The new system is able to automatically calculate process durations using the internal clock of the computer. This is far more reliable and accurate than manual entry. The only necessary entry by operators is when they finish their current job. The time data will be calculated by the system and entered in the database. Afterwards the next job for the operator will show up on the screen.

7.4.4 Microsoft Access Prototype

The previous steps in prototyping developed the framework for the system. An actual prototype has been build using Microsoft Access. Access is used because it is a rapid way of prototyping. Besides this, Sarandi’s system mainly consists of a large database and Access can model databases easily. The prototype allows end users to enter the finish time and automatically updates the database. The next job for the operator is displayed afterwards.

This prototype is used to discuss functionalities with the IT department and making improvements, before the IT department can start with building the actual system. The actual system will be based on MySQL database, the new database management system used at Sarandi.

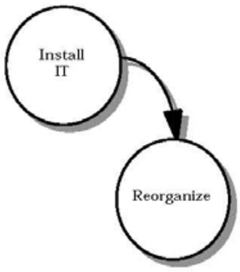
Figure 7.6 shows the main table in the prototype. Production administration can add rows with jobs to the table. The operators enter duration information automatically, using the GUI. An example is given in figure 7.6, where operator Mulyadi has performed a drilling job. Reports can easily use the start and finish dates to calculate durations and delays.



DKK	Operator	Product	Component	Process	Planned Start D	Actual Start Da	Finish Date	Drawing
3101	Ujang Ramlan	12BSS	Frame unit	Bubut	12-12-2007			Bitmapafbeelding
3502	Darwis	01A	Frame unit	Drilling	1-5-2007			Bitmapafbeelding
3502	Ujang Ramlan	01A	Sideguard	Bubut	3-8-2007			Bitmapafbeelding
4601	Mulyadi	11BSS	Sideguard	Drilling	3-3-2007	4-3-07	5-3-2007	Bitmapafbeelding
3101	Darwis	12BSS	Sideguard	Punch	3-3-2007			Bitmapafbeelding
7201	Ujang Ramlan	Ex.lamp	Wheel	Drilling	2-8-2007			Bitmapafbeelding
3502	Mulyadi	01A	Wheel	Punch	4-4-2007			Bitmapafbeelding

Figure 7.6 Prototype main table

8. Reconstruct



The reconstruct phase is the moment for the actual change of the organisation: the new IT will be installed and the organisational changes will be implemented. For Sarandi, this step will contain a detailed plan to succesfully complete this phase.

Now that the new manufacturing process and human resource architecture are designed, it is time to formulate requirements and necessary output for the IT system. Next to this, new job and task descriptions have to be formulated. The shift to the new quality control procedure and managing cultural aspects will also be subject of the reconstruct phase.

8.1 Install IT

Actual installation of both the software and hardware will be done by the internal IT department of Sarandi. The objective is to provide Sarandi with a computer terminal in each production department, where operators can enter their production data in the system as described in section 7.4.

Requirements new system:

- No physical job cards (only for backup)
  - Job Cards are shown on screen and possibly printed by a label printer
  - Job Cards are shown one by one
- Direct entry job durations by operators
  - Operators press finish, the system automatically updates start and finish time
- Direct entry results quality sample
  - Quality Improvement has access to the same database and job card instance to enter the results of quality checks
  - Repair times are stored in the system
- One database for drawings Engineering
  - Engineering updates drawings in the same database (Part class) to ensure alignment

Necessary output system:

- Accurate data on lead times
  - Lead times can be used as input for planning and marketing
- Accurate data on quality performance
  - Uncover permanent problems
- Accurate data on delay time/operator
  - Operators receive objective feedback based on scores on delay
- Accurate data on quality/operator

- Operators receive objective feedback based on scores on quality

The implementation of the system will be in line with the corresponding reorganisation steps. This means that there is a period planned solely for development of the software, testing and buying the hardware. During this period, operators will be trained in using the system. This leads to the following timeline.

