Communication of Changes in Parallel Processes at IRO AB in Ulricehamn, Sweden

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Abstract

This thesis is aiming at finding a solution for the manufacturing company IRO AB in Ulricehamn, Sweden to communicate the changes that are made in processes and products of the company to its Chinese subsidiary company IWTC. The company wants to have a system through which any change and improvement happened at one company is communicated to another one in order to exercise the same changes at parallel processes that are running at both companies. To solve their problem and to find an effective solution, first current situation regarding change processes at the company is examined to make sure that all changes and improvements made at the company are registered in a structured way. Then different communication channels existed between two companies is reviewed to find out the possibilities and capacities of the company. This thesis focuses on using the ERP system as a communication tool at both companies IRO AB and IWTC through which all the changes can be registered and communicated in an effective, fast way. This capacity in ERP systems is found out through a comprehensive study of this concept and its characteristics that has been done in this research.

Keywords: Parallel Processes, Change Process, Change Communication, ERP Systems
# Table of Contents

Abstract ........................................................................................................................................ 4

1. Introduction .............................................................................................................................. 7
   1.1. Background and Problem Discussion .............................................................................. 7
   1.2. Purpose and Research Questions..................................................................................... 7
   1.3. Demarcations and Limitations ......................................................................................... 8
   1.4. Thesis Disposition .......................................................................................................... 8

2. Theoretical Frame of Reference ............................................................................................... 9
   2.1. Introduction on Enterprise Resource Planning ............................................................... 9
   2.2. ERP; Concepts and Definitions ....................................................................................... 10
   2.3. ERP Market in Sweden ................................................................................................. 15
      2.3.1. Most Frequently Addressed Modules in Swedish companies .................................. 16
   2.4. Reasons for ERP implementation .................................................................................... 16
   2.5. Advantages with ERP implementation ......................................................................... 17
   2.6. Difficulties with ERP implementation .......................................................................... 18

3. Research Methodology .......................................................................................................... 20
   3.1. Research Approach ........................................................................................................ 20
   3.2. Qualitative and Quantitative Research ......................................................................... 21
   3.3. Reliability and Validity .................................................................................................. 21
   3.4. Information Gathering .................................................................................................. 22
      3.4.1. Interview ............................................................................................................... 22
      3.4.2. In-depth Interviewing ............................................................................................ 22

4. Empirical Work ....................................................................................................................... 23
   4.1. Company Description .................................................................................................... 23
      4.1.1. About IRO AB ......................................................................................................... 23
      4.1.2. History ................................................................................................................... 23
      4.1.3. Products ................................................................................................................ 24
      4.1.4. Relationship between IRO and IWTC ................................................................... 25
   4.2. Investigation and Findings ............................................................................................. 25
      4.2.1. Structure of quality management at IRO AB ......................................................... 27
      4.2.2. Types of change at IRO AB ................................................................................... 28
4.2.3. Change origins at IRO AB ................................................................. 29
4.2.4. Change process at IRO AB: Current status .................................................. 30
4.2.5. Communication channels between IRO AB and IWTC ................................. 35
4.2.6. Information that must be communicated to IWTC ........................................... 36

5. Analysis and Discussion ..................................................................................... 38
5.1. Analysis of change registration at IRO AB .................................................. 38
  5.1.1. Product change through PCOs ................................................................. 38
  5.1.2. Deviation handling process .................................................................... 39
  5.1.3. Customer complaints handling process .................................................. 40
  5.1.4. Process change in machining shop ......................................................... 40
  5.1.5. Process change in assembly lines ............................................................ 41
5.2. Analysis of change communication between IRO and IWTC .......................... 41

6. Conclusion and Suggestions ............................................................................ 44
  6.1. Conclusion ................................................................................................... 44
  6.2. Suggestions for Improvement ....................................................................... 46
  6.3. Suggestions for further research ................................................................. 47

7. References ....................................................................................................... 49

Appendix 1: Flowcharts for current situation of change process at IRO AB .......... 52
Appendix 2: Questionnaires with answers .......................................................... 62
1. Introduction

An overview of this research work is presented here in this chapter. The background and description of the problem that brought about this research, research questions this thesis is based on, framework and limitations of the work and the structure of this report are described in the following parts.

1.1. Background and Problem Discussion

IRO AB is an industrial company that produces some parts of textile machines and motor products in two factory sites in Sweden and China. There are two similar production processes running parallel in two different companies. Both processes, one at IRO AB in Ulricehamn and the second one at IWTC in China, produce almost the same products. It is very important for the company to keep the products of these parallel lines as similar as possible. At the moment, daily changes are made in processes some of which are not registered nor communicated between both companies. In other words, there is no system that takes care of improvements made in either process in order to communicate findings so that both processes can benefit from any improvements made. This situation may cause some deviations in parallel products in the future.

1.2. Purpose and Research Questions

The current situation for changes and improvements made in products and processes at IRO AB should be improved so that these changes are to be registered and communicated at both company sites in Sweden and China. This thesis work is searching for a solution to improve the change procedure and also a solution for communication of changes at IRO AB so that changes made in one process can be successfully applied to another one that is in parallel situation. Such a solution will prevent parallel processes to have deviation from each other. This thesis work, therefore, is searching for the answer to two main questions as following:

1. Whether and how the change process at the company should be improved so that all the changes and improvements made in parallel processes are registered in a standardized, reliable way?
2. How the changes and improvements made in parallel processes can be communicated between both companies IRO AB and IWTC?

1.3. Demarcations and Limitations

This thesis is not kind of a comprehensive study and investigation of the change process or change management at IRO AB. In other words, the objective of this research is not improvement of the whole change process at the company. In addition, this research doesn’t follow the improvement of any specific process or product at the company. This research, instead, focuses on the investigation of whether all the changes made in parallel processes are registered and how these changes can be communicated between both companies IRO AB and IWTC. As a result, the whole change process with all details is not studied here and just those parts of change process of the company that are relevant to parallel processes are considered in the research.

1.4. Thesis Disposition

The thesis follows the structure arranged by the School of Engineering at the University of Borås and will contain six chapters described as following.

Chapter One presents the introduction and an overview of whole the thesis work including problem definition and research purposes. Chapter Two includes a review of literature in the fields relevant to ERP systems as a theoretical framework of this research. Chapter Three describes the methodologies used during this thesis work. Findings and results from the empirical investigation at the company are presented in Chapter Four indicating the situation of the company and its change processes at present. Chapter Five contains an analysis of the current situation of the company and provides an analytical comparison of the empirical results against the theoretical frame of reference. Finally, Chapter Six concludes the analyses and investigations by a number of suggestions for the company to make some improvements in its change processes and to establish a system for communication of changes.
2. Theoretical Frame of Reference

In this chapter, the theoretical frame of reference is discussed. We begin with an introduction on Enterprise Resource Planning (ERP) system in the first part. In the second part, we will try to provide a conceptual understanding of the concept. In the following up, there would be a review on the ERP market. In the fourth part, of this chapter we aim to motivate ERP implementation by some discussions on the reasons for ERP implementation. Some more motivations will be clarified on part titled as advantages with ERP implementation. Finally, we explain some difficulties and problems encountered with ERP implementation.

2.1. Introduction on Enterprise Resource Planning

Over the last decades, computer-based information systems have been continually developing both administrative and scientific technology. Computer-based information systems were initially employed on formal financial accounting functions, and then they have been developed through production scheduling, product design, inventory management, and human resources etc.

Recently, Enterprise Resource Planning (ERP) has been emerged in this context to develop management information systems, and within last two decades, many companies in all sizes have been extensively using ERP systems [1]. These systems are referred as an information system solution, for every kind of activity at a company.

High ability for integration of collected data from different departments and through various functions, using single unified computer software has empowered ERP success. In fact, information from different systems will be entered in one core system, then databases and correct data will be accessible for an organization at local, regional, national and international level.

These computer-based information systems not only are capable to meet companies’ technical requirement, but also it is the empowerment of these packages to handle companies’ organizational requirement [2]. This integration of information will empower the organization to standardize captured data and provide organization-wide access, which will automatically provide seamless interfaces across functions, responsibility centers, and locations [1].

Since ERP systems are becoming more widely used by companies in all sizes and types, there should be conceptual understanding of definition and technical aspects of development and
implementation of these systems. In the following sections, the researchers will review the literature in order to give comprehensive understanding of the concept.

### 2.2. ERP; Concepts and Definitions

In this part, the authors are aim to give a definition of the concept, which also serve to give direction to their analysis when reviewing the problem in analysis and discussion chapter.

One of the packaged application software in computer-based information systems, which has been introduced to the management information systems, is called Enterprise Resource Planning. This packaged application software predominantly is aim to integrate information flow through various functions and processes within the whole business. Accordingly, all information captured will provide a holistic view of the organization from unified information and IT architecture.

Although large worldwide organizations have implemented ERP, within last decade even small and medium size companies have found these packages cost effective and worth to invest on it. While statistics show that in 1997 more than 10 billion US$ has been invested on ERP by almost 20,000 companies [3], and in the year 2002 about 39% of large scale firms and 60% of smaller companies have deployed on ERP systems [4].

