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Business Processes in Project Business

– CASE PROJECT DELIVERY PROCESS FOR A FACTORY AUTOMATION SUPPLIER

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MASTER'S THESIS | ABSTRACT

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Business Processes in Project Business

The purpose of this thesis was to re-define and re-describe a business process for IPTE Factory Automation, which adds value to customers' manufacturing processes. IPTE is a leading supplier of production assembly and test automation in the electronics and mechanics assembly industry (IPTE 2011). The thesis includes reengineering of the Project Delivery Process resulting in a visual process description. The thesis concentrates on process waste elimination, organizational structure, increase of added value to customer by focusing on clear information and work flow, as well as the communication between process inputs and outputs across all the organizational boundaries. The thesis is aimed at personnel working in the project delivery process and responsible for processes and projects at IPTE.

The need for the reengineering was created by the global business environment that has changed during the past years, global standardization of the Project Delivery Process, implementation of the ongoing product standardization work in the Project Delivery Process, and the possibility to automate the process or parts of it in the future.

This development work combines the background information of processes and project business examination with the IPTE organization's experience and knowhow about the global business field, customers' expectations, and processes. Consequently, the objective of the effective Project Delivery Process is to meet today's challenging delivery time as well as the cost and quality requirements of the global market environment.

The new improved Project Delivery Process looks promising on the paper. The process owner and meters were not defined, which needs to be done before the actual implementation phase. All the processes and their relations are tightly tied together, which affects the obtainable benefits from the process work. Therefore, a proposal for a new process map including all core and support processes was also made.

KEYWORDS: Project Delivery Process, Business Processes, Project Business, Business model, Quality, Project

OPINNÄYTETYÖ (ylempi AMK) | TIIVISTELMÄ

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Liiketoimintaprosessit projektiliiketoiminnassa

Opinnäytetyön tarkoituksena oli määrittää ja kuvailla liiketoimintaprosessi IPTE Factory Automation -nimiselle yritykselle, joka tuottaa lisäarvoa asiakkaiden valmistusprosesseihin. IPTE on johtava tuotannon kokoonpanojärjestelmien ja testausautomaation toimittaja elektroniikka- ja mekaniikkakokoonpanoteollisuudessa (IPTE 2011). Opinnäytetyössä käsiteltiin projektitoimitusprosessin uudelleensuunnittelua, minkä tuloksena syntyi visuaalinen prosessikuvaus. Projektitoimitusprosessissa keskityttiin prosessihävikin eliminoimiseen, organisaatiorakenteeseen ja asiakaslisäarvon kasvattamiseen keskittymällä selkeään informaation- ja työnkulkua kuvaavaan kaavioon sekä organisaatiorajat ylittävään prosessin syötteen ja tuotoksen välissä tapahtuvaan kommunikointiin. Prosessin kuvaus on tarkoitettu henkilöille, jotka työskentelevät IPTE:llä projektitoimitusprosessissa sekä ovat kokonaisvastuussa prosesseista ja projekteista.

Projektitoimitusprosessi oli uudelleensuunniteltava, koska globaali liiketoimintaympäristö on viime vuosina muuttunut, projektitoimitusprosessi oli yhdenmukaistettava yksiköiden välillä ja prosessi tai sen osien tulee olla automatisoitavissa. Lisäksi yrityksessä on käynnissä tuotteiden standardisointityö, joka oli implementoitava prosessiin erillisenä vaiheena. Lähtökohtana oli yhdistää prosessien ja projektiliiketoiminnan tutkimukseen liittyvä taustatieto IPTE:n organisaation kokemukseen ja asiantuntemukseen globaalista liiketoimintaympäristöstä, asiakkaiden odotuksista ja prosesseista. Uudistetun projektitoimitusprosessin tavoitteena oli vastata niin nykypäivän haastavien toimitusaikojen, hinnan kuin laadun asettamiin vaatimuksiin globaalissa markkinaympäristössä.

Uudistettu projektititoimitusprosessi näyttää lupaavalta teoriassa. Prosessin omistajaa ja mittareita ei määritelty. Tämä on kuitenkin tehtävä ennen uudistetun prosessin implementointia. Kaikki prosessit ja niiden väliset suhteet ovat tiukasti yhteen sidottuja, mikä vaikuttaa prosessityöstä saavutettavissa oleviin hyötyihin. Tästä syystä tehtiin ehdotus myös uudesta prosessikartasta mukaan lukien kaikki ydin- ja tukiprosessit.

ASIASANAT: toimitusprosessi, liiketoimintaprosessi, projektiliiketoiminta, laatu, projekti

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1 Introduction

A company that wants to exist in the future needs to re-think their business processes continuously in order to meet today's and tomorrow's customer needs. Every company has processes, even if they were not described or even thought about. *Process* as a term means activity, which starts from an input and ends to the output. The basic idea in process work is to find value-adding activities; customers pay for the value-enhancing activities in their production, not the machinery and equipment provided. This will be kept as the core idea of this work.

Continuous development of added value (technology, product and service), economics and human resources is the most important daily activity in the company to be able to differentiate from competitors and to be the first on the market with new, competitive products. Companies like IPTE that provide added value to customers' production processes, which operate in the electronics and mechanics assembly industry, must meet all three of the market requirements: cost level needs to be competitive (added value per unit), quality needs to meet the standards, and delivery time needs to be as short as possible. A well-defined and working Project Delivery Process facilitates meeting the above-mentioned requirements for being on the market at the right time and with a competitive price.

Developing existing processes at IPTE goes typically through the following phases:

- Add new value to customers' production processes by re-evaluating **what** products and services IPTE provides
- Streamline workflow, communication flow and data flow inside and between the organizations by changing **how** it is done
- Automate manual work phases enabling employees to concentrate on customer **value-adding work**
- Streamline the organization by changing or defining **who** does what
- Remember to **reengineer** also employee's work tasks, not only the processes

In this work the term “project business” refers to the way of thinking; almost all the activities that cost money to the company, regardless of the business sector, can be split into projects and handled as projects within the processes.

A project inside the process always needs a customer, internal or external, and needs to have a budget defined by the management. We need to keep in mind that whatever we do at work, someone always pays for the hours and materials used (Figure 1). This seems to be forgotten quite often, and, unfortunately, is highlighted in bigger companies where employees can more easily be forgotten to do something that brings absolutely no benefits for the company. This kind of non-value-adding activity is called *waste work*. The author also wants to emphasize that this is not the fault of the employees; it is the management job to keep the work tasks updated and interesting enough to achieve a win-win situation for both the company and the employee.

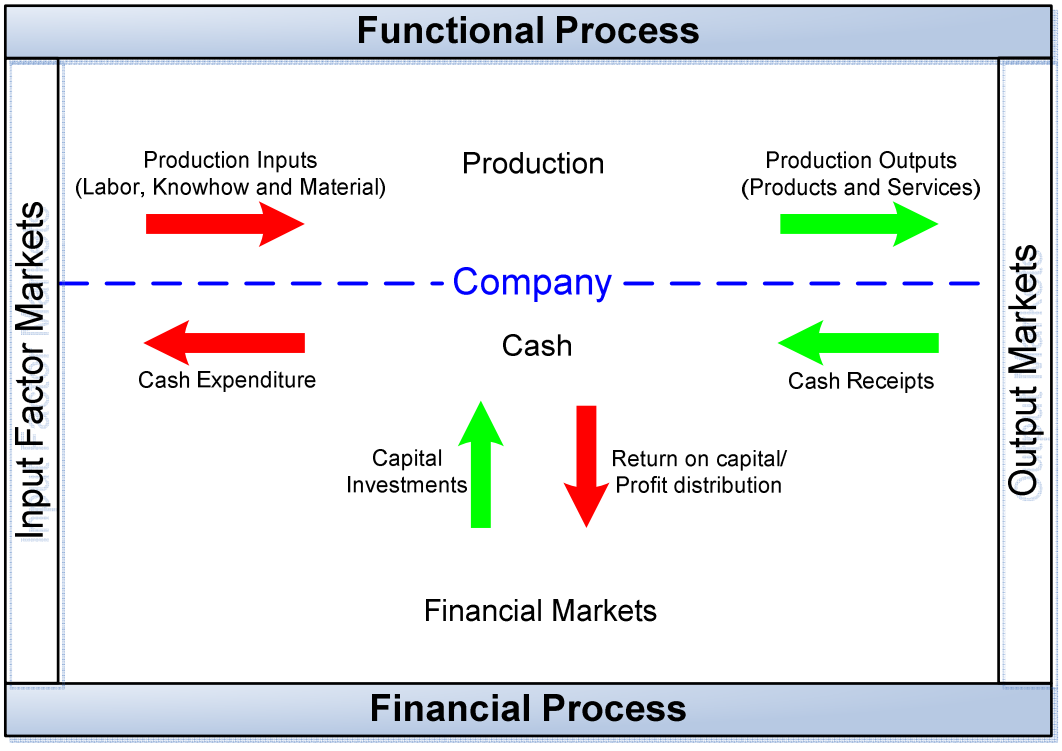


Figure 1. The company as a process (adapted from the source: Vierros 2009)

As an example, based on the author's own experiences, below are listed different types of projects, which may facilitate the achievement of clearer cost allocation to be used in decision making:

- Standard equipment delivery project to external customer
- Customer-specific delivery project to external customer
- Spare part delivery project to external customer
- Service support delivery project to external customer
- Warranty delivery project to external customer
- Internal or external IT support delivery project to internal customer
- Research and Development project
- New employee hiring project
- Employee training project
- Process development project
- Process reengineering project
- Process design project
- Six Sigma and/or Lean project
- Documentation project
- IT development project
- Human resource development project
- Sales and/or Marketing project (can be one time task or yearly based) or
- any other short or long-term customer value adding activity

By thinking this way, projects in processes are part of a company's core and key business activities that are supported by other functions, and driven by the company's mission, values, vision, strategy, and quality policy. A combined process and project business model can be used in many different industries by understanding what the word *project* may in practice include without adding any unwanted bureaucracy to the process flow. This kind of "projects within processes" thinking makes it possible to easily monitor the cost structure of all individual activities through the whole organization.