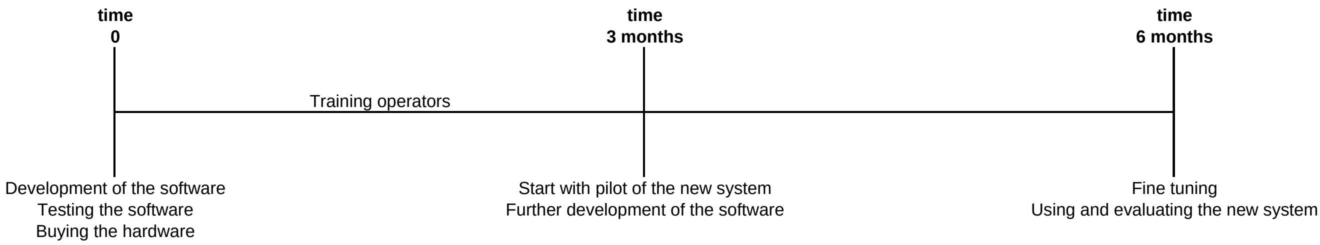


Figure 8.1 Timeline IT reconstruction

One of the failure factors of implementing IT according to Al-Mashari and Zairi is the difficulty in reengineering legacy information systems. The current information system at Sarandi also has to be modified to make data entries from the new system possible. The old system will not be replaced, therefore Sarandi's IT department has to ensure that the two systems are completely compatible. Sarandi's databases are currently based on mSQL. However, the database will be transferred to MySQL in the near future. This means that the database structure will be reprogrammed. During this switch to MySQL it is relatively easy to implement the new system.

Section 8.2 states the accompanying reorganisation steps that are necessary to ensure that it is possible to successfully implement the IT solutions.

8.2 Reorganise

In the redesign phase, a description of the new human resource architecture was given. To successfully implement this new architecture, concrete recommendations have to be formulated for how to construct this new architecture.
Three categories of employees will be subject to change: operators production, employees of the QC department and production administration employees. First the new job descriptions will be given. Secondly the new tasks will be formulated in task descriptions. The shift to the new quality control procedure deserves extra attention. Therefore, this shift will be the subject of the final paragraph.

8.2.1 New job descriptions

Operator production

The operator is responsible for operating on products within his division. The jobs that need to be processed will be made available for him. His responsibility is to finish his jobs within the scheduled time and to deliver good quality. The operator reports to the head of division.

Employee production administration

The production administration employee is responsible for planning the jobs from the scheduled start and finish dates of an order. Also, it is his responsibility to adjust the planning and job cards when necessary.

Employee quality control

The employee quality control is responsible for a good quality of all of all the semi-finished products. In a later stadium, the employee quality control will only be responsible for sampling critical areas in the production process like painting and assembly.

Employee quality improvement

The employee quality improvement is responsible for prevention of errors in the production process. In addition, the employee quality improvement samples production for errors and retrieves underlying causes of mistakes.

8.2.2 New task descriptions

Operator production

The tasks of the operator can be split up into three tasks: retrieving the next job, operating on the product and assuring good quality. These tasks will now be explained in detail.
Retrieving the next job: the operator can obtain his next scheduled job from a computer system. The computer is installed in the workspace within his division. The operator sees an interface where he can click on his name and his next job with all the relevant information will roll out of the printer.
Operating on the product: the main task is to operate on the product so that the product will be ready to proceed to the next operation.
Assuring good quality: during the process of operating on the product, the operator is responsible for assuring a good quality of the product. It is his task to make sure no errors will be found later in the process due to his operations.

Employee production administration

The employee production administration has three tasks: making job cars, monitoring finish dates operators and adjusting job cards. These tasks will now be explained in detail.

Making job cards: the PPIC department provides scheduled start and finish dates for the different orders. It is the task of the employee production administration to make job cards from these data.
Monitoring finish dates operators: operators production are entering their finish data in the computer system. The employee production administration checks if the entered finish times differ significantly from the scheduled finish dates.
Adjusting job cards: when the real finish dates of the jobs differ in such a way from the scheduled finish dates that the planning has to be adjusted, the employee production administration makes new job cards based on the new schedule.