Until last years, the concept has not been reviewed in information management and information systems in curricula [5]. However, ERP has found good and a standstill status in information systems literature, there are some disagreements among the academics about the concept and finding a unique definition of ERP. Gartner Group [6] defines ERP as follows:

“...A collection of applications that can be used to manage the whole business; ERP systems integrate sales, manufacturing, human resources, logistics, accounting, and other enterprise functions. ERP allows all functions to share a common database and business analysis tools”.

Some authors suggest that instead of using the term ERP, some other appropriate terms can be used, [7, 8]. Other authors claim that ERP is rather a category signifying a range of similar products [9]. In addition, some believe that as a result of development of IT support for manufacturing ERP has been introduced [10].

Given the above discussion, determination of a unique definition for ERP that can be approved in general is rather unlikely. Nevertheless, here ERP is referred to a software package created from IT support manufacturing that correspond to the ultimate phase of a progression towards
integration. The authors still emphasize that this definition and other definitions have never been considered completely correct; however what stated above is a widespread view on definition of ERP [11].

Based on this clarification we will focus on the above definition and will continue with some more explanation on the subject. In general, there are three perspectives for ERP as a concept, which we can take a look on and explain the concept. First, ERP is a product in the form of computer software, secondly, it is set of collected data from processes, activities etc from development perspective. These collected data and corrections should be integrated in one unique system for an enterprise. Finally, ERP can be taken into account as a key element to give an ultimate solution for company.

Now is the time for underlying and review the characteristics of ERP software. Currently, ERP software is found in three different forms: generic, preconfigured, and installed [11].

(a) In its most comprehensive form, the software is generic, targets a range of industries, and must be configured before it can be used.

(b) Packaged, pre-configured templates have been derived from the comprehensive software. These templates are tailored towards specific industry sectors (e.g., automotive, retail) or companies of a certain size (SME).

(c) For most users, ERP-software presents itself as the operational installation after the generic or pre-configured package has been individualized according to the particular firm’s requirements on site.

Any configuration by adding or reducing details can contribute to distinct instances of the product in generic state. Accordingly, only in this state one can characterize ERP software by purpose.

After clarification and some explanation on ERP in academics, now it’s time to look on ERP from enterprise perspective and on its implementation. From an enterprise perspective ERP software is a package, which enables the company to integrate captured data and corrections through different standard functional modulus (Production, Sales, Human Resources, Finance, etc) in one unified software system.

This package is developed by the vendor and can be specified to meet company requirements both technical and organizational. As figure 1 show, this unified package attempts to capture information across all departments and functions and put all into one single computer software
[13]. This single software was defined to meet requirements of all departments, and consequently information will be accessible throughout the company at all levels.

It has been approved that ERP systems takes all tasks (financial control, operational management, analysis and reporting, and routine decision support) beyond planning. Furthermore, ERP takes into account all levels of an organization’s hierarchy [12]. From above definition one can claim that for ERP implementation a ‘process’ view of the enterprise is required.

In summary, ERP can improve business operation in areas like integration, globalization, up to date IT, process improvement, [4]. Since data between business components and functions is recorded and any kind of changes are updated by ERP, a high promotion in integration and communication within business processes is achieved. It uses different sources to analysis and provides up to date data.

By using ERP, business can easily shift its data and information towards different languages, currencies, and accounting standards, which is referred to adaption to globalization of ERP. It also empowers the business to adjust itself with latest information technology such as internet and e-commerce.

Finally, the process improvement towards ERP implementation is inevitable. In fact, any kind of changes within the processes, production, manufacturing and other functions related to different business enterprise should be recorded on databases and be accessible online for company-wide.
Botta-Genoulaz and Millet [13] say: “The current generation of ERP systems provides reference models or process templates that claim to embody the current best business practices by supporting organizational business processes”.

The authors’ interpretation from above definitions and discussions is stated here. In fact, what we would take to mean from ERP is that ERP can be referred as a communication language in a company-wide. This communication language is consisting of a unique software package, which will give accessibility to all departments at all levels. The task of this package is to record any changes within the business enterprise functionality including processes (planning, manufacturing, decision-making, production), financial issues, human resource etc. These changes are all towards improvement and are aim to prevent variation among different dependent functions and departments on company-wide. This improvement and prevention of variation result from the fact that ERP has the characteristic of organizational integration all in the direction of process improvement.

In addition, companies working on international level will gain some benefits of ERP characteristic of adaption to globalization. To us this means that ERP not only utilizes companies to use update data, but also will empower those who have departments, subsidiaries on international level to use one unique communication language. This has also thanks to pros of ERP that indicates the utilization of the latest IT. In fact, ERP uses advances in computer and information technology such as internet and e-commerce, where this facilitates these types of enterprises to inform different departments and subsidiaries, wherever they are located, from possible changes.

This will prevent variation within processes, products, financial or decision-making issues among different subsidiaries; changes in any function will be recorded online and will be accessible to all.

So far, we have discussed that ERP can be used as an integrative communication language in a company-wide with respect to different departments and functionalities. We have stated indirectly so to speak some of the modules, which have gotten effects of ERP system. Here, we would like to highlight categories and tasks (modules) that ERP can considerably concern on them. In general, one can classify ERP modules in six major categories. These are including Accounting, Costs, Manufacturing and logistics, Customer and Supplier Relations, Information Management, and Organization & Culture [14]. In this context, each category has
some aspects that have been affected by ERP implementation, which we will describe in the following sections.

**Accounting**
Closing the books, forecast, financial reports are aspects of this category. ERP can facilitate companies in closing the books days’ reduction and consequently the costs of closing the accounts, which all are the result of integrative nature of ERP and prevention of using redundant and multiple data source. Better forecasting also will be achieved by ERP as a result of availability of data in one system and creation of a unified recognition of financial sites.

**Costs**
IT costs, administrative cost, personnel cost, sales cost, production costs are related aspects for this category. There is enormous money, which is spent on updating obsolete software code, rationalizing and storing abundant data, and programming communication links between systems to automate the transfer of data and reformatting of data from one system to use in another system. However, these direct IT costs will be reduced by ERP implementation. In addition, ERP can reduce indirect costs of IT. The spending time by administrative personnel on tasks will be considerably reduced as a result of automatic update in information flow within ERP implementation.

**Manufacturing and Logistics**
Aspects encountered with this category are purchasing management, warehouse management, production planning, product quality, production flexibility, order management. A daily production calendar for manufacturing plants will be created by performing capacity planning as ERP is implemented. This will lead to simplification of production planning. It has been stated that ERP will standardize production processes. This will prevent a lot of rework and increase product quality.

**Customer and Supplier Relations**
This category includes delivery precision, customer relation, customer service, supplier relations. It is clear to all that better quality will improve the company relation with its customer. Since data are always update and real time, better customer information be available for companies and this will lead to improvement in customer service.

**Information Management**
This category includes five aspects that are information flow, availability of information, content of information, and data for decision-making. ERP improves the companies’ communication and collaboration between different functions, departments and subsidiaries, while it eliminates information asymmetries. Decision-making is improved by ERP implementation since it provides information flow and accessible update data for responsible parties and decision-makers.

**Organization and Culture**
Centralization, responsibility, work routines are related aspects for this category. Centralization through process standardization and control over information will be achieved by an ERP adaption in an organization. Furthermore, some has used ERP as a mean of educating more innovative and responsible employees. Finally, ERP turn an organization from functional to process-oriented organization and this will affect considerably responsibility, role and work-routine.

However the modules affected by ERP implementation have been clarified above, it is wise to give priority between these modules. Since this research has been developed for IRO AB manufacturing company in Sweden, we will highlight modules’ prioritization among Swedish manufacturing firms in the following part.

In the following parts, authors are aim to motivate ERP implementation by reviewing the ERP market, reasons for ERP implementation, advantages with ERP implementation.

### 2.3. ERP market in Sweden

Over last two decades, different driving forces in the market place such as lower prices, faster services, wider choices and even better quality have employed a lot of pressure on the clients. At the same time, foundation of new information systems and their development have been considered as responses to these challenges. One instance in this context is ERP systems, which initially have been implemented in manufacturing section of different industries in the earliest of 1990s. While those with implementation of ERP, were seeking solutions to challenges like globalization, acquisition consolidation, process standardization, and changes in customer expectations.
The result of one study [15] shows that just in Sweden about 83.6% of small to large size manufacturing companies in this country have implemented or are in the process to implement ERP. This study clearly emphasizes on high ERP maturity in Sweden. Furthermore, this study emphasizes that Swedish manufacturing firms are more interested in ERP systems provided by Swedish vendors.

Finally, there are five ERP vendors (SAP, Oracle, JD Edwards, People Soft, and BAAN), which share more than 50% of the ERP market. However, some Swedish companies such as IRO AB preferably use MOVEX system as their ERP package.

### 2.3.1 Most Frequently Addressed Modules within ERP Implementation in Swedish companies

Referring to the study done by Olhager and Selldin [15] the most important modules among Swedish manufacturing companies within ERP implementation are as follows: purchasing, order entry, materials management, production planning, Financial accounting, Distribution/logistics, Financial control, Asset management, Personnel/human resources, Quality management, Maintenance, R&D management.

Results obtained from this study shows that the most frequently implemented and customized modulus are those related to time-to-customer process. These modules are purchasing, order entry, materials management, and production planning. These modules are referred as the core functionality of ERP system according to the history of MRP via MRPII to ERP.