The author of this thesis has been working more than 10 years as a designer, specialist, team leader and in different management posts in three different companies that provide added value to customers which operate in the electronics and mechanics manufacturing industry. During that period there have been a lot of changes in this business field. Globalization has had the greatest influence on the changes in the last ten years. The biggest growth has taken place in developing countries partly because the demand is there, and the costs of manufacturing have been lower in those areas. In the author's opinion this will be the case also far into the future but we cannot forget the fact that local production is starting to be increasingly popular again. This means, for

example, that the products that are now delivered to Europe will in the future be manufactured in Europe, too. The physical locations of both design and R&D centers, as compared to globally organized local production, will not be relevant any more, if today's Information Technology is used to support enterprises' activities wisely and efficiently.

Customer-specific and maybe even standard products can be manufactured near the customer to add flexibility (easier and deeper cooperation with local customer), to reduce delivery time (custom issues and long distances), to save money in transportation costs and for easier communication (culture and language). It is more of a company-specific issue where both the Design and R&D centers are located. More important is that the implementation of the design and R&D work can be done wherever needed globally. A good and simple metaphor to describe this is the possibility to design the new product on a yacht in the Caribbean Sea and carry out the actual manufacturing by 3D-printing it at the customer's site in Beijing, directly from the product 3D-file. Another future possibility in this specific business field could be spare parts, which could be remotely 3D-printed via internet as close to the demand as possible by using the design data owner's 3D-files.

1.1 Subject

The target of this work is to re-define and re-describe Project Delivery Process for IPTE Factory Automation, which adds value to customers' manufacturing processes. IPTE is a leading supplier of production assembly and test automation in the electronics and mechanics assembly industry (IPTE 2011). In general, the work concentrates on process waste elimination, organizational structure, increase of added value to customer by investing more to the clear information and work flow, as well as communication between process inputs and outputs across all the organizational boundaries. At a more detailed level, the main focus will be kept in the new Project Delivery Process. The work is meant for personnel who work with project delivery process, as well as on a general level with processes and projects at IPTE.

1.2 Selection of the Subject

The idea to reengineer the external customer Delivery Project Process came from the company that the author is currently working for. There is a real need to re-think the Project Delivery Process through. A business environment change has brought more

competition into the standard equipment delivery field globally. More and more suppliers are coming to the market which keeps the business development in high priority. The highest profits in this business field are made when a company is the first one on the market with new technology. After a certain period any product becomes a standard product for all the suppliers in the field and profit margins decrease rapidly. Therefore, when this happens there is an urgent need to have new products coming out of the R&D pipeline. One important means for keeping the standard products' margin level high is the effectiveness of the Project Delivery Process.

The starting point of this work is that the current project delivery process needs to be reengineered. The reasons for the need are a changed global business environment during the past years, the implementation of the standardization work made for products as a part of the IPTE project delivery process, a global unification of the project delivery process within IPTE, and a possibility to automate the process or parts of it in the future. The above-mentioned reasons are examined in more detail below:

- Globalization has had extensive impact on the business of IPTE. In a business environment marked by globalization, the world seems to shrink and other competitors halfway around the world can exert as great an impact on a business as one right down the street. Due to the market becoming worldwide, IPTE have to upgrade their products and use technology skillfully in order to face the increased competition. Logistics also play a bigger role in the worldwide delivery chain with the possibility to do production near the customer or any other cost effective location around the world
- IPTE has been growing with acquisitions in different countries, which results in different types of Project Delivery Processes between the sites at different locations. Therefore the standardization of the Project Delivery Process within different sites at IPTE is one of the targets for the output of this work
- In the future, the company will be using a standardized product library for each supply level: machine, module, and part (buy and make) for sales, design and production use. This phase is not included in the current project delivery process and needs to be implemented within this work

- The company has new possibilities to develop its functions by the support of today's Information Technology. These possibilities need to be taken into account when a new process is defined. Today's Information Technology plays a big role in the globalization and in the development possibilities of IPTE as a group

A project business model inside the processes is worth thinking of in this kind of business environment where added value for the customer will be manufactured only when order is received. In this study the model of this work will be examined and linked to the process work. Most of the company's activities and functions can be managed as projects which also helps decision-making when information received is valid and based on actual costs.

In this work no existing processes are presented or reviewed but instead a new process with today's requirements will be introduced. This enables process value stream mapping without the burden of the old, and in the best case leads to a decrease in waste work. This work will be a small part of a larger process-related development work in the company.

To summarize the main objective and deliverables of the thesis work:

- **To re-define and re-describe visually the Project Delivery Process** for IPTE Factory Automation, which operates in the earlier specified business field. This is the primary objective for the work and has a proven need in the current global organization that I am working for at the moment

Deliverable from the subject:

- **Project Delivery Process** Flow chart which visually describes the principles of the operation, not the sub-processes and work flows under it

2 Overview of Processes and Project Business

In this section the material that was used to achieve the results, that is, all the important background information related to processes and project business, will be introduced:

- The author's knowhow and experience mainly from the years in the referred industry, but also ideas used across business sectors' boundaries
- Literature and e-articles from Project Business, Business Models, Business Processes, Continuous improvement, and Business Process Modeling
- Material that was used during the author's studies in the Technological Competence Management Master's degree Programme at Turku University of Applied Science between the years 2008 and 2011

This process evolutionary perspective (Figure 2) describes companies' different process ways of thinking and working implementation levels compared to strategic importance of, and renewal and growth.

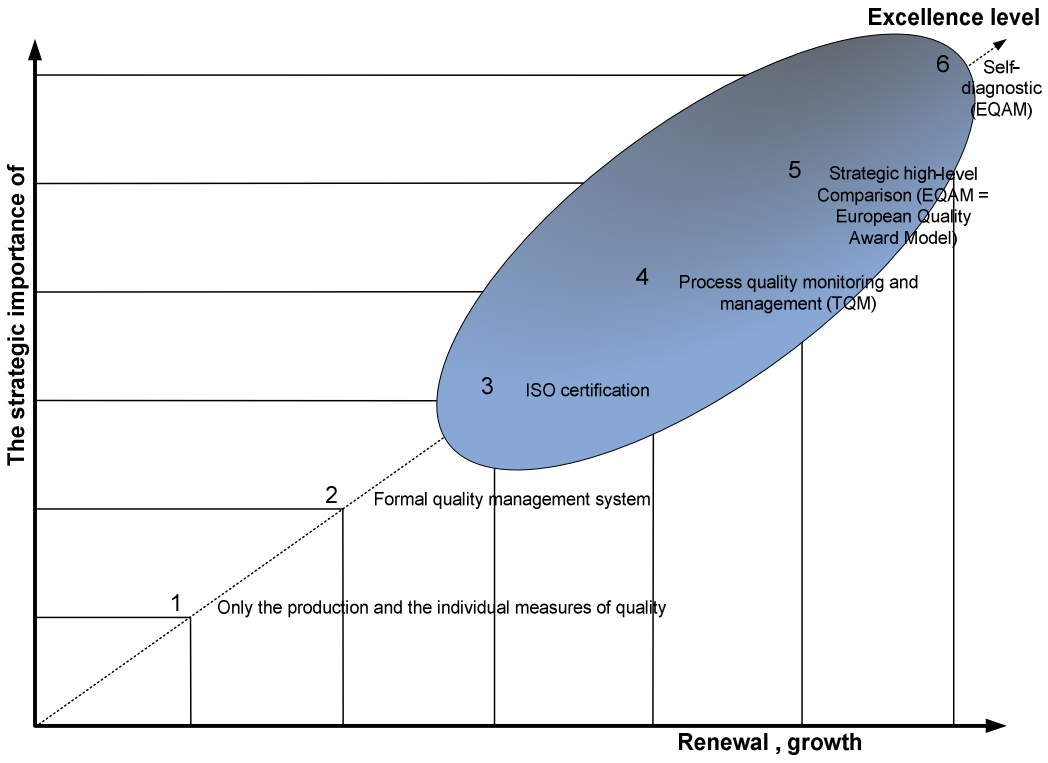


Figure 2. Process evolutionary perspective

2.1 Processes Review

The most important success factor for both actual process work and development is the commitment and knowhow of the top management, as well as clear and undeniable responsibilities.

The basic idea of the Process Management is the understanding of companies' functions as business processes as a set of consecutive and interactive activities, as well as the implementation of the necessary resources to enable the transformation of the process inputs into process outputs. As an example, a generic order-delivery process within a functionally organized company is presented in Figure 3. The business process description starts with the objective set by the customer, and ends with the process deliverables to the customer, whether being an internal or external customer. The objective "set by customer" does not mean that the company could not have its own ideas on how to improve customer processes alone or in cooperation with other parties.