Employee quality control
The two task of the employee quality control are checking quality and entering data.
Checking quality: the head of division alerts the head of quality control when a job of an operator is finished. The head of quality control alerts the employee quality control. The employee quality control then checks the batch for quality.
Entering data: after the quality checks has been performed, the employee quality control enters the results in the computer system at the quality control department.

Employee quality improvement
The tasks of the employee quality improvement can be split up into four tasks: prevention of errors, finding ways for more efficient producing, sampling production and retrieving causes of errors.
Prevention of errors: the employee quality improvement will form a quality circle, together operators from one division. It is his task to organise discussions and find out what improvements there are possible so that less errors will be made in de production process.
Finding ways for more efficient producing: this task will also be a subject in the previous mentioned discussions. The employee quality improvement has to make sure the members of the quality circle come up with ideas about more efficient producing.
Sampling production: the employee quality improvement samples production for quality control. This will be done on all manufacturing areas. Within critical areas like painting and assembly, all semi-finished products will be checked.
Retrieving causes of errors: when an error is found by the employee quality improvement, a small task force will be initiated. The task force will exist of the relevant operator(s), the head of the division and members of the quality improvement department. Their task is to find out how the errors can be prevented in the future.

8.2.3 Shift to the new quality control procedure

The quality control and quality improvement department were described as they exist completely next to each other. In reality, employees from the quality control department will gradually shift to the quality improvement department so that quality control will completely disappear. At the start of the implementation, quality control will still check 100% of the batched produced. At the same time, one person from production administration and one person from quality control will form the new quality improvement department. Their job will be to start with the tasks as described in the task description above, and to find out in which format these new tasks can be best carried out in real life. From this starting point, the remaining quality control employees will start training the operators for checking their own jobs on quality. This can be done by organising training sessions, so multiple operators can learn about the quality check at the same time.

After three months, three more employees from QC can shift to the quality improvement department. At this stage, the already two members of this department will have developed efficient ways to perform the tasks of this new department successfully. At this point in time, all the operators will be trained for checking their own work on quality. They will start checking their own jobs, but will still need assistance and re-check from the QC department or the quality improvement department.

Then six months form the start of implementation, all the operators will check their own work for quality, and there only will be a need for quality check by quality improvement on specific critical areas like painting and assembly. All the remaining QC employees will also shift to quality improvement.

Everything described above is visualised in the timeline in figure 7.1

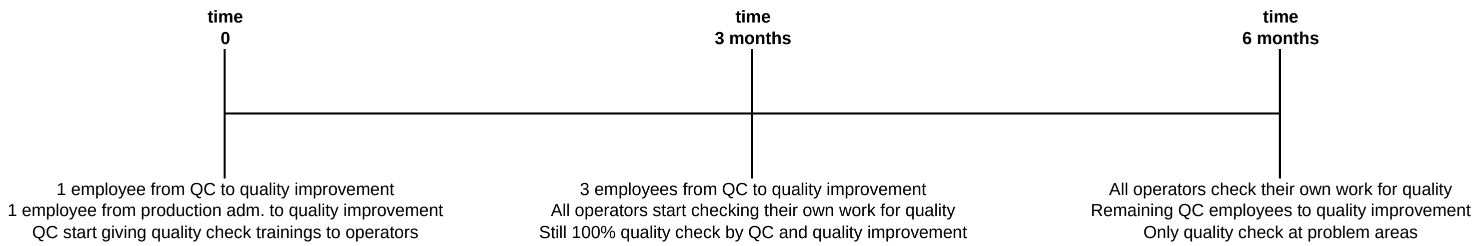


Figure 8.2 Timeline for the shift to the new quality control procedure

8.2.4 Managing the change: cultural aspects

The design of the new human resource architecture and IT system has to be done with cultural aspects in mind. It is impossible to implement Western solutions directly into the Indonesian environment. Therefore Hofstede's[28] theory on international cultural differences is used to evaluate the business culture in Indonesia and to ensure a good fit with the solutions from this research. Hofstede has identified five dimensions to measure cultural differences. The dimensions are: Distance of power, Individualism, Masculinity, Avoidance of uncertainty, Short or Long term thinking. The PRLC does not contain this extra step on cultural aspects, because it was originally designed to be used in Western countries.