The above mentioned modules have a frequently implementation rate of about 90% and the customization rate is almost 60% in average. In addition, quality management, maintenance, and R&D management modules have a frequently implementation rate of 50% and customization rate of 36%. It is worth to mention that between these modules quality management, order entry, and distribution/logistics have gotten the highest rank for customization.

### 2.4. Reasons for ERP Implementation

Davenport [16] believes that there are several reasons, which encourage enterprise for ERP implementation. Since, maintenance of old computer systems can be expensive, ERP implementation can be cost effective alternative, while this system is considered as the provision of a single source of data. It has also a great potential in business integration when
reducing indirect costs. In other words, if the sales/ordering systems are not linked to manufacturing productivity and customer responsiveness, decisions made by management can be based on aged data and not based on detailed understanding of up-to-date information. In addition, findings from surveys distributed in Europe [17] and United States [18] show that the following motivations, see table 1[13], encourage enterprises for ERP implementation. Precisely one can represent that three top encouragements for ERP implementation are improving productivity, competitive advantage, and customer demands, according to Scott and Shepherd [19]. Consequently, if companies in all sizes have been motivated enough to adopt ERP, they will gain its benefits.

Table 1
Motivations for ERP program

<table>
<thead>
<tr>
<th>Technology motivations</th>
<th>Operational motivations</th>
</tr>
</thead>
<tbody>
<tr>
<td>System not Y2K compliant</td>
<td>Poor or uncompetitive business performance</td>
</tr>
<tr>
<td>Disparate systems</td>
<td>Cost structure to high</td>
</tr>
<tr>
<td>Poor quality/visibility of information</td>
<td>Not responsive enough to customers or suppliers</td>
</tr>
<tr>
<td>Business process or systems not integrated</td>
<td>Complex, ineffective business process</td>
</tr>
<tr>
<td>Difficult to integrate acquisitions</td>
<td>Inability to support new business strategies</td>
</tr>
<tr>
<td>Obsolete systems</td>
<td>Business becoming global</td>
</tr>
<tr>
<td>Inability to support growth</td>
<td>Inconsistent business processes</td>
</tr>
</tbody>
</table>

In the following part, there will be some explanation on benefits and success factors with ERP implementation.

2.5. Advantages with ERP Implementation

Lozinsky [20] believes that companies can gain plenty of benefits towards ERP implementation. Based on his findings, as a result of cost reduction in operating costs the return of investment will be improved. Furthermore, with ERP implementation data will be accessible for all levels, which will lead to better decision making by responsible parties. This will also cause better negotiation between the company in one hand and customers and suppliers on the other hand, while there is no need to rewrite the reports. Besides, company’s performance can be analyzed using reliable figures. This analysis along with enhancement of efficiencies (through computerization) and decision making (using accurate and timely enterprise-wide information) will conclude to cost reduction. In fact, many have put efforts to identify the benefits gained by ERP implementation [17, 18, 21, and 22].
In summary, the following benefits can be achieved by enterprises that implement ERP; Information quality, single system/integration, real-time accessibility, inventory reduction, productivity improvement, logistics/order management improvement, cash flow and forecasts improvement.

Although there is an immense potential for positive impacts on ERP implementation for every kind of enterprise, there might be difficulties that companies face within ERP implementation. In the following part, we will review some of these difficulties.

2.6. Difficulties with ERP Implementation

It has been clarified that there are many benefits that ERP implementation can bring to companies and there are successful stories in this context. On the other hand, there has been found that some project in ERP implementation has failed or could not reach expected results. This, of course, can be due to market expansion, which causes to higher level of expectations. There is some estimation that about 31% of ERP projects have been failed [23]. In this context, some discuss on the risk encountered with return on ERP investment, [24, and 25].

Davenport [16] discusses about two possible reasons for such failures. First, those involving ERP systems should be expert on using these systems, which this deal is due to technical complexity of ERP systems. Secondly, in some failed projects it has been observed that business requirements do not match with ERP systems specifications.

In the context of difficulties with ERP implementation, Buckhout and Frey [23] claim on two stems. They discuss that for configuration of the processes and systems in ERP system companies should make strategic choices, and if they fail to do so, the project will fail. They also explain that the implementation process might be out of control.

Botta-Genoulaz and Millet [13] think that some difficulties with ERP implementation can be from the motivational prerequisites of its adaption such as: legacy systems (poor data quality, interfacing), understanding business processes, infrastructure requirements, customization of new system. They also add that the main reason for ERP failure is related to the people. This includes changing work practices, change management, internal staff adequacy, training, top management support, and consultants.

In addition, Poston and Grabski [26] discuss that companies should be aware of the point that observing visible impacts of ERP implementation, from financial perspective, require some times. According to their findings:
"A significant improvement in firm performance resulting from a decrease in the ratio of cost of goods sold to revenues was found 3 years after the ERP system implementation; further, there was a significant reduction in the ratio of employees to revenues for each of the 3 years examined following the ERP implementation"

Therefore, some companies may not truly examine the ERP implementation with the time that is needed to the project effectively flow on the system and the true results will show up.

Nevertheless, not all goals specified for an ERP implementation has been achieved in all cases. Some companies claim that ERP systems have had significant effect on their business operation. This is while some others say that they could not reach the initiative goals defined for an ERP implementation, or in some cases, it could not payback the investment.

These kinds of companies claim that there is no promise for promotion in business value, even if the ERP project will be executed good enough [13].

Based on literature review we would conclude that ERP system is more likely to be an alternative solution when firms from different sizes and industries are thinking of a high priority of developing an integrative value chain, and prevention from variation in different functions such as processes, production, manufacturing etc.
3. Research Methodology

This chapter is about research method used in this thesis work. In fact, this chapter is a reference for scientific method necessities. It deals with how the study was conducted and includes discussions of research approach, data collection, sources of data and the validity and reliability of the thesis.

3.1. Research Approach

The authors’ understanding towards the problem will certainly affect the result of this study. How the authors see the problems associated with ERP goes back to literature studies and data collected during interviews and meetings with key persons at the company. There are four general approaches: exploration, explanation, description, and prediction which can be used for research. Descriptive approach mostly is used when a specific problem area is defined well enough, and the researcher tries to provide information regarding the characteristics and facts of the problem under discussion. One can use explanatory approach when there are some variables and there is necessity for proving casual relationship between the connection and the effects of these variables with each other. In explorative approach, the researcher has most often no enough knowledge about the subject area and there is a need for clarifying the issues that shall be addressed in the research. In some cases, researchers use this approach in the initial phase of their research to distinguish the research problem. Finally, prediction of the future development of any phenomena is referred as a predictive approach in a research [28].

The researcher's position is based on past experience and with the help of literature studies, and it will obviously have an impact on the outcome of the research. Noting the problem description which was rather vague, and not having enough knowledge about the subject area for the researchers, this research has got an explorative attitude at the starting point. Therefore, there was necessity for finding the issues to be addressed in the beginning, and then as they reached the position where they had sufficient knowledge a descriptive approach was employed. They have tried to provide information about the characteristics of the problem under discussion.
3.2. Qualitative and Quantitative Research

Both qualitative and quantitative research is recommended to be used in a research. However, the choice of qualitative or quantitative research depends on the quality and accessibility of the problem. The basis of qualitative research is the study items and non-quantified data, such as thoughts and principles. Generally, the focus would be on ways to collect data to get a deeper understanding of the study items. Qualitative research emphasizes on interviews, meetings, and observation. When it comes to using these methods, a deep understanding of the problem is necessary to increase the accuracy of the results [27]. The fact is that qualitative research applies four methods to collect and to compile the data and information. These four methods are direct observation, depth interviews, analysis of documents and material culture, respectively. These methods arrange necessary part of the investigation. Quantitative research is focused on bringing together a large number of tasks that can be quantified.

In research and study, if one works with both qualitative and quantitative methods the results would be more reliable. Indeed, qualitative and quantitative methods complement each other effectively. Therefore, we must use and analyze the results from both qualitative and quantitative methods in the process of investigation. However, this work was largely qualitative and researchers rely on interviews with some key persons at the company.

3.3. Reliability and Validity

Designing indirect questions and interpretation of own view from the responses to the given questions is referred to the issue, validity of a research. Increasing the validity of a research will be obtained if interview questions be planned in advance, and consequently they are in agreement with the survey’s aim and what is intended to be measured.

Explanation of how to prevent unwilling effects by using measurements methods is described under the concept of reliability. In this case, reliability of interviews and questionnaires depends on personal status, comfort factors, and formulation factors. Appropriate questions, allocating enough time for respondents and providing a comfortable environment are the issues which can be taken into consideration to achieve higher reliability in interviews. In addition, designing accurate and understandable questions in information gathering phase leads to higher reliability, more effective information and data related to usage. Besides, we
must try to avoid of errors in making questionnaire, because these errors can decrease the reliability of questions in interview.

### 3.4. Information Gathering

There are two groups of known data as primary and secondary data in information collection. Obtaining data from techniques such as interviews and questionnaires belongs to the primary data group. The sources of secondary data are literature studies, newspaper, magazines, related articles, internet, and organizational documents. Primary information can be collected in three ways: observations, opinion investigation, and interviews. Among the primary data techniques, in depth interview is more common, which we will review in the following section.