A process based management approach offers several benefits (Saari 2004):

- More comprehensive cooperation with the customer
- Better view from the whole
- Understanding the role of individuals enables self-directing
- Development activities based on the organization's overall objectives and customer's needs
- Easier implementation of strategy

Primary targets for process development is to streamline processes, reduce overlapping functions, increase flexibility with cooperation, and remove waste work. The process can, in the worst case, zigzag through the functionally organized organization in a very complicated manner (Figure 3) causing delays, and getting exposed to mistakes and errors.

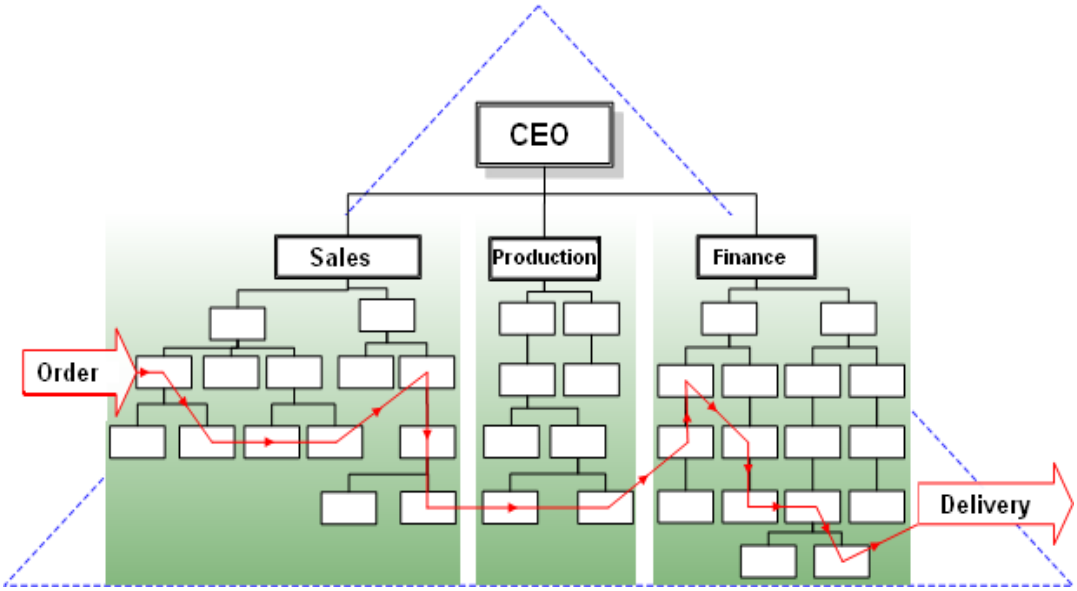


Figure 3. A complex process flow through organizations (adapted from the source: Lecklin 2006)

Well-defined and working business processes facilitate the achievement of companies' short and long-term targets by delivering the right products in the right markets in the right time. There is no single business process model that would suite all purposes. Processes present the vital functions for an organization's success, and breaks down the barriers of traditional functional departments. The size of the organization is also one factor that plays a role in processes extent. The target is not to describe processes on too detailed a level but in the extent which serves the organization's needs.

The primary target for processes is to provide added value to customers by such products and services which they are willing to pay for. Added value examples that IPTE can offer to its customers include:

- Improved production effectiveness; more products to markets faster
- Improved product quality; less after sales and repair costs with higher end customer satisfaction
- Lower production costs; better margin
- Shorter delivery time for added value; customer can benefit from the added value faster or place the order later
- Additional feature to the product enables larger market share

Principles of a process way of thinking (Saari 2004):

- Input is a customer need whether it is internal or external
- Definition of the product or service that fulfills the needs
- Identify core and support processes
- Design process with functions and resources which provides the products and services
- Indentify what information and material is needed for the process
- Evaluate and improve the process constantly

A process consists of input, activities and output. The input starts the process; for example, when manufacturing a production machine, the inputs are design documents, mechanic, electric and pneumatic parts, and related assembly drawings, schedule, and budget. Activities transform inputs into a desired output; in this example activities are frame and separate functional modules assembly, module assembly into frame, electrics and pneumatics installation into the mechanics, mechanical adjustments and testing, process ramp-up and testing. Output is the result from the activities; in this example it is a ready-built production machine for shipping to a customer with all the requested documentation for internal use, freight forwarder and customer.

We can think that a process combines people, technology and information together to create value for customer (Figure 4).

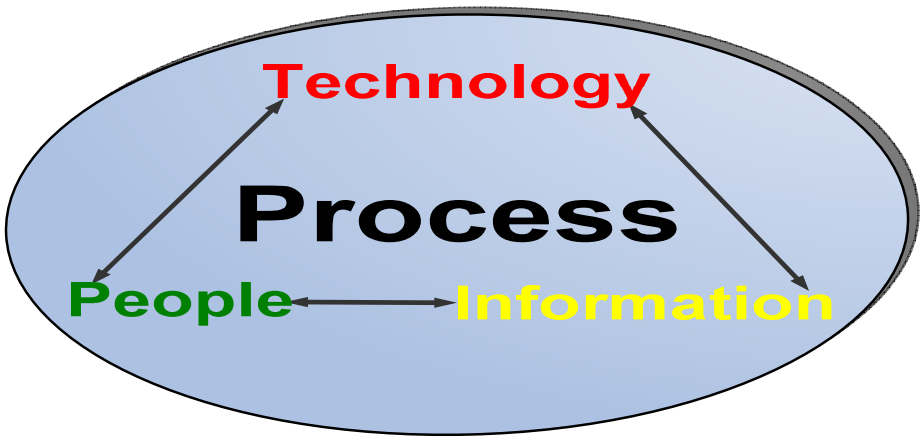


Figure 4. Process combines people, technology and information together

Below are listed reasons for process design, development and reengineering which is related to this business field in the author's opinion:

- Certain Quality Standard Certification requirement from customer
- Changed business environment like globalization
- Information technology procurement
- Profit margin maximization
- New way of working
- New company or site establishment
- New product
- New customer
- Quality problems in products which causes a lot of extra costs and possible loss of confidence by customers
- Standardization of the company's way of working
- To gain more confidence from the markets

2.1.1 Organization Based on Process Way of Thinking

The organization structure should follow the company's strategy. Below are listed known organization types which also can be combined under the company's organization structure:

- Traditional functional organization structure
- Matrix organization structure
- Project organization structure
- Process organization structure

The traditional organizational structure (Figure 5) describes the duties, the division of labor and reporting relationships, and leaves out the workflow that produces the products. The traditional structure does not describe any relations between customers and suppliers. Its strength is that it is largely based on the structure of competencies.

The traditional functional type of organization's risks lie, in the author's opinion, in a "military based" way of thinking with clear responsibilities and a strong manager and staff axel. In today's western world of working organizations this is not so black and white anymore, when a manager and employee can actually discuss the problems together in good spirit, however, the manager makes the decision in the end. Responsibilities of the specific functions inside the organization are typically emphasized in this structural model, and white "border" areas between functions are the most difficult ones to manage and develop. There is a risk for "this is not my problem" -way of thinking.

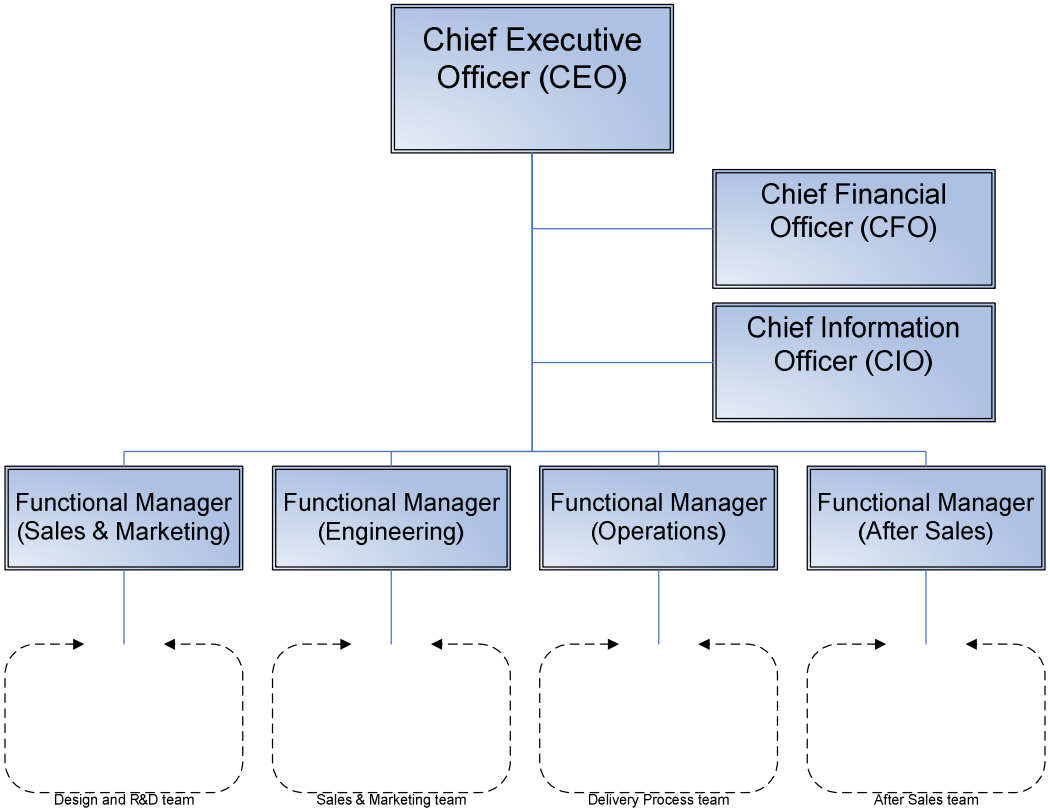


Figure 5. Traditional organizational structure example

Usually when following a process-based management thinking the shape of the organization is matrix (Figure 6). The process structure has a horizontal workflow description from inputs to outputs which cross-cuts the organization structures. The process adds value with every step from the supplier to the customer. The organization has both vertical and horizontal guidance. Vertical control is handled in basic organization and horizontal in processes. Strategic Management is on the business level and vertically controlled, and Process Management is on the process level and horizontally controlled (Saari 2004).