[28] Hofstede, "Culture's consequences"

The big power distance in Indonesia implies that there is strong hierarchy within companies. This might be of negative influence on the new quality control procedure, because employees are used to just do what they are told. There will have to be a culture shift to the new attitude of more responsibility and suggestions for improvement. When quality controllers are training the operators for the quality check, they should also emphasize on the importance of this aspect.
The culture from Indonesia is a male dominant one. All of the employees subject to the change process are male. Since this aspects only gives problems when there are men as well as women involved, there are no threats that this aspects may cause problems.
Indonesian people are not individualistic. There is no mismatch with the proposed changes in this report and the fact that the employees have a collective mindset.
The uncertainty avoidance aspect is the same for The Netherlands and Indonesia according to Hofstede. The members of the reengineering team do not completely agree on this point, because in Indonesia people are less used to procedures and rules. This could be a problem when implementing a performance measurement and feedback system. It is important that the feedback system is actually applied in the beginning, so that the operators understand the rules and consequences are serious. In the new system, the employees are responsible for entering the data and retrieving their next job. Both can be a problem because it are procedures that have to be followed. However, entering the data is necessary for getting the next job and retrieving the job is automatically done when the data is entered, so there is no room for neglectance.
The above comparison makes clear that the change can fail when the employees are not aware of these threats. A new attitude, more responsible behaviour and accepting procedures can be reached by good communication and open information. Of course should, next to this, a reward/punishment system help to let the employees accept the proposed changes.

Part III:

Conclusions and Recommendations

The final part contains the conclusions, recommendations and the lists of figures, tables and references.

9. Conclusions

9.1. General conclusions

The central problem presented in the introduction was formulated as:

How can Sarandi's internal business processes be reengineered to realise a cycle time reduction?

For answering this question, a Business Process Reengineering approach was used. The manufacturing process was selected as subject for the BPR cycle. Nine pathologies were identified in the current manufacturing process, from which three were selected for redesign and reconstruct. Those three pathologies were: the excessive number of job cards, insufficient inherent process quality and inadequate performance measurement.

Changes in the manufacturing process have been made in two areas: IT and HRM. The underlying process has been redesigned. The improvements have direct implications on the manufacturing process and on the supporting process of quality control.

Improvements in the manufacturing process:

- There will be no more time lost by production administration for manually making and adjusting job cards.
- The physical job card will disappear and no separate IT systems for planning, production and quality control will exist anymore. Instead, one new IT system will be developed for job cards, production planning and quality control.
- All relevant information for the operator will be visible on the computer screen in the workplace, including drawings.
- Accurate registration of start and finish times of jobs of operators due to the new IT system in newly installed computers in the workplace
- Ability to generate performance reports on total process times and amount of errors by operator.

Improvements in the supporting process of quality control:

- The quality control department will disappear.
- Operators will get the responsibility for checking their own jobs for quality.
- A new department called quality improvement will be formed, which is responsible for the prevention and finding causes of inefficient production and errors.

The new process will be implemented within the timeframe of six months. The second part of the central question refers to the problems with the long cycle time. The proposed changes will lead to time savings in the manufacturing process. Actual measurement of the improvements can be done by Sarandi in the Monitor phase, that has yet to be completed.

However, not all the time savings will lead to cycle time reduction, due to parallel processes within the manufacturing process. ‘No more time lost for manually making and adjusting job cards’ and ‘making less errors’ will lead to a reduction in cycle time. The other changes will lead to tasks that become redundant. The result is that the departments of production administration and quality control will be able to function with less FTE. This efficiency step will be used for the shift to the new department of quality improvement.