#### 3.4.1 Interview

The situation of asking questions similar to communication among three types of operators; interviewer, interviewee and possible spectators, is discussed towards the concept of interview.

#### 3.4.2 In-Depth Interviewing

Qualitative researchers use and trust on deep interview more than the other methods of data collection. Some explain interviewing as a conversation with a purpose. A qualitative interview is characterized on its width instead of its depth. As a matter of fact, interviewing differs in terms of its construction and the scope that interviewee has in answering to questions. In general, doing interview with enough number of peoples can lead to gathering a large amount of data. When doing the interviews, interviewer must take into account the attitudes of the participants and also the prosperity of interview depends on the interviewer’s role in moral issues, meaning her/his ability in effective communication and interaction.

In conclusion, interviewers must be skillful at listening and question designing. Large amount of data can be gathered by interviewing, but correct analysis and interpretation is more important and can be time consuming.
4. Empirical Work

This chapter illustrates the picture that the company IRO AB has and the situation in which it is located at present. There are two parts included in this chapter that are the introduction of the company and the findings from the investigation of current situation of change process at the company as following.

4.1. Company Description

In this part, the company in which this research has been conducted is introduced. A history of the company and its activities, its products and the relationship between the company and its Chinese subsidiary are described in the following sections.

4.1.1 About IRO AB
IRO AB is a manufacturing company whose headquarter is located in Ulricehamn, Sweden. IRO AB is part of the IRO group which is the world’s leading producer of yarn feeding equipment to the textile industry with production facilities in Sweden, Germany, Italy, China and Taiwan. The IRO group includes two main companies: IRO AB (Sweden), and ROJ (Italy). With an annual turnover in excess of 100 million Euros, the IRO Group answers today for over 60% of the global production of yarn feeders and is unique in offering a complete product range covering virtually every yarn feeding requirement within the textile industry. The IRO group, in turn, is part of the Van de Wiele group that includes three big companies [29]. IRO AB is responsible for producing a wide range of textile products and motor products through cooperation with its partners, sister, and subsidiary companies. It owns a subsidiary located in China that is called IRO Wuxi. Both IRO AB and its Chinese subsidiary have together more than 500 employees with an annual turnover of about 285 million SEK.

4.1.2 History
IRO was founded in 1958 when Isac Rosén, the production manager in the Rosén family’s knitting company, invented a positive yarn feeding system for their circular knitting machines. Some milestones in the history of the company are listed as below [29]:

- 1988: IRO acquired Memminger GmbH and centralized development and production of knitting products to Dornstetten in Germany
• **1992**: The IRO group was further strengthened through the acquisition of ROJ Electrotex in Italy

• **1996**: The company’s main supplier of electronic components, AROS, was incorporated into the group, resulting in a vast increase in proficiency within this rapidly developing area

• **1998**: The acquisition of Savitech Srl in Italy

• **2000**: The IRO group was acquired by Van de Wiele, the world’s leading producer of carpet weaving machines

• **2003**: The introduction of the X2 range – the most advanced weft-feeding system on the market

### 4.1.3 Products

The product lines of IRO AB are divided into two main categories: textile products, and motor products [29].

**Textile Products**

Textile products offer a comprehensive range of weft feeders and auxiliary equipment for Rapier, Projectile, Air and Water jet weaving machines. The range comprises of products for all stages of the weft insertion process and includes: Stands and creels, Controlled bobbin take of units, Input tensioners, Yarn oilers, Weft feeders for all applications, Output tensioners, Controlled tensioners, Weft detectors, Tensiometers. Textile products of the company that are produced in Ulricehamn include XD X2, HD X2, Luna X2/Chrono X2, Stella G2, and Laser creels. Among these products, Stella G2 representing the latest generation of rapier feeders is a culmination of years of development incorporated into one new feeder. This is, at present, the only product that is produced in parallel at both IRO and its Chinese subsidiary.
**Motor Products**

IRO cooperates with Aros Electronics, which is specialized in the following fields: motor-controllers, sensors and field buses. Aros Electronics is a sister company within the Van de Wiele Group. This cooperation results in production of a range of customer designed electric motors for different applications. Some examples of these electric motor products are “drive by wire” for marine engines, servomotors for knitting machines, drive train (driving motor) for warp and take-up on carpet weaving machines.

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**4.1.4 Relationship between IRO and IWTC**

IRO Wuxi Textile Machinery Co. Ltd. (IWTC) is IRO’s subsidiary located in Wuxi, China. IWTC, founded in 2002, is responsible for production, sales and service of IRO weaving products for the Chinese market. IWTC has a complete service and sales organization with fully trained IRO technicians. IWTC plays three roles against IRO AB; i.e. as a customer, as a supplier, and as a subsidiary with parallel product lines. Figure 2 shows the relationship between two companies and their parallel product line. The position of some activities relevant to change process at IRO AB such as deviation handling, customer complaint, and product change request is also illustrated in this figure.

**4.2. Investigation and Findings**

In this part, current status of the company regarding change and quality management is figured out. Whatever presented in this part has been derived from on-site investigation and interviews with key persons together with the study of company’s relevant documents. The main focus has been to examine if and how any change is registered at the company and is communicated to Chinese subsidiary. Structure and organization of quality at IRO, types of change at IRO, change origins at the company, change process at IRO, communication procedure and channels existing between two sites, and critical information relevant to changes in processes.
Figure 2. Relationship between IRO AB and its Chinese subsidiary IWTC
and products to be communicated to Chinese subsidiary are issues described in the following sections.

4.2.1 Structure of Quality management at IRO AB
Affairs of quality improvement at the company are organized and operated by the department of quality and environment. However there are different improvement teams at the company that consist of relevant persons from relevant departments and are continually discussing and reviewing various ways to improve the quality of works and products. Main present improvement teams and their structure and purposes at the company are named as below [30].

**Quality Control Group**
This group is formed by 8 persons mainly from management positions of the company. They have about 10 meetings a year discussing major problems like time delivery to customers, scrap rate, material problems, machining errors, and prioritizing improvement projects. They have recently shifted their approach into more general issues concerning IRO quality system.

**Improvement Teams in Assembly Department**
There are seven improvement teams in the assembly department each of which is belonging to an assembly line. Each team is composed of supervisor and operators of related assembly line. They have regular meetings each two weeks to discuss minor problems they face during daily work and to suggest their ideas to production engineer to improve their work process.

**Production Engineers Meetings**
Production engineers from both machining shop and assembly department have weekly meetings with each other to review assembly related and machining related problems, to share their ideas, and to find solutions to those problems. These problems may be major or minor and/or common to both machining and assembly departments.

**Machining Shop Improvement Meetings**
There are about 6-8 improvement meetings a year in the machining shop to find solutions to improve the quality of processes and products in this area. The members of this meeting are production engineer, supervisors in machining shop, and representatives from machining shop sub areas. They discuss problems relevant to manufacturing area like scrap rate, and share their ideas to increase the efficiency of work and products.
Surface Treatment Improvement Meetings
A number of operators in surface treatment part together with their supervisor have 6-8 improvement meetings per year. They investigate relevant problems to this part and share their ideas and suggestions to improve their work process.

Powder Coating Improvement Meetings
There is a similar improvement meeting to surface treatment in powder coating part composed of a number of operators together with the powder coating supervisor. They make this meeting about 6-8 times a year to discuss relevant problems to their work and to find the ways to increase the efficiency and quality of work.

4.2.2 Types of change at IRO AB
Changes that happen at the company can be distinguished based on categories as follow. This categorization is used just to show the nature and type of changes at IRO. Obviously a change can belong to some categories at the same time; for example it can be a major, rare, and registered change.

Changes in products/processes
Changes at IRO can be divided into two general types. There are some changes that affect directly company’s products while many changes happen to improve the processes of doing works and production procedures but not the product itself. In this thesis, we call them as product change and/or process change.

Major/minor changes
Changes at IRO can be considered as either major or minor. Major changes are those changes that may result in the introduction of a new product or a new component or changes in a product shape and function. Minor changes, on the other hand, are small changes that affect work processes and usually result from employees’ suggestions. They may also affect the quality of products but without any change in product itself.

Registered/not registered changes
Most changes at IRO are registered in a systematic way in various documents and on the company’s database. However, there are still few changes that are not registered as the usual
way. These changes are normally neither so important nor influential on the processes or products and can be ignored.

**Frequent/rare changes**
Changes can also be categorized based on the frequency of their occurrence. Some changes such as those suggested by the employees and operators happen regularly on a daily basis while some other changes like major changes in a product design happen on the odd occasion.

### 4.2.3 Change origins at IRO AB
Changes that are made in products and/or processes of the company result from various sources. These sources may be either internal or external. The most important origins of changes at IRO are described as below.

**Development of new products**
When a new project or a new product is about to be introduced at the company, some changes are required to be made mainly in manufacturing department. These changes are usually suggested by R&D department that is responsible for development of new products. They are handled through the PCO procedure.

**Product Change Request**
All employees within the IRO group as well as customers, agents, or suppliers who have an idea about any changes in products or parts and/or discontinuation of products may initiate a PCR and register their request by filling out a specific form. The PCR, then, is reviewed by the PCR group and results in a PCO if it is approved [31].