A matrix type of organization has it risks, in the author's opinion, due to usually not very clear responsibility of functions, and time-consuming internal meetings and negotiations between different departments. This kind of work is, of course, important on a certain level but does not add any value to the customer, which means no money

from the time spent. A few examples of reasons for this kind of waste work are more than one superior for an individual employee or a business unit manager without any subordinates. When decisions are needed, a meeting will be arranged between all relevant parties, provided that they all find a slot from their already overbooked calendars. The matrix type of organizing is not recommended for small companies to use, but with clear way of working, responsibilities and prioritizing, matrix can be very effective organization structure.

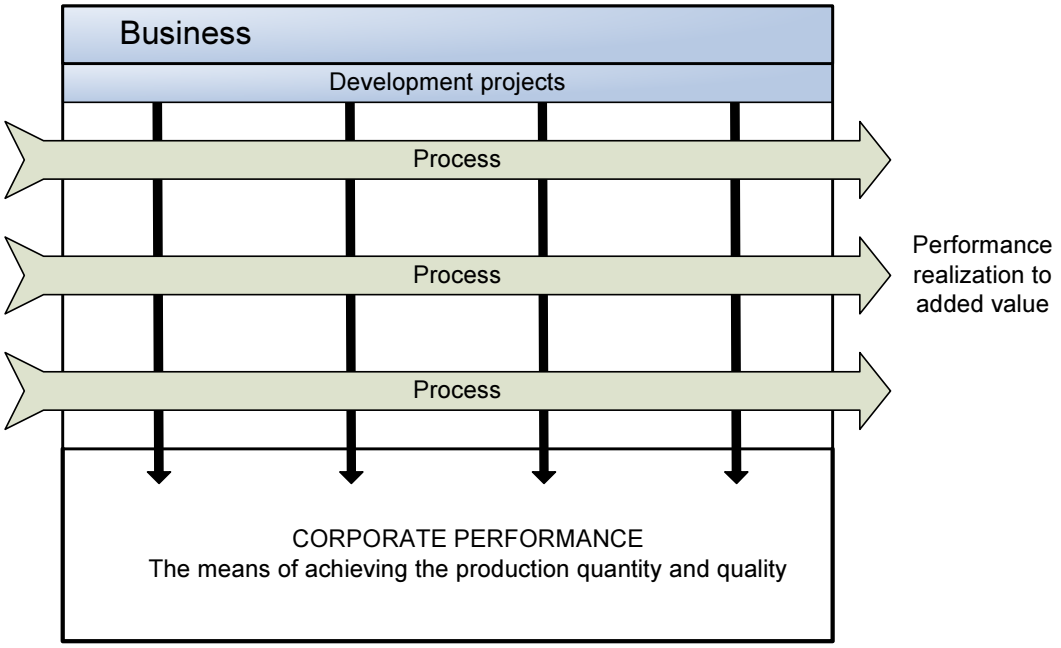


Figure 6. Process organizational structure (adapted from the source: Saari 2004)

Both commonly used organizational structures have their place in the world separately, partially combined or mixed with the project organization structure. It depends on the size of the company, products, working environment, and industry. The traditional functional organization and the process organization are not contradictory or mutually exclusive models (Table 1). The differences consist of different priorities and ways of thinking, of what is considered the center of activity. Process organization is built on customer needs in working around the core processes, while the functional organization consists of specialized functions and departments, which cooperate to achieve the objectives of the organization. (Laamanen 2009).

Table 1. Differences of traditional and matrix type of organizations (adapted from the source: Laamanen 2009)

	Traditional Functional Organization	**Process Matrix Organization**
Organization based	Functions and departments	Customers
The allocation of responsibilities and organization	Team- or occupational group specific	Process-specific (possibly In addition function-specific)
Objectives	Per-team or occupational group specific	Customer- and problem specific
Operational meters	Team- and employee specific: Measuring the performance of departments and individuals	Process- and step specific: Measuring the overall process performance
Queen bee	Departmental efficiency and quality of operations	Overall efficiency and quality of operations

The world is moving towards less management levels and more cooperation between company's employees -type of problem solving and continuous development. Employees are most valuable resources for the companies, and they can improve the overall competitiveness by their ideas and ways of working. This is not any more a job of the white collar workers only, but all staff members are invited to cooperate. It is a good investment for any company to listen to ideas from inside the company as well as of the customers outside.

2.1.2 Recognizing Processes

Process-recognizing starts from the strategy point of view: in what business the company is, and where it wants to be in the future. The next step is to define which functions are critical when thinking about customer value adding; which functions are critical to the company success factors, and whether some of them can be outsourced immediately or later.

Processes have sub-processes and in the end of the chain there are activities which perform the specified tasks (Figure 7).

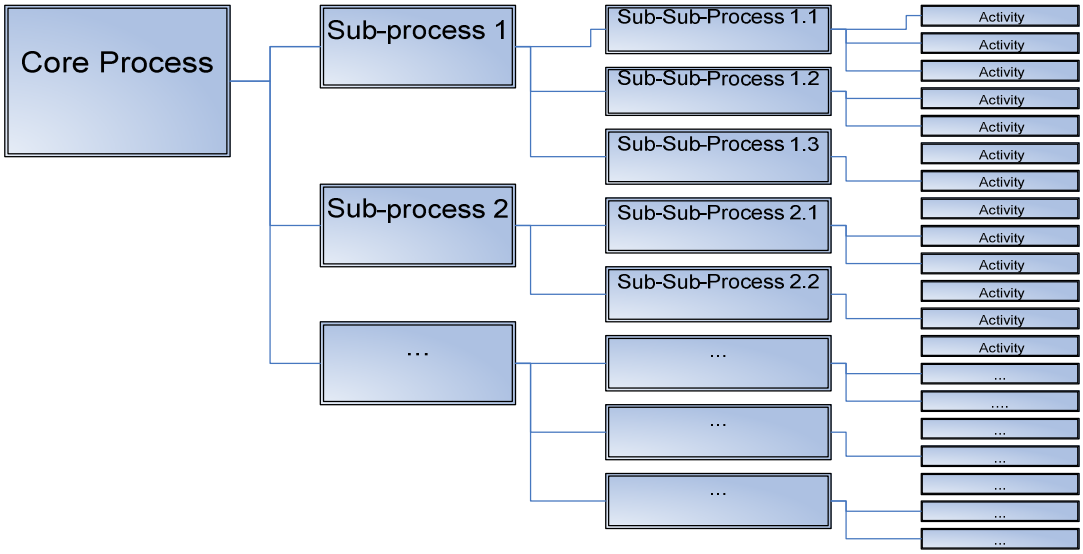


Figure 7. Process structure example

2.1.3 Describing Processes

The meaning of the processes is to present important functions for success of the organization in the form of key processes, which consist of core and support processes, and customer processes. It visually describes the activities between process input and output. Visual process descriptions are also much more effective to use for both internal and external usage than using just plain text.

Core processes are the ones which generate the value added, and they also serve the customer. Support processes generate infrastructure services and conditions for core processes. Key processes emphasize their connection to the companies' core competencies and critical success factors, and make them the primary objects for monitoring and development.

Process describing helps to understand the activities and their relations between others. It promotes the understanding of the systemic nature of the organization activities, describes the business logic of organization, and should be simple enough. A good process description includes both text and visual description, is logical, has a standard way of descriptions, includes company specified identifying information, and

is easily accessible and usable, as well as is part of the actual processes by visualizing the flow statuses of individual “projects”.

The description of the process begins by defining the scope and interfaces for the input and output. Every process starts from an input, ends to an output and in the between there are different kinds of activities which enable the wanted output. The vision about the target and purpose of the process needs to be crystal clear for measuring and analyzing.

It needs to be known who the customers are and how they will use the products and services, and what the products and services should be. A process description also includes roles with actions, responsibilities, and teams. The description never includes names of the persons who are handling functions, but names the functions instead. This way there is no need to update process descriptions when a team member changes. In the descriptions vague terms are not allowed: for an example, when defining a response time for a customer request an exact time limit should be used instead of “quite fast”.

Process description levels (Figure 8) are (Laamanen & Tinnilä 2009) Process Map, Operating Model, Process Flow and Work Flow.