9.2 Conclusions regarding success factors and cultural aspects

The relevant success factors of BPR for Sarandi have been identified. Most of the success factors did not prove to be major threats to the project. Empowerment of employees during BPR cycle has proven to be difficult, due to strong hierarchy and Indonesian business culture. Empowerment of the employees will be increased as a part of the new HRM system. Therefore coming BPR cycles will have less difficulties with the issue of empowerment. Creating an effective culture for organisational change is also complex because of the business culture, however such a culture for change has been achieved by extensive training of operators.
Because this BPR cycle was performed in a culture different from the Western, cultural differences have gotten extra attention. Big power distance and uncertainty avoidance are the two aspects that could give problems. An extensive training program is making employees familiar with a more responsible behaviour and rules an procedures. This new attitude is necessary for the proposed changes.

9.3 Conclusions regarding BPR in the manufacturing process

As was stated in this report, the manufacturing process is not a process that is commonly selected for reengineering. In this research there was found that it is very well possible to apply BPR in the manufacturing process. However, an important comment has to be made: the model which was used starting the BPR cycle did not prove to be completely sufficient. When reengineering a manufacturing process, a clean slate approach is not completely logical because there are physical product flows within a manufacturing process. These physical product flows are not so easy to reengineer from clean slate because of the direct relation with the size and lay out of the factory. This results in too much constraints for applying a complete clean slate approach. Therefore a dirty slate approach was chosen for this BPR cycle. It appeared that the model from Guha missed some aspects for when a dirty slate approach for BPR is used. For that reason Guha’s model was adjusted so that it fits a dirty slate approach. This new model is presented in the recommendations section.

9.4 Summarising conclusion regarding the objective

The improvements in the manufacturing process will lead to cycle time reduction. Cycle time reduction leads to reduced costs, increased variety and flexibility and improved quality. Those three aspects combined ensure that a competitive advantage for Sarandi has been obtained, which was the primary objective of this project.

10. Recommendations

There are two categories of recommendations for Sarandi and a recommendation on methodology. The first category contains recommendations on finishing the BPR cycle that has been started by this research. The second category contains general recommendations for Sarandi.

10.1 Current BPR Cycle

The BPR cycle that was performed in this research is not complete, because of the limited time. Sarandi should finish the BPR cycle and therefore complete the stages ‘Reconstruct’ and ‘Monitor’. The stage Reconstruct consists of the steps ‘Reorganise’ and ‘Install IT’. The success factors for BPR make clear that successful reorganising in Sarandi requires a focus on the success dimensions ‘Change management, systems and culture’ and ‘Organisational structure factors’. Successful implementation of IT requires a focus on compatibility with the legacy system.

The stage “Monitor’ consists of the two steps ‘Measure performance’ and ‘Link to quality improvement’. The new IT system makes it possible to precisely measure the performance of the different manufacturing divisions. This allows Sarandi to pinpoint areas for improvement. As Guha’s model suggests, Sarandi should go back to the ‘Diagnose’ phase and investigate the processes that are candidates for improvement. Besides this, the IT department can compare the old lead times with the new lead times and estimate the benefits of the new system. To improve quality, Sarandi should keep implementing TQM methods in the processes where BPR was performed.

10.2 General Recommendations

Process Approach

This research has made Sarandi familiar with the possibilities of BPR and more general with a process approach to improvement. It is therefore important that Sarandi’s management uses these methods in the future when appropriate.

Automatic planning

Production planning within Sarandi is mainly done by hand. Golbach & Meutstege proposed a comprehensive in-house developed Master Production Schedule (MPS) and Material Requirements Planning (MRP) system to overcome the problems caused by manual planning. Unfortunately the knowledge for developing and implementing such a system is currently not available within Sarandi. Therefore it is possible to investigate the possibility of buying an IT package or hiring a consultant who can develop such a system together with Sarandi. Such a system would support the interface and data measurement system as developed in this BPR cycle.