**Deviation reports**
Anything that deviates from a specification is defined as a deviation at IRO. It can be a dimension that is out of tolerance, casting defects, or functional errors. Deviations are mainly discovered by incoming inspection staff due to purchased materials from suppliers. However, they may be due to internal failures. In a few cases, deviations originate in a customer complaint. Deviation reports may sometimes result in making a PCO to remove their causes.

**Customer complaints**
Complaints received from the customers may result in some changes at the company to solve the problems that cause complaints and to prevent their recurrence. Customer complaints are usually because of insufficient number of products delivered, fault in a product or in its packaging, and, in most cases, fault in electronic circuit boards.

**Improvement teams’ suggestions**
Besides other sources of change at the company, suggestions from all employees may also cause some changes especially in processes. These suggestions usually come from improvement teams that were considered in previous section to facilitate work flow at the company. Employees’ suggestions are a very critical and maybe the most common source of change at IRO.

### 4.2.4 Change process at IRO AB: Current status

Present situation for change process at IRO is described in this section. Changes at the company can affect either work processes or products and, as considered above, come from various origins. Procedure for these changes is described in five categories as below. Each category indicates an independent change process from origin to the end. In addition, the map for current change process of the company is shown as flowcharts in appendix 1 at the end of this thesis report.

**Product changes through PCOs**
Changes in products are registered in PCOs. The PCO is a standard form at the company and may result from a PCR or indicate a new project regarding product development. The PCO is often created at R&D and passed through different departments using a computer database system called Lotus Notes until is completely approved and put into operation. The procedure of making changes through PCO based on interviews with key persons at the company together with studying document “RUT004”[32] has the order as following:

- Any request for change from everybody within the company, its customers, agents, or suppliers is registered in a PCR form
- All PCRs are sent to PCR group to be reviewed and approved
- The PCRs that are approved and about to make a change in drawings are sent to R&D department while the rejected PCR is sent back to its creator
- R&D department creates a PCO based on each PCR
The PCO can be created by R&D itself without any PCR when a new project is in hand or as a result of deviations or customer complaints.

The PCO is approved and signed in R&D and sent to production engineering administration (Anna-Karin) together with relevant drawing [33].

Anna-Karin sends the PCO to relevant production engineer in machining shop or assembly department.

In Machining Shop [34]:
- The PCO is received by production engineer through Lotus Notes database.
- Production engineer sends a request to CNC programming personnel to implement the ordered change.
- If the PCO is relevant to a new part (with code 11), production engineer draws a fixture.
- CNC programmers start to make a program based on ordered change.
- CNC programmers also make a machine setup list containing materials and tools required and their position in the machine.
- CNC programmers send back the request with a response to production engineer when they have implemented the change.
- Production engineer updates the operation list in MOVEX system when they receive the programmers’ response.
- Production engineer moves the new drawing to current documents folder and the old one to invalid documents folder.
- Production engineer sends a copy of new drawing to machining shop to be distributed among operators.
- Production engineer sends the PCO to logistics department.

In Assembly Department [35, 36, and 37]:
- The PCO is received by production engineer in assembly line.
- If the PCO is rejected, a new PCO is asked to be created.
- If it is approved, the ordered change is implemented.
- After implementing the change, assembly job instruction is updated by production engineer.
• The introduction serial number, relevant to the first product after making the change, is registered on the PCO and sent back to Anna-Karin by production engineer

• Anna-Karin changes the documents in MOVEX system according to PCO
• Anna-Karin moves new document from pending documents folder to current documents folder in the database
• Anna-Karin sends the PCO to logistics department [38]

In Logistics Department [39]:
• The PCO is received from production engineering department (machining shop or assembly)
• A logistics expert adjusts various data in MOVEX system based on the PCO if it is approved and is about a new part (with code 11). The following data are adjusted in MOVEX considering if the PCO is due to a purchased or a manufactured material:
  o Part number record (ARTIKEL REGISTER)
  o Warehouse record (LAGERSTÄLLE REGISTER)
  o Part number supplier record (ARTIKEL/LEVERANTÖR REGISTER)
  o Agreement record regarding purchasing parts (INKÖPSAVTAL)
  o Part number facility record (ARTIKEL KOPPLA TILL VERKSAMHETSENHET)
• Logistics expert checks if the PCO is relevant to a supplier or not
• The PCO is sent to the supplier attaching with relevant documents such as drawing, part list, and PCO delivery notes and letters if it is relevant to a supplier
• The PCO is sent back by the supplier together with the first serial delivery to IRO
• The PCO is signed as “completion and distribution” and filed in Lotus Notes database

Changes resulted from deviations
As described earlier, deviations may cause change in processes or products. Finding and solving the deviations is an important activity within the company to prevent faults in products and to ensure the wanted quality of products. Procedure for handling the deviations at IRO is coming as follow [40]:

• A deviation in parts or products is discovered by incoming inspection staff or material responsible staff in assembly lines and/or operators in machining shop and surface treatment
• A preliminary deviation report “Preliminär Avvikelserapport” is created by somebody who has found the deviation

• Deviation is reported to Thorbjörn Johansson who is responsible for making deviation report

• A deviation report “Avvikelserapport” is created by Thorbjörn Johansson in which relevant persons are assigned to follow and solve the deviation before a definite deadline

• If deviation has been found in a purchased material from a supplier, the responsible person creates either an “8D Problem Solving Report” or “4D Report” depending on the importance and affects of deviation and sends it to relevant supplier via an email as “Deviation Notification”

• The supplier replies to deviation by an email when it has been corrected

• If deviation is due to an internal problem, in cases that there is a design flaw and drawing needs to be changed, a PCO is initiated by Thorbjörn Johansson, otherwise someone who is responsible is asked to prevent recurrence.

Changes resulted from customer complaints
Customer satisfaction is a critical factor for every company including IRO AB. IRO takes every complaint from the customers into account. Procedure for handling the customer complaints at IRO is described as below [41]:

• A complaint is received from a customer by an email or fax or phone call

• The complaint is addressed to service department that has an email group with 3 members

• Service department makes a deviation report “Avvikelserapport” in which relevant persons are assigned to solve the compliant

• In some cases, an emergency meeting is asked to be held if necessary to find a quick solution

• If complaint is due to a fault in production or assembly that needs a change in products or parts, it is addressed to R&D to create a PCO

• If complaint is due to a fault from a supplier, a deviation report (New 8D report) is sent to the supplier. In this case, the procedure is the same as the procedure for handling of deviations
Finally, the complaint is removed when a new part or product is sent to the customer to replace the faulty one.

**Process changes in machining shop**

Besides changes that are made in products through PCOs, some changes may happen in work processes of machining shop most of which are suggested by personnel. Those changes that are guessed to affect the quality of products are registered according to following procedure [42]. Examples of such changes are: change of degreasing method for parts that are glued, introduction of new fixtures for painting or plating, change of tumbling process time, change of machining method, change of machine type, introduction of new type of glue, and changed method of inspection [43].

- A change is made in machining shop as a result of its personnel suggestions
- If the supervisor distinguishes the change as one that may affect the quality of products, it is registered, otherwise it is not registered
- To register the change, the CNC programmer fills in the specific form “Ändring Som Skall Dokumenteras” and describes the change on it
- The programmer sends the form together with related material to production engineer in assembly line
- Production engineer enters the change description to computer database
- If concerned material is approved, it is used; otherwise the form is sent back to machining shop together with material

**Process changes in assembly lines**

A lot of changes happen daily in assembly department based on suggestions from different improvement teams in different assembly lines in order to improve the work processes. These changes rarely affect the quality of products. Improvement teams sum up all suggestions from assembly operators in their meetings every two weeks. Procedure for process change in assembly department is coming as below [35, 36, and 37]:

- Assembly operators and supervisor discuss on their suggestions in improvement teams
- All suggestions for process improvement on which all members have consensus are written down in the meeting report
- The meeting report is submitted to production engineer of relevant assembly line
- The production engineer registers these suggestions in database
- Suggestions are reviewed by production engineer
- If suggestions are approved, the production engineer creates an action plan assigning relevant persons to implement them in a deadline; otherwise it is skipped
- The assembly job instruction is updated accordingly by production engineer after implementation of changes

4.2.5 Communication channels between IRO AB and IWTC
As mentioned earlier, IWTC plays three different roles versus IRO at the same time, i.e. it acts as a customer, as a supplier, and as a subsidiary with parallel processes. Various channels that are currently used to communicate information and documents between two companies at each of these three situations are described in this section.

**IWTC as IRO’s supplier**
Communication channels between IRO and IWTC when it comes to IWTC as a supplier are the same as those between IRO and its other suppliers. In other words, email is frequently used to interchange purchase inquiries and quotations when it is about to buy some materials from IWTC, to send a PCO when it is relevant to a purchased material, and to send a deviation notification when deviation is due to a supplier.

**IWTC as IRO’s customer**
When IWTC is seen as IRO’s customer, communication ways are also the same as those between IRO and its other customers. Email is a frequently used way in this situation too; for example in the case of customer complaints.