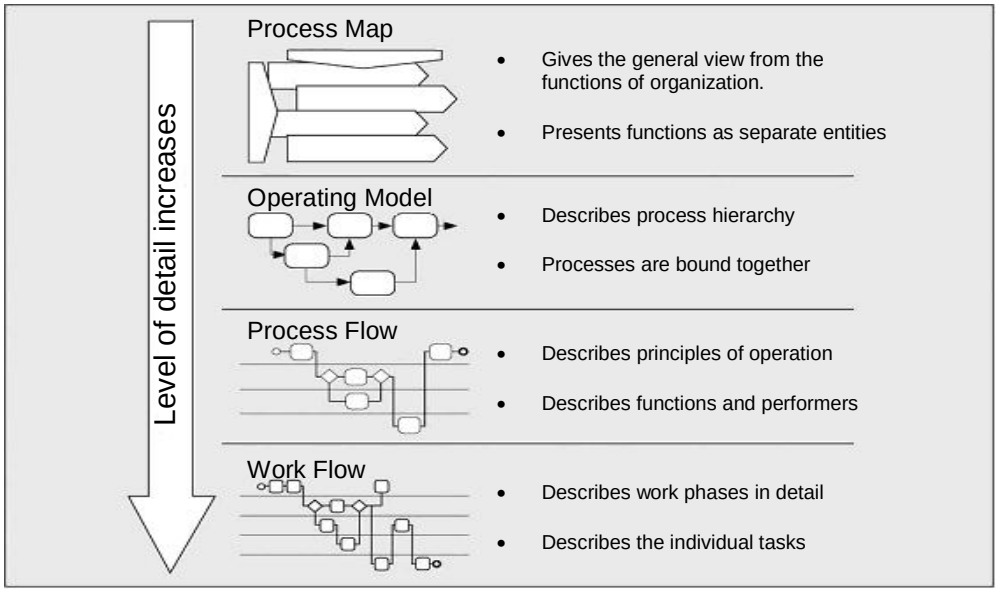


Figure 8. Process description levels (adapted from the source: JUHTA 2008)

Process Map (Figure 9) gives a general view of the functions of an organization. The most common way to describe the process map is that (core) processes are described horizontally with arrows from left to right and (support processes) functions vertically. This is the top level description without describing the relations between processes. It can be used for external communication and to support the decision making.

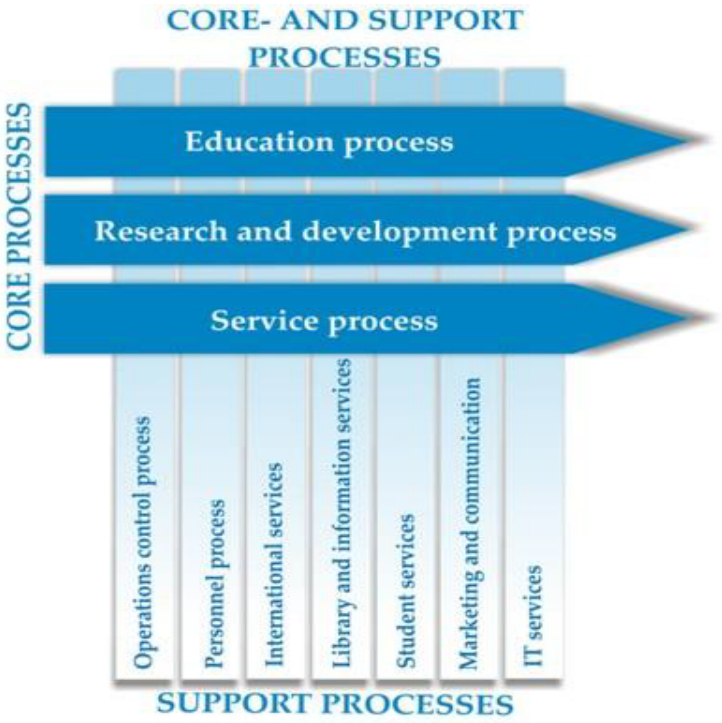


Figure 9. Process map sample (Mikkeli University of Applied Science 2011)

The Operating Model (Figure 10) describes the process hierarchy and architecture on a deeper level than in process map. The model includes responsibilities in the forms of process ownership, relations between processes and the interaction, as well as interfaces with the rest of the environment.

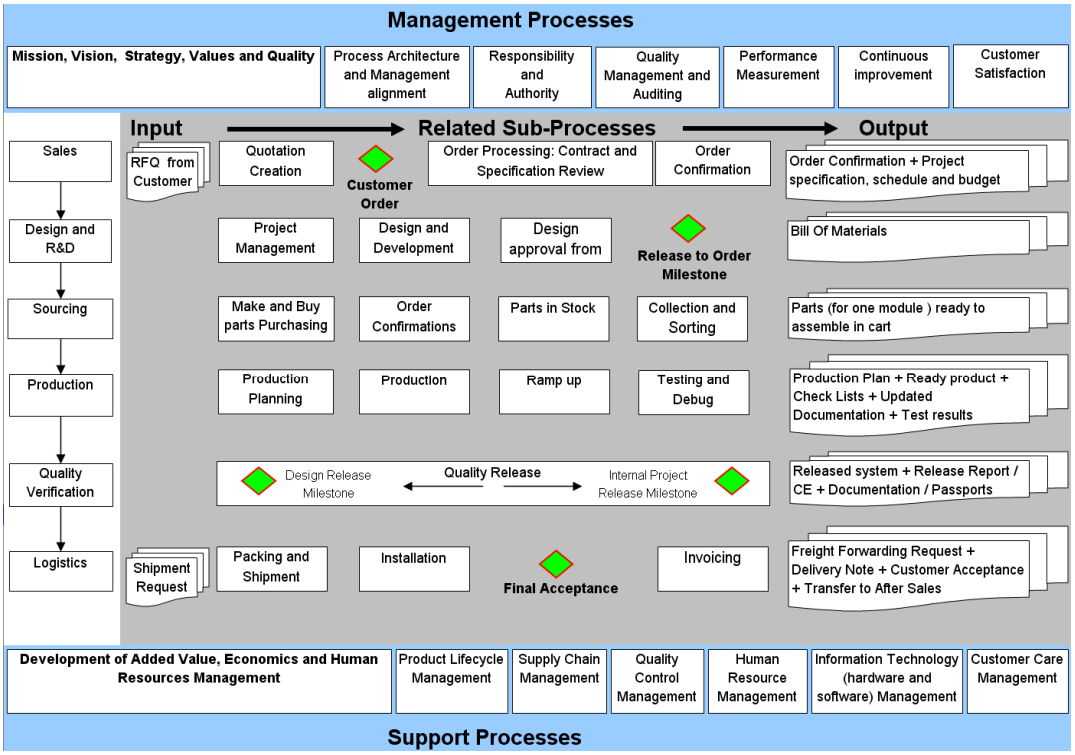


Figure 10. Operating model example

Process Flow (Figure 11) describes principles of operation on a deeper than in the operating model. On this level operation phases and functions with responsibilities are described. This level brings out the current operational problems.

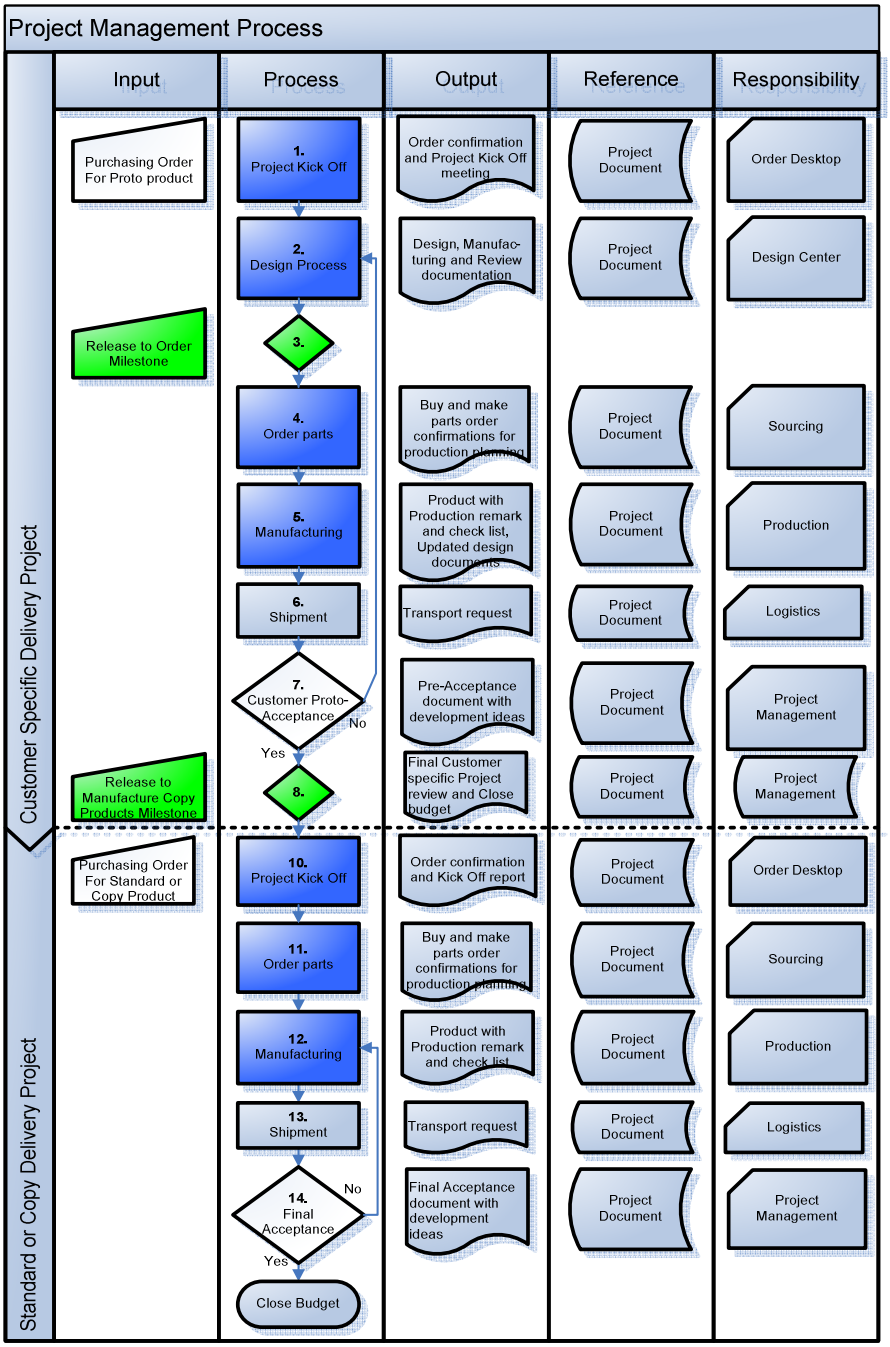


Figure 11. Process flow example (Project Management)

Work Flow (Figure 12) describes work phases in more detail than the Process Flow. A major difference compared to Process Flow is that internal and external relations are described as a data type.