Other pathologies

This research focused on three pathologies that were considered most important on the basis of feasibility, impact on process time and dysfunction. Besides those, there were multiple other problems extracted from the interviews with Sarandi’s management. Those problem areas still need improvement. Examples are problems in communication and procedures between both production and engineering and production and warehouse.

It is necessary to identify new problems on a regular basis. The company can use SMART analysis to attach priority levels to the problem areas.

10.3 Recommendation on methodology

In the conclusions section was explained that some adjustments were made to Guha’s model for a dirty slate approach. This adjustment can be generalised for all dirty slate approaches. For this reason, a new model has been developed that includes the new steps for when performing BPR with a dirty slate approach. The adjusted model can be found on the next page. The new steps are “Document existing human resource architecture” and “Document existing IT”. Next to the new steps concerning the dirty slate approach, there is also a change in the new model regarding “manage transformation”. This aspect emphasises on keeping in mind succes factors of BPR. Succes factors concerning managing the change do not get the attention they deserve in Guha’s model. In particular these factors are “effective communication”, “empowerment”, “people involvement”, “training & education” and “commited leadership”. Furthermore, when performing BPR in an other culture than the Western culture, manage transformation also includes accounting for the differences between the national culture of the specific country and the Western culture.

In this research general tools were used for the two new steps. Finding better tools would lead to a more stuctured way of performing the steps. On the next page the adjusted model is shown.