**IWTC as IRO’s subsidiary**
When IWTC is considered as IRO’s subsidiary, various ways are used for communication between two companies most frequent of which is through sending emails. There is also a coordinator person at IRO who frequently travels to IWTC and works as half time at each company to bring necessary information from one to another, to monitor work processes especially in IWTC, and to ensure that information is communicated correctly and that a continuous interrelationship exists between two companies. This coordinator also follows up the changes requested by IRO to make sure that they are implemented at IWTC and gives a
feedback to IRO. In addition, some contact persons have been assigned at both companies to communicate relevant information directly by sending emails to each other. Each contact person is responsible for sending and receiving specific information.

4.2.6 Information that must be communicated to Chinese subsidiary (IWTC)
Various information and documents are regularly communicated between IRO and IWTC. But when it comes to parallel processes with similar product, it is very important to distinguish what information should be communicated between two companies in order to exchange the last changes made at each process. The most critical information and documents that should be always communicated between both companies are listed as below [44].

**Relevant PCOs**
Besides PCOs that are relevant to purchased materials and sent to IWTC as a supplier, the PCOs that are about parts or product in parallel processes should be sent to IWTC as well. It is crucial to inform IWTC about any change that happens in parallel process at IRO and to order the same change to be implemented at IWTC. Such information is communicated through a PCO because all changes in products at different departments of the company are registered in PCOs. The relevant PCO to Chinese subsidiary should be sent attached with related documents including machine drawing, part list, and so on.

**Job instructions**
Job instructions are important documents that are used in assembly department to train its operators how to exactly assemble different parts in a process up to packaging the final product. They contain important steps that should be taken in an assembly process and description of each step in detail. Every change in product or processes in assembly department is registered in relevant job instruction. So it is important to communicate the last updated version of this document to IWTC when it is relevant to parallel processes in order to use the same instruction at both companies.

**Control plans**
Control plans are documents that are created by R&D department to control the processes at the company. They indicate what to check throughout work processes, how to check, and
when to check and include links to technical specifications of products and processes. They can also have updated tolerance limits, if the function allows bigger tolerances than the drawing. Control plans make it possible for all departments and persons who inspect the parts to inspect on the same way. Control plans have a significant role to minimize deviations in products at the company. Therefore, they are useful to be communicated to keep parallel processes in the same status at both companies.

**Deviation reports/problem solving report**

Deviation reports are one of the most important documents through which any deviation in products or processes is registered and is planned to solve and to prevent its recurrence. At present, about 22 deviation reports are monthly sent from IRO to Chinese subsidiary regarding purchased materials [40]. A deviation report usually results in a problem solving report that should contain a set of corrective and preventive actions. These reports should be communicated between both companies when they are relevant to a deviation happened in a parallel process. These documents can be used to share the lessons learnt from those deviations and to prevent repetition of the same problem in another company. They are, therefore, critical to keep the similarity of parallel products in terms of quality and functionality.

**Measurement document**

Measurement documents are those which show the result of measuring machine that is done to measure the specifications of materials that are to be purchased from a supplier. Measuring department creates this document and sends it attaching with IST report to R&D department for final decision making whether to buy or not to buy the material. This is an important document regarding which area of the part/article and how it is measured. Communication of this document contributes to both companies purchasing and utilizing almost the same materials in their parallel processes.
5. Analysis and Discussion

In this chapter the facts and current situation of the company derived from the empirical study are analyzed in order to reach the answers to the research questions. Two questions were pointed out at the beginning of this thesis both of which will be addressed during this analysis; one was regarding change registration at IRO AB and the other was mentioning change communication between IRO AB and IWTC. Analysis of the company regarding these issues is conducted in terms of strengths and weaknesses in two parts as follows.

5.1. Analysis of Change Registration at IRO AB

In this part, current situation regarding change process at IRO AB is analyzed to find out if the changes and improvements made in products and processes are registered. In each analysis section, as following, the strengths and weaknesses of the change process will be mentioned as well.

5.1.1 Product Change through PCOs

Investigation of change process at IRO AB shows that, among various change processes distinguished throughout the company, the process of changing products using PCOs is the biggest and the most frequently happened. Every major and minor change that is to be made in products, parts, and articles is definitely registered at PCO forms and recorded in the company’s databases. All necessary information about the changes at question is registered on the PCO forms including the name and specifications of the product/part that change belongs to, reason and description of the change, the manufacturing quantity, attached documents, and approval points and dates.

Strengths

- Product change at the company follows a clear, standardized process and is made in a systematic, structured way.
- Every change that may affect the products/parts/articles is registered.
- Changes ordered through the PCOs are controlled and approved in many points by different persons throughout the process.
- The date from when and the serial number form which the change is made are registered in database so that the changed products/parts/articles can be tracked.

Weaknesses
- There is no instruction regarding how and by whom different data should be adjusted in ERP (MOVEX) system when a change is made through a PCO.
- When a PCO is relevant to a purchased material from Chinese subsidiary, there is usually a delay in getting confirmation that the change has been done.
- The decision regarding if a PCO is relevant to Chinese subsidiary is made by logistics expert based on his/her experience and there is no instruction to determine when a PCO should be sent to IWTC especially when it comes to a change in parallel products.
- When the PCO is relevant to parallel processes, information about the number of parts available at Chinese subsidiary should be got before releasing the PCO that is not currently done in an organized way.

5.1.2 Deviation Handling Process
Any deviation found at a product/process is handled through a defined procedure. The ultimate objective of deviation handling at the company is to solve it and to remove its root cause in order to prevent recurrence. When it comes to parallel processes at both IRO and IWTC, this process should be seen as much more important than what it is in other situations. Besides, by this process any potential deviation can be identified at various points at the company.

**Strengths**
- This process follows a well-defined procedure at the company.
- Any deviation is registered at the company so that can be used in future to show the most frequent sources of deviations.

**Weaknesses**
- There is no documented instruction for the process of deviation handling in English at IRO AB in order to be used at Chinese subsidiary as well.
- The information in problem solving reports is not completely filled out. There are only a few complete problem solving reports (8D reports).
- In the most cases in deviation handling preventive actions are missing and the focus is made only on corrective actions.
- There is no system to follow up the deviation notifications sent to suppliers when they are due to a supplier fault. There is sometimes a big delay in supplier’s reply to a deviation notification.
5.1.3 Customer Complaints Handling Process
This process ensures that customers have a significant role in making improvements at the company and in helping the company to find out its deviations. The procedure for removing customer complaints is aiming at finding out the root causes and to prevent their reappearance. However the priority is given to removing the complaints quickly.

Strengths
- The process for customer complaints handling is well connected to other change processes at the company like deviation handling and product change.
- Every customer complaint is registered and can be used to identify the most frequent sources of complaints.

Weaknesses
- The main focus is made on short term solutions for removing the complaints and preventive actions in form of finding the root causes are usually missing.
- There is no documented instruction for this process to be used by Chinese subsidiary as well.

5.1.4 Process Change in Machining Shop
This process is due to changes made in work processes at machining shop and powder coating departments that are not directly relevant to changes in products but may affect the quality of products as well. These changes happen daily but are not often registered in specific documents.

Strengths
- All big changes that affect the quality of work/ the process of manufacturing are registered according to a written instruction: “RUT026”
- These changes made in machining department are controlled and approved in assembly department.

Weaknesses
- Some daily changes made in machining department are not registered including changes in tool, changes in work flow (order), changes in the number of fixtures, changes in the volume of fixtures. Such changes are supposed not to affect the products but they may affect the efficiency of production process.
• The form “Ändring Som Skall Dokumenteras” is seldom received by the assembly engineers or it is received too late.

5.1.5 Process Change in Assembly Lines
These changes are daily happening in assembly lines based on consensual suggestions made by improvement teams and almost all of them are registered. Although these changes don’t directly affect the quality and functionality of final product, they are critical for the company to be registered and followed up since they can facilitate the work of operators and have a positive impact on their work efficiency and productivity.

Strengths
• All changes made in assembly work processes are registered in a regular way.
• After every change made the assembly instruction is updated.

Weaknesses
• Although all the changes in assembly line are registered and the instruction is finally updated, changes are not documented well in a way that shows why the change has been made, the purpose of the change, the results of the change, and if any more improvement is needed.

5.2. Analysis of Change Communication between IRO and IWTC
IRO AB and IWTC have continuously contact with each other through different communication channels. Part of these contacts is due to their supplier-buyer relationship. However, we here focus only on their relationship as two companies with parallel processes. Among different ways of communication that are currently somehow used inside IRO AB and between two companies such as email, lotus notes database, MOVEX system, contact persons, and coordinator’s travels, we will come up with a solution that causes an effective communication channel that is continuously accessible at both companies and that can be managed based on requirements of each company. Generally, two kinds of communication channels can be distinguished at IRO when it comes to parallel processes. One is direct communication between assigned persons at both companies as shown by figure 3. Another one is kind of indirect communication between relevant departments through a centralized origin and destination at both companies as shown in figure 4. This centralized way can be
referred as a database/system that is accessible by relevant departments/persons at both companies.

![Diagram](image)

**Figure 3**

At both cases, it is important to define specific persons as responsible for sending, receiving, and following up specific information/documents.

![Diagram](image)

**Figure 4**
Some strengths and weaknesses existing in current communication process of the company are listed as following:

**Strengths**

- There are potential communication infrastructures at IRO AB that can be employed as a basis for an effective communication between two companies.
- Some contact persons have been assigned at both companies to be responsible for communicating any specific information.