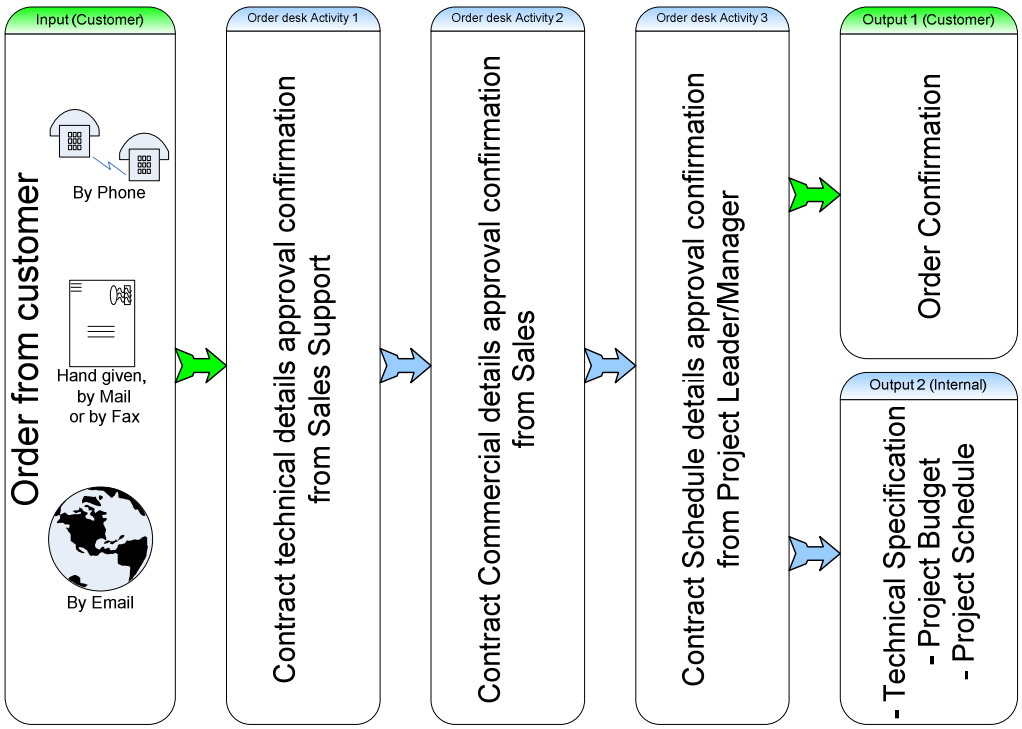


Figure 12. Work flow sample (order handling)

Process description model standards can be found on the list below:

- SA/SD – Structured Analysis/Design (Prosa 2011)
- UML – Unified Modeling Language (UML 2011)
- BPMN – Business Process Modeling Notation (OMG 2011)

2.1.4 Process Types

There are many types of business processes and ways to describe the vital functions of an organization. The differences might be difficult to understand so in this chapter will be presented the different types of processes and their contents in this business field.

There are three different general level business process types (Wikipedia 1 2011):

- **Management processes** – the processes that govern the operation of a system. Typical management processes include "Corporate Governance" and "Strategic Management"
- **Operational processes** – the processes that constitute the core business and create the primary value stream
- **Supporting processes** – the processes that are supporting the core processes

Processes consist of several process layers (Appendix 1). The depth of the process description tree depends on the need for communication, quality requirements, foreseeable changes in the process, and resources available for describing. It is advisable to go as deep with the processes as the organizations steering it requires by keeping in mind that simpler and less is more also in this case. Below are selected process types used in this specified business field, and in this work:

Key processes are essential for the success of the IPTE's organizations. They present important operational functions in the form of core and support processes, and customer processes. Key processes emphasize their connection to the companies' core competencies and critical success factors, and make them the primary objects for monitoring and development.

Core processes deliver value to IPTE's customers directly, in the short or long term. The customer is linked to both the input and the output of the core processes. Below are listed a few business-specific examples:

- Development of product or service
- Finding and convincing the customer
- Delivery of product or service
- Maintenance of customer satisfaction

Support processes at IPTE generate infrastructure services and conditions for core processes. With support processes, for example, strategic planning, yearly planning, administrative processes, human resources, financial management, information management, materials management, quality management and usually process development process can be managed.

Customer processes means in this work that IPTE should know its customers' processes, their needs and working environment, to be able to deliver added value to their production environment. If you do not know your customers' business environment you most likely will never get further than to the quotation phase with them. It is also important to know the customers' processes to be able to create a fluent interface, a supply chain link, between the supplier and the customer for smooth delivery of added value. Customer processes should also be the starting point for process design, development and reengineering, when following the customer-focused strategy. There does not seem to be any other strategy that can lead to success in long-term? IPTE's customers' processes are not presented in this work due to confidentiality requirements.

2.1.5 Designing, Developing and Reengineering Processes

Reasons why companies like IPTE are interested to design, develop and reengineer their processes are changed business environment, cost savings, improved efficiency, new product in portfolio, new customer, new process phase, better customer satisfaction and improved employee satisfaction. Process design means the description of totally new processes. Process development means continuous improvement of existing ones and usually the initiative comes from the employees working for the process. Process reengineering is more like a quantum leap in process development when compared to continuous development, and usually the initiative comes from the management covering the broader entities over functional boundaries. Process reengineering, which is the case within this work, is needed when continuous development has been neglected for a longer period of time, the way or working changes, the business environment changes or when some function is outsourced to a 3rd party.

When designing, developing or reengineering processes you first need to assess the starting point; what are the strengths, what needs to be designed, developed or reengineered, what are the changes in the internal or external factors, or in the

strategy, what about technological opportunities and what is the feedback provided by the processes?

General level steps for process design, development and reengineering are: plan, analyze, redesign, acquire resources, implement, and continually improve. In the plan phase the process or the needed output is selected, the scope is defined and the team is assembled. In the analyze phase the process to be designed, developed or reengineered is closely examined. In the redesign phase the needed changes is determined. In the acquire resources phase the needed resources like personnel and equipment to be able to fulfill the specified plan or changes in redesign phase is obtained. In the implement phase the specified plan or changes with needed resources is carried out. In the continually improve phase the current status and development of the process effectiveness is constantly monitored and evaluated, and made adjustments when needed (Harward 2010.)

Process design, development and reengineering are not a one time project (Figure 13); it is companies' competitiveness in terms of a necessary element of a recurring. It includes process monitoring, analysis, change design and change management! When thinking of companies' processes, those will never be perfect, just good enough for a specified activity and usually for an unknown time period. Continuous change of customers' added value needs, and competition with the business innovations in the markets maintains the need for continuous process design, development and reengineering.

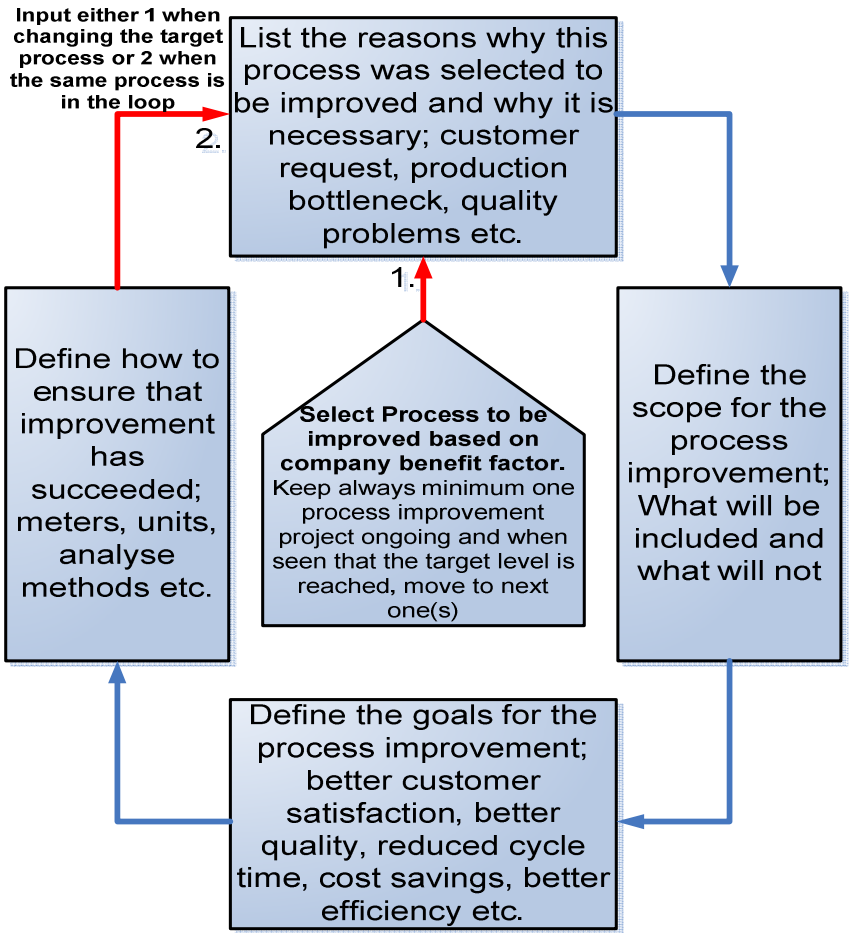


Figure 13. Process development idea on general level (adapted from: Harvard 2010)