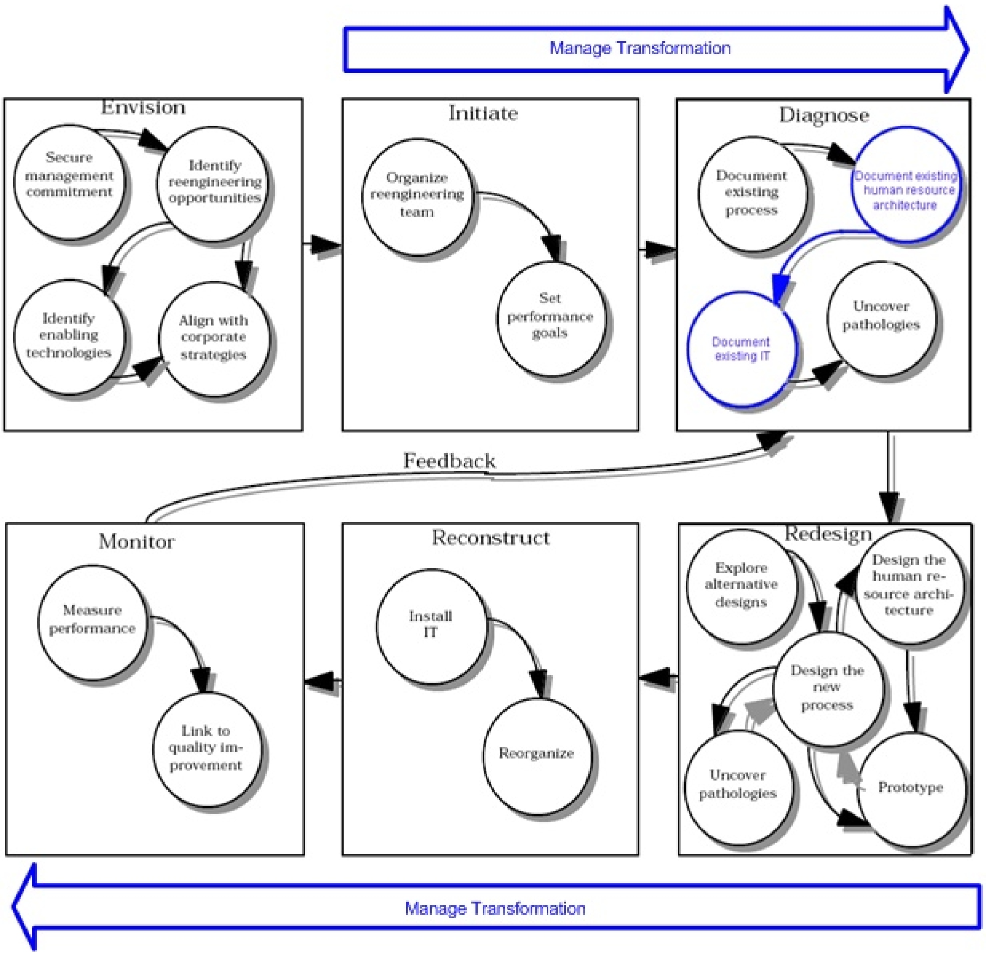


Figure 10.1 Revised PRLC: adjusted for BPR with dirty slate approach

Figures and Tables

Figures

Tables

Reference list

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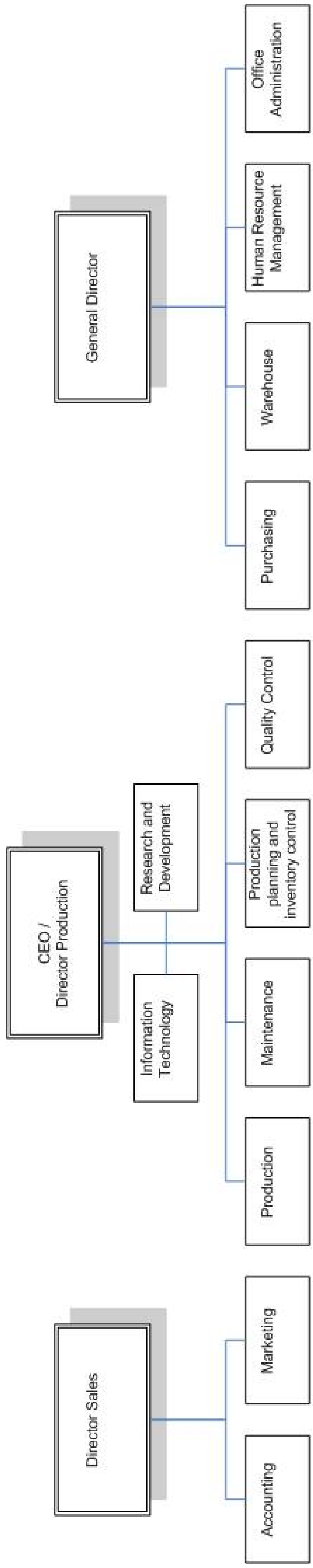
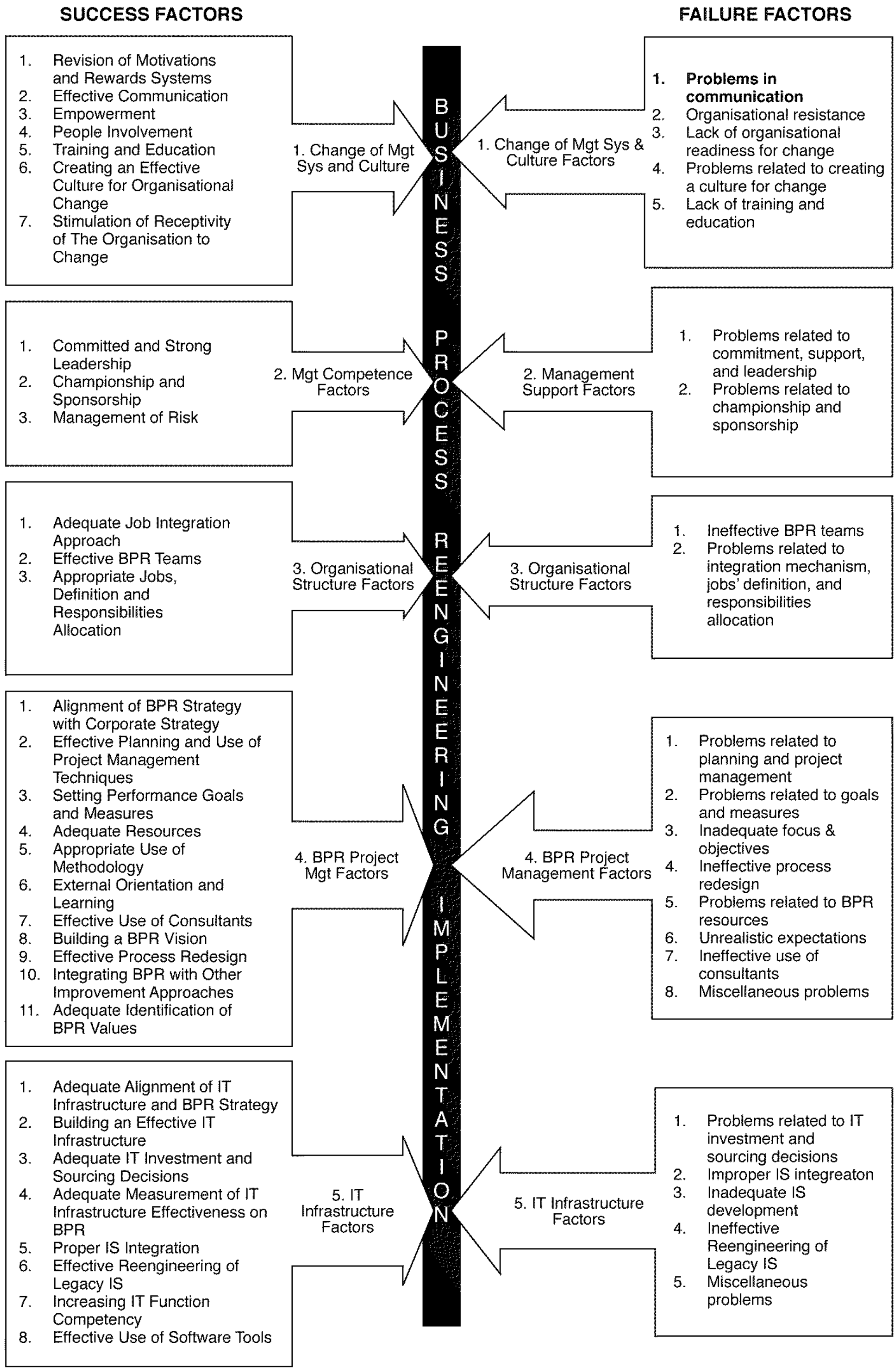
Appendix A: Organisational chart



Appendix B: Success factors BPR



Appendix C: SMART

The table states the different pathologies and their ratings on the criteria. The last column indicates the general importance to tackle that pathology.

Please rate on 0-100	*Feasibility*	*Normalised factor 0,25*	*Impact on process time*	*Normalised factor 0,5*	*Dysfunction*	*Normalised factor 0.25*	*Total*
Production							
Inadequate performance measurement	570	142,5	440	220	450	112,5	475
No employee feedback system	470	117,5	260	130	500	125	372,5
Excessive number of job cards	540	135	590	295	565	141,25	571,25
Production - Engineering							
DKB Drawings change too frequently	270	67,5	300	150	375	93,75	311,25
Not enough time for drawing new products	260	65	390	195	305	76,25	336,25
Production - IT							
IT system works until Welding	425	106,25	420	210	350	87,5	403,75
Production - PPIC							
Production does not follow PPIC's schedule	515	128,75	480	240	365	91,25	460
Production - Warehouse							
Incorrect data from warehouse to production	295	73,75	265	132,5	415	103,75	310
Production - QC							
Procedures are not clear (inconsistent quality control)	325	81,25	410	205	280	70	356,25
Insufficient inherent process quality	595	148,75	550	275	450	112,5	536,25