**Weaknesses**

- There is no standardized, structured procedure for communications between both companies IRO AB and IWTC.
- It is not clear enough what information, through which way, from whom to whom, and when should be communicated between two companies.
- When an information/message is sent from IRO AB to IWTC, there is no effective, fast confirmation procedure that ensures if the message is received correctly and if the requested items have been done right in a right, scheduled time.
6. Conclusion and Suggestions

In this chapter, two research questions of this thesis are answered based on the analysis made in previous chapter. Besides, some basic, preliminary suggestions to improve the change process at IRO AB are figured out. These suggestions are made based on the weaknesses discovered during the research and investigation of current status of the company. A few suggestions for further research work at the company are also provided at the end of this chapter.

6.1. Conclusion

To conclude this study, we look back at the research questions stated at the beginning of this thesis and answer them based on the investigation of current situation, analysis of findings and results and theories we used in our research. Two questions were pointed out in chapter one as following:

1. Whether and how the change process at the company should be improved so that all the changes and improvements made in parallel processes are registered in a standardized, reliable way?

Considering findings from our study of current status of change process at the company, it is obvious that all changes relevant to parallel processes are registered when they are made. How this registration is happened has been described in chapter four as our empirical work at the company. As a conclusion we find current change process at IRO AB well, structured enough in which almost all changes are registered at least when it comes to parallel processes that are operated at Chinese subsidiary as well.

2. How the changes and improvements made in parallel processes can be communicated between both companies IRO AB and IWTC?

To answer this question the authors refer to theoretical frame of reference chapter where the ERP terminology was developed in details. In fact, an explorative attitude based on problem definition and current situation of the company has given direction towards this concept.

In one hand, considering current communication capacities and infrastructures that exist at IRO AB, all changes made in products and processes and all the information regarding production, inventory, accounting and financial are registered. However, these information registrations are made in different systems. In other words, most of the company’s information
is recorded in its MOVEX system while the changes and improvements made in products and processes are recorded in company’s database that is called Lotus Notes. In fact, MOVEX system is a preconfigured package which integrates all necessary data across different departments of the company.

On the other hand, based on definition and characteristics of ERP, all the data across the company and all the changes made within different processes and functions can be integrated in a one unique package. This is while; this integration will lead to both data accessibility and availability to all people in different departments within different locations in a world-wide company such as IRO AB. We already discussed that ERP system with such characteristics can be seen as a communication language in a global scope. To motivate this discussion, we clarify the terminology with respect to the current situation of IRO AB.

Considering the case where a change in a product/part/article is happened in a parallel process as a change in supplier or a in a part drawing; such changes are registered in PCO documents and Lotus Notes database. If this change is recorded in ERP system, through either integrating the database with ERP system or registering the changes directly in ERP system, it can be communicated and made accessible for relevant persons at both companies IRO AB and IWTC and even at other subsidiaries as well. ERP system has the ability to send kind of notification of the change happened to all relevant parties/persons at every subsidiary immediately after registration of the change at the system. All the following changes influenced by the change at question are also automatically made by the system. The confirmation of receiving and implementing the requested changes at other subsidiaries can be also got through the system. This system can also make registered information available in different languages either as international or local languages.

Given these ERP features and considering its potential capabilities, we suggest the company to employ its established ERP system as a communication channel. In other words, we suggest the company to register all the changes made in products and processes and all updated documents in this system and to make them available for every specific parties including IWTC through web integration ability of the system. Through such a web-based ERP system the most updated changes and documents are accessible by the relevant, specified persons at both companies at any time and everywhere. There is also a big cost saving in employing web-based ERP system since there is no need to install the system at every user computer.
6.2. Suggestions for Improvement

This part includes a number of suggestions for improvement of change process at IRO AB. These suggestions result from the empirical study and investigation of current situation of change processes at the company. As already mentioned at the beginning of this thesis, the improvement of change process has not been the main purpose of this research. However, suggested improvements below are the most obvious ones found out during the investigation work. These suggestions are categorized under relevant issue as following.

**PCO**
1. A check box can be inserted in the top of the PCO form to be marked when the PCO is relevant to parallel products that are produced in both IRO and IWTC
2. IWTC can be asked to send a sample of changed part/product to IRO in order to make sure that the change has been implemented (using the same procedure as what is carried out to confirm the change when a PCO is about purchased parts and is relevant to a supplier)
3. Making sure that the information regarding the number of parts available in IWTC’s processes and inventory stock is obtained before a relevant PCO is released

**SUGGESTIONS FROM ASSEMBLY OPERATORS**
4. Registered suggestions from assembly operators can be communicated to IWTC through regular reports if they are not put in ERP system

**STANDARDIZATION OF CHANGE PROCESS**
5. Distribution of routines and forms that are used in IRO to IWTC will contribute to harmonization of change process at both companies
6. Creation of bilingual routines in Swedish and Chinese for those procedures that are commonly used at both IRO and IWTC

**COMMUNICATION PROCEDURE**
7. A communication procedure (routine) can be created to clarify the communication channels between IRO and IWTC (How), contact persons at each company (Who), the information that should be communicated between both companies (What), and the way to get feedback (confirmation) from each other
**ERP SYSTEM**

8. The use of the same ERP system at both company eases registration and communication of any change that happens at each one

9. Creating an instruction routine to describe how different data in ERP system should be adjusted according to a PCO in different departments

**DEVIATION HANDLING**

10. Improvement of procedure for handling the deviations so that besides the corrective actions, some preventive actions are defined and carried out after a deviation is discovered

11. The number of completely filled out 8D reports related to discovered deviations, that are few at present, can be increased through assigning enough time and doing it based on team work; i.e. some relevant persons fill them out together in a meeting

12. The follow-up for handling the deviations due to both internal and external factors needs to be strengthened to make sure that deviation is removed (corrective action) and will not happen again (preventive action)

13. Creation of a bilingual routine for handling the deviations and customer complaints

### 6.3. Suggestions for Further Research

Considering research limitations and demarcations pointed out at the beginning of this thesis, we couldn’t and didn’t include many issues in our research. Therefore, we suggest here some problems that can be put under question and investigation in future researches at the company.

- The change process at the company can be studied as a whole in order to improve fundamentals, methods, procedure, and documents that are currently used. That research can be conducted with the purpose of reviewing change management at IRO AB. Through such study, value adding and non-value adding activities in change processes can be identified.

- More specifically, the coding system that is currently used to distinguish different kinds of change in products needs to be improved. Such improvement should aim at re-identifying the different possible changes that may be happened in products, and classifying them in relevant categories.
• IRO quality management system based on ISO 9001 dates back to a relatively long time ago and needs to be reviewed in order to find out values and benefits that company can obtain from this system.

• This thesis assumes current ERP system at the company as a potential infrastructure for communication of changes between IRO and IWTC. The ERP system of the company can be also studied in order to observe if it is effective enough or it should be improved by for example adding more modules, or employing a different ERP vendor and so on.
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Appendix I – Flow charts for current situation of change process at IRO AB

This appendix contains the flowcharts showing the current procedure for change processes at IRO AB. Although there are different kinds of mapping processes some of which could be more interesting and more effective, we use a simple flowchart to only make the current situation of the company visible. The symbols used in these flowcharts indicate following meanings:

- **Starting and Ending point of a process**
- **An activity within a process**
- **A decision point within a process**
- **Connection between two activities within a process**
- **Arrows of activities within a process**
**Flow Chart for product changes through PCOs**

Different departments at IRO

- **R & D Department**
  - A PCR is created
  - PCR is sent to PCR Group
  - Is PCR approved?
    - Yes: PCR is sent to R&D dept. if it is about drawing change
    - No: PCR is sent to PCR Group

- **Production Engineering**
  - A PCO is created based on the PCR or a new project or as a result of a deviation report or customer complaints
  - PCO is approved and signed and sent to production engineering accompanied by drawing
  - PCO is sent to relevant production engineer
  - Introduction serial number is received from assembly production engineer

- **Administration (Anna-Karin)**
  - D

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53
Anna-Karin

B

Documents are changed in MOVEX according to PCO

New documents are moved from pending to current documents folder

PCO is sent to logistics department *

C

*PCO may be sent to logistics department at the same time as it is sent to assembly production engineers
PCO is received by production engineer in machining shop

Is PCO approved?

Yes

A request is sent to CNC programmers to implement the change

If PCO is for a new part (code 11) production engineer draws a fixture

CNC programmers make a program based on requested change

CNC programmers make a machine setup list

CNC programmers send back the request with response to production engineer

The operation list in ERP system is updated by production engineer

New drawing is moved to current documents folder by production engineer

Production engineer sends a copy of drawing to machining department to be distributed among operators

PCO is sent to logistics department

No

A new PCO is asked to be created

Machining Shop
PCO is received by production engineer in assembly line

Is PCO approved?

Yes → Change is implemented

No → A new PCO is asked to be created

Assembly job instruction is up-dated

Introduction serial number is registered on PCO
Logistics Department

PCO is received from Production Engineering department

Is PCO approved?

Yes

Logistics expert adjusts various data in ERP system depending on PCO

Is PCO relevant to a supplier?