Below is a list of important points that need to be taken into account when proceeding with the implementation of a new or redesigned process (Harward 2010):

1. Model and simulate process before full roll-out by “walking through” test project through all phases from input to output
2. Evaluate carefully effects on the whole and prepare solutions for all different kinds of expectable problematic situations in advance
3. Progress step by step in development; do not try to implement everything at once
4. Development must be continuous

Evaluation of the processes needs to be done, if possible, before and after a new or redesigned process implementation by management, process responsible employees, key employees, external and internal customers and/or auditors. At this point the measures need to be defined to be able to compare the results before and after the change. The evaluation period varieties are based on the analyzed target. The better quality of feedback received from the reviewers and from the process to analyze, the better change of success in improving the processes is. The next chapter will present ways to evaluate processes by means of measuring.

2.1.6 Measuring Processes

Process measuring (monitoring) is needed to follow up the performance, make adjustments and develop. With this valuable information received from the correct process meters, the management can get the needed analyses. The analysed information supports the management decision-making, which makes it critical for the whole IPTE. The monitoring of processes enables IPTE to maintain and develop its competitiveness.

Primary monitoring objectives divided into subgroups for IPTE's future process work based on business field requirements are listed in Table 2.

Table 2. Primary monitoring objectives for IPTE

1. Customer and/or Business Unit account monitoring objectives
o Added value quality o Added value delivery time o Added value cost level compared to competitors o Customer satisfaction and loyalty o Understanding customers' future needs o Profit margin (customer/added value/business unit) o New customer acquisitions o Market share (added value/business unit) o Response times o Continuous improvement
2. Strategic monitoring objectives
o Mission, Values, Vision, Quality policy and Strategy o Balance sheet o Gearing o Turnover o Profit margin o Inventory cycle time o Economy o Money and Capital commitment o Market share o Ownership o Continuous improvement
3. Operative monitoring objectives
o Money and Capital commitment (fixed costs/stock/delivery process) o Inventory cycle time o Efficiency o Throughput time o Yield o Waste o Economy o Energy consumption o Continuous improvement
4. Personnel monitoring objectives
o Motivation o Responsibilities o Knowhow o Waiting time o Work hours o Occupational accidents o Sickness absences o Continuous improvement (self-diagnostic)

Good meters support a company's strategy, measures several different aspects such as time, economy and customer loyalty, are easily linkable to the goals of the different organizations and are transparent. Inoperative meters are hard to understand and communicate to the process related personnel, outside the influence area of the process personnel, heavy to maintain, change too often and are inconsistent with other meters.

Process monitoring planning needs to clearly specify what will be measured (Figure 14), how it will be measured, type of the measured data wanted out for further processing, target levels and analysis period for each meter. It is important to "walk-through" the process in the end of every meter analysis period and during process

changes to observe and discuss with all the related personnel; to get their opinions and development ideas for management meeting, to observe individual tasks, and to check compliance with the operating instructions. It is recommended to show the real time "dashboard" about the process performance status for the ones related to the process activities, not only for the management.

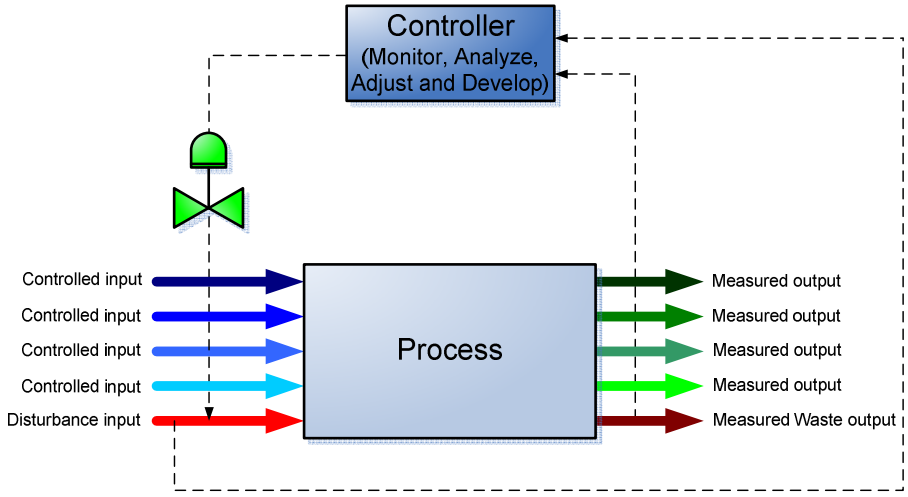


Figure 14. Every process needs measurement to be controllable

One important point is to think how these meters will affect the employees' way of working and how those will be used in possible rewarding. If rewarding plays a big role in an employee's income, it is important that set measures lead to a win-win situation where both the company and individuals can benefit when the process improves.

2.1.7 Interactions of Processes (Management and Leadership)

Management generally refers to "handling things" whereas Leadership means "handling people" to achieve targets. In both management disciplines communication and interaction are the most important parts of the puzzle.

When change occurs, there will always be different kinds of receptions to it. It is no matter how big the change is. It might even be that big changes go through easier in the organizations due the lack of understanding, but small, concrete things can face high resistance. This is due the human nature; when change occurs in the human

“working” environment, he experiences different emotions. This is a fact that just needs to be accepted and one must try to prepare for that as well as possible by training the personnel responsible for the change management adequately. People responsible for the change need to be able to handle their own emotions when facing resistance, understand the reasons for it, and to be able to explain understandably why this is important for the whole company and everyone’s job, without any kind of intimidation.

It is also very important to communicate about the change at an early stage and maybe even involve all employees into recognizing the value chain in their own processes. Change management training needs to include technical, practical and general issues related to processes, and people management. Employees’ training need is related to the changes planned, and to the new requirements of the process activities. Most of the organizations have at least one so-called non-team player on whom the change management will spend too much time trying to convince him or her. More useful would be to focus the energy to the people who have already bought the new way of thinking and have influence in the workplace. Those will help the change management to sell the idea to the others. Change management teams should set an example to the others.

2.1.8 Challenges of Processes

Too often process diagrams are not understood or not even seen by the employees, who are the most important influencers of process activities and improvement. The term *employee* refers to everyone who works in the process, or is responsible of it. The second problem is that processes are designed without thinking any future automation possibilities, or are simply from the last decade when today’s IT possibilities were unknown. Automation can increase productivity by transferring part or all of the routine work from an employee to the information technology. Process re-evaluation and describing enables the use of automation. It should be noted that automation is not the way to happiness, or a solution to fix processes that do not work. It is only one tool to support the functional processes. Thirdly it is often forgotten that Process design, development and reengineering are continuous work, not a one time “development project” which can be forgotten after closed. The most important point is to understand that the core factor of successful business is the customer, and to base the organization, processes and monitoring on that.

Practical level challenges based on the author's experience in designing, developing and reengineering processes, as well as working in processes, because of the diversity:

- Open and understandable communication and interaction within organization should be continuous activity – but seldom is
- Problems with understanding the importance of the support processes for the whole business entity. Compare it to an army brigade at war which does not get food, medical supplies and bullets from the maintenance team
- Too complicated process diagrams, which are understood only by the creator, who might not even work in the company any more. We are dealing with abstract operation and the terminology maybe problematic for the personnel. It is important for everyone to understand the process flow, objectives, meters and the importance of their own activity, which allows the correct functioning of the whole process. It is also difficult to automate complicated process parts to support employees activities
- Too long and detailed process instructions. No one has the strength nor the time to read all the related documentation. Difficult to keep up-to-date. Updates made in real life are not updated into documentation due to excessive impact on the employment
- Process does not meet the need. it is not enough to do things right but to do the right things
- When working in a process organization model environment, functional and administrative responsibilities can cause confusion. How to avoid management conflicts in overlapping and interlocking organizations?
- Cultural issues
- Unclear responsibilities inside the processes. Employees will continue working like they have been or the knowledge of the changes made inside the process flow can be found only in the employee's head. Not a very good solution when the cooperation between the company and the employee ends for any reason
- Unclear management responsibilities of the processes. No one monitors and develops the processes
- Employees who are responsible for the processes do not have any real decision-making powers. Nothing changes even if good ideas are raised
- Lack of meaningful meters to analyze by top management. Top management cannot make the right decision if it gets wrong or irrelevant information to back up the decision-making. One example of a good meter to start with inside a work flow: monitor how much time an employee spends on customer value-adding, management specified and waste activity.

When changing from a functional to the process organization model, it takes years to fully adapt the new way of working and process streamlining, including continuous development methods. This is not the case with this work, but it is worth mentioning to be able to understand all the aspects of the whole process work.