No

A new PCO is asked to be created

PCO is sent to the supplier attaching with relevant documents

PCO is received back from supplier together with the first serial delivery

PCO is signed as "completion and distribution" and filed in LotusNotes database

No
Flow Chart for changes resulted from deviations

A deviation in parts or products is discovered

Incoming inspection

Production

Operators

A preliminary Deviation Report is created

Deviation is reported to Thorbjörn Johansson

A Deviation Report "Avvikelserapport" is created

Thorbjörn Johansson

Is deviation due to a supplier?

Yes

No

Is deviation due to a design flaw?

Yes

A PCO is created

D

No

A person within the company is assigned to solve the problem

Assigned person in deviation report

An "8D Problem Solving Report" or "4D Report" is created

8D/4D report is sent to relevant supplier by an email

Supplier replies to deviation by sending an email to IRO
Flow chart for changes resulted from customer complaints

A complaint is received from a customer

A deviation report (Avvikelserapport) is created assigning relevant persons to solve the complaint

Does complaint need an emergency meeting?
- Yes:
  - An emergency meeting is made
- No:
  - Does complaint due to a fault in manufacturing or assembly?
    - Yes:
      - Complaint is addressed to R&D to make a PCO
    - No:
      - Is complaint due to a fault from a supplier?
        - Yes:
          - A deviation report is made and sent to the supplier
        - No:
          - A new part/product is sent to the customer to replace the faulty one and remove the complaint
Flow chart for process changes in Machining Shop

A change is made in machining shop by its personnel suggestions

May the change affect the (quality of) products?

No

It is not registered

Yes

CNC programmer fills in the form "Ändring Som Skall Dokumenteras" to describe the change

The form is sent together with related material to assembly line

Production engineer enters the change description to database

Is concerned material approved?

No

The form is sent back to machining shop together with material

Yes

The form is thrown away and material is used
Flow chart for process changes in Assembly department

1. Improvement meeting in assembly line
2. Suggestions for improvement of work process are discussed
3. Consensual suggestions are written down on the meeting report
4. The meeting report is submitted to production engineer
5. Suggestions are registered in database
6. Is suggestion approved?
   - Yes: A person is assigned to implement suggestion with a deadline through an action plan
   - No: Suggestion is skipped
7. The assembly job instruction is updated accordingly after implementation of changes
Appendix II – Questionnaires with Answers

To find out current situation of change processes at IRO AB and before interview with key persons at the company, a questionnaire was made at the beginning of this research and sent to those persons to get their preliminary answers and to have a rough idea before going to interview. The questionnaire is put in this appendix followed by the answers from those key persons/interviewees.

Questionnaire

(A survey to improve the change process at IRO AB)

Dear respondent,

This questionnaire is aimed at finding the current situation of change (improvement) process at IRO AB as a part of my master’s thesis. I would appreciate your complete answer to the questions as accurate as possible. If you find something unclear, please contact me at x070057@utb.hb.se or Mikael Johansson at your company. You are kindly requested to respond the questionnaire in 1 week, and give it to Mikael after completion. Please also set a date/time before 15 April for more discussions on your answers.

Regards,

Amir Siadat

Name: Position:

1. How do you make a change/improvement in the process (es) under your control? (Describe the change/improvement flow that you follow currently)

2. Do you register the changes that you have made in the processes in any document or any other format?

3. Is there any fault/problem in the current change flow (change process) from your point of view?

4. How often do you make a change/improvement in the process (es) that are under your control?

5. Who usually suggest(s) a change in the process (es) in your work field?

Date/Time for meeting:
Respondents’ answers

Name: Patrik Birkhammar

Position: Designer, Responsible towards IWTC from R&D side (coordinator towards IWTC in technical matters, excluding big issues regarding Motors)

1. How do you make a change/improvement in the process (es) under your control? (Describe the change/improvement flow that you follow currently)

Since I work at R&D department, my general process to work in when it comes to changes is the PCO system. The PCO system is working as following:

The designer is creating the PCO, and then the Project leader is attesting the PCO request. After this is made the PCO is spread internally though marketing, service, purchase, production and the customer.

If there are other changes that need to be implemented we have the PCR system, which works as a request, which is decided by a group of people that comes from different departments in the company.

Towards our biggest supplier IWTC, we cooperate a lot since we in fact are owned by the same owner.

When it comes to manufacturing and goods supplied from IWTC there are 3 processes we just have started to implement to exchange information regarding the manufacturing processes.

It is mainly the JI (job instruction), that concerns the production.

The JI is issued by our project team when making a new product. Later on the JI is used by IWTC and if some changes / problem occurs we are notified though a specific e-mail group. If we want to make changes from here, we have a database to make these changes though.

I work with all these tools.

2. Do you register the changes that you have made in the processes in any document or any other format?

I register all the changes I make or issues by some of our bigger systems like PCO, PCR, JI.

Sometimes of course some changes are made directly through e-mail or face-to-face. But usually these changes are followed up by using some documents.
3. Is there any fault/problem in the current change flow (change process) from your point of view?

I think that the processes I use works quite good. However of course there are always possibilities to make the processes better or change some in them.

4. How often do you make a change/improvement in the process (es) that are under your control?

I make changes and improvements quite often. Especially cases the involves production parts related to IWTC

5. Who usually suggest(s) a change in the process (es) in your work field?

All designers, production department, quality department, purchase department.

Name: Per-Arne Ryberg

Position: Production Engineer/ Manufacture dept.

1. How do you make a change/improvement in the process (es) under your control? (Describe the change/improvement flow that you follow currently)

I give suggestions to the CNC programming personnel whom then are responsible for any actions and results

2. Do you register the changes that you have made in the processes in any document or any other format?

No, unless it will end up in changes on a product or part. If we move the manufacturing (machining) from one machine to another the work elements in the ERP will be up-dated accordingly.

3. Is there any fault/problem in the current change flow (change process) from your point of view?

A follow up of implemented changes should be done in a more structural way.

4. How often do you make a change/improvement in the process (es) that are under your control?

Daily changes are made and far from all of them are made by me.

5. Who usually suggest(s) a change in the process (es) in your work field?
Changes may be suggested by R&D e.g. through Product Change Orders, by Production Engineering or as a result from a deviation (report)

Name: Björn Larsson

Position: Production engineer, assembly dept.

1. How do you make a change/improvement in the process (es) under your control?

Mainly “Just do it”, larger changes can be preceded by test and verification, changes are seldom followed up to see if the result was according to expectation or if it can be further improved.

2. Do you register the changes that you have made in the processes in any document or any other format?

Some changes are documented in instructions and change database.

3. Is there any fault/problem in the current change flow (change process) from your point of view?

Lack of test and verification, planning, follow up and documentation.

4. How often do you make a change/improvement in the process (es) that are under your control?

Every day, more or less, can be anything from switching place of box for screws to complete layout change

5. Who usually suggest(s) a change in the process (es) in your work field?

There are many inputs for changes, assembly personnel, R&D, colleagues, logistics etc. and of course myself. It can be a solution, an idea or a problem that is presented.

Name: Mikael Milano

Position: Production Engineer/ assembly dept.

1. How do you make a change/improvement in the process (es) under your control?

(Describe the change/improvement flow that you follow currently)

En ändring eller förbättring kan innebära att man förtydligar en instruktion till en förbättring som kräver en större investering.
An improvement or change can be small things like changing an instruction or larger investments carried out as a project.

2. Do you register the changes that you have made in the processes in any document or any other format?

Små ändringar som görs i det dagliga arbetet registreras ej. Däremot protokollförs ändringar initiade från produktionen. Vi stora förändringar vi efterkalkyler.

Small daily changes are not registered or filed. Changes initiated by operators in production are recorded. Larger investment projects are followed up by cost accounting.

3. Is there any fault/problem in the current change flow (change process) from your point of view?

Det finns inte tid till att genomföra många ändringar/förbättringar som dyker upp.

Lack of time for most possible changes/improvements that occurs

4. How often do you make a change/improvement in the process (es) that are under your control?

Jag vill påstå att det görs förbättringar varje dag av varierade art och storlek.

I would say that improvements, of varying size and kind, are made every day.

5. Who usually suggest(s) a change in the process (es) in your work field?

Förbättringar kan initieras av mej själv eller från personer från produktion. Jag får även idéer om förbättringar från representanter av IROs ägare samt chefer och ledning på IRO.

Improvements can be initiated by myself or by personnel in the production. I also get ideas about improvements from the company owner, supervisors or management at IRO.
Name: Pernilla Kåremark

Position: Production Engineer

1. How do you make a change/improvement in the process(es) under your control? (Describe the change/improvement flow that you follow currently)

   If I want to do a product change I write a PCR. Routine for product changes. (RUT 002)

2. Do you register the changes that you have made in the processes in any document or any other format?

   I register a change in a database called produktionsförändringar (product changes)

   I also update the assembly instructions and the checking instructions.

3. Is there any fault/problem in the current change flow (change process) from your point of view?

4. How often do you make a change/improvement in the process(es) that are under your control?

   I make small improvements every day usually in the assembly line. I don’t register these small changes.

5. Who usually suggest(s) a change in the process(es) in your work field?

   A change in the process is usually made to solve a problem. It’s often the assembly personnel who contacts me.