Below is a list which outlines the challenges involved in the whole change from functional to process management model and the extent of it (Harmon 2007):

- **Phase 1: Formation to Process Management**
  - Definition of critical business processes
  - Naming of process owners
  - Definition of preliminary exclusions
  - Identifying added value in processes
  - Formation of processes development teams and training
  - Preparation of meters
  - Project and change management plans
- **Phase 2: Understanding the Processes**
  - Modeling and analyzing process diagrams
  - Walk-through of the processes
  - Cost and cycle time analysis of the processes
  - "Rapid improvement" of the processes
  - Integration of the process, procedures and operation
- **Phase 3: Streamlining the Processes**
  - Redesign of the processes
  - Reengineering of the processes
  - Redesign of the processes
  - Benchmarking of the processes (best practices)
  - Cost and risk analysis of the development
  - Final selection of the processes that will be streamlined
  - Preliminary implementation plan
- **Phase 4: Implementation, Monitoring, and Control**
  - Final implementation plan
  - Implementation of the new process
  - Monitoring of the process
  - Ensuring of the process internal feedback system functioning
  - Monitoring of the quality costs
- **Phase 5: Continuous Development**
  - Targeting to significant performance improvement
  - Development needs to be continuous and be based on proven method
  - Responsibilities of processes development needs to be clear

This list can be used to evaluate the current status of IPTE's process work in general; is there something that has not been done in the past that should have, and is some of the phases or tasks forgotten during the years of process work?

2.1.9 Information Systems

The ultimate goal for future IPTE IT systems would be to combine all the core processes, which communicate with customers, and between each other, under one information systems tool. This tool would guide all the employees through the needed activities while saving process-related data automatically into correct documents. In this kind of system, sales, design, sourcing, production, after sales and maybe even customers, suppliers and partners, would be using the same system data base just for different purposes. The rest of this chapter will concentrate on functionalities that are required from the IPTE's future global IT systems.

Information System should support IPTE's business processes and employees, not force control them. By automating systematic tasks for processors and/or robots to handle, employees can concentrate on value-adding work. The most important task for IT systems supporting process work is the user interface and easy employee access. Process workers need to be able to access the delivery project status info and related documents, as well as the quality documents including process descriptions and meters, and work instructions with their native language. This is the key for active and operational efficiency-increasing use.

An information system needs to be designed flexible not to slow down the company development, and needs to be easy to maintain and to modify internally. Extent, scalability and interfaces need to be kept in mind for both hardware and software updates. A good IT system provides valuable real time information to top management to analyze from the whole group and to other teams based on the need. IT systems can produce different kinds of data (Figure 15) which helps the management in business planning and control, without any waste work done by employees in the form of excel sheet twiddling.

Processes and information systems are nowadays so tightly tied together that every process (re)design is also a systems (re)design. The IT department should be heavily involved in business process changes. With today's IT, IPTE can achieve things that most are not even aware about, and therefore, part of the easily achievable process improvements might not be realized. The business process could become the new basis for communication.

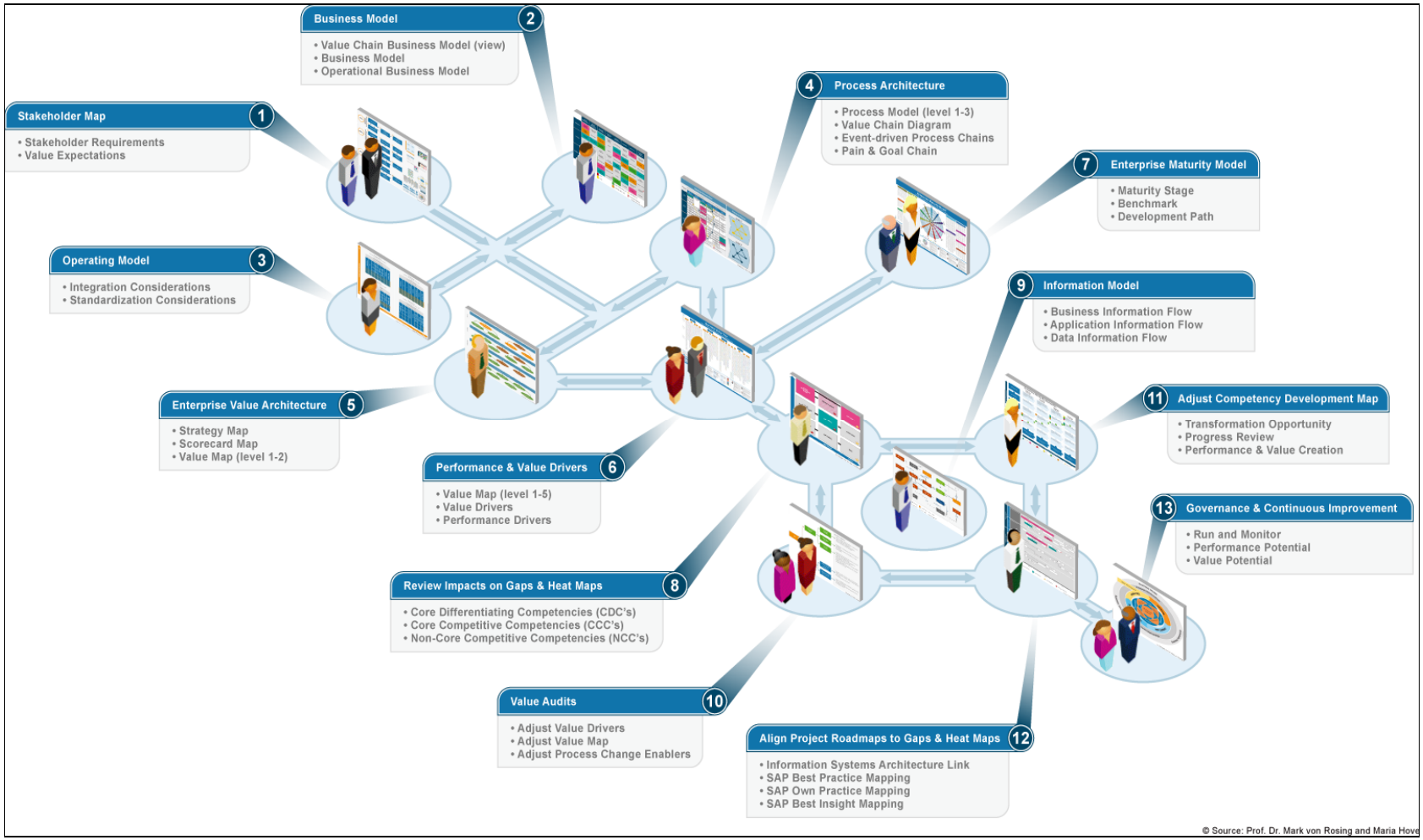


Figure 15. Synergy and context between business and IT (Wikipedia 2 2011)

2.2 Project Business Review

Project business is managed and purposeful activity, which serves the company's goals. More significant business requirements are subjected to projects nowadays, but still project management methods are applied in varying success (Artto, Martinsuo & Kujala 2006.) Project business knowhow is needed by most of the employees; still very few will get proper training for it, which is quite contradictory in relation to the obtainable benefits.

Professional project business is not just handling well individual projects, but making right decisions before the actual execution of them. It involves project lifecycle management, long-term customer relationship management and strategic management of the project business (Artto, Martinsuo & Kujala 2006).

There are two different project business types which could be both used inside the IPTE's process model environment:

- **Added Value Delivery Project:** this kind of delivery project is a production and business tool, which provides added value in the form of customer specific solutions
- **Business Development Project:** Projects are tools for development, which creates added value to the business itself and customer by means of improved effectiveness and renewal of operations

It is difficult to analyze the real benefits of one individual project to the company in whole, whereas it is easy to calculate the "one time" profit margin. Management is often struggling with the project long- and short-term benefit calculations in situations like: customer project results in a totally new value adding process phase to be offered to other customers, in new customer acquisition process, and when the outcome creates a new business platform for providing new products or services to customers. In all the above-mentioned cases, the profit margin from the first project or platform can be very low, maybe even negative. In the future, profit margin starts to rise, due to the product copy possibility (lower or non R&D costs), and the possibility of expanding the sales of new platform based products and services.

A company might have projects and other types of business models integrated together. Because of this, there could be several different types of organizational structures or their combinations, which already briefly presented in chapter *2.2.1 Organization based on Process way of thinking*. Pure project organization is based on

temporary projects or programs, which are independent, and the Project Manager/Leader has a full control over the resources and decision making. In this kind of organization project a team reports only to the Project Manager/Leader and the project can be kept as a cost and profit responsible unit.

Today's project management highlights the need of innovation and creativeness. More and more responsibility is given to the people responsible for the projects by trusting that they will make the right choices from the business point of view. Projects play a more and more important role in the businesses' strategic leading, and they are not only for single technical problem-solving tools anymore.

2.2.1 Project

The term *project* has a variety of different definitions, but there is one unifying matter among them; every Project has a start and an end, and between those two it targets to fulfill a pre-defined objective. Projects are a very common way to execute processes; added value is created with effective execution of the projects, in other words, efficient processes.

In the author's opinion, even company strategies could be non-recurring (project-natured), in the sense that it should be examined automatically at predetermined intervals. With this thought, most of the short- and long-term activities and functions of company could be handled as projects.

A project can be seen in three different perspectives (Artto, Martinsuo & Kujala 2006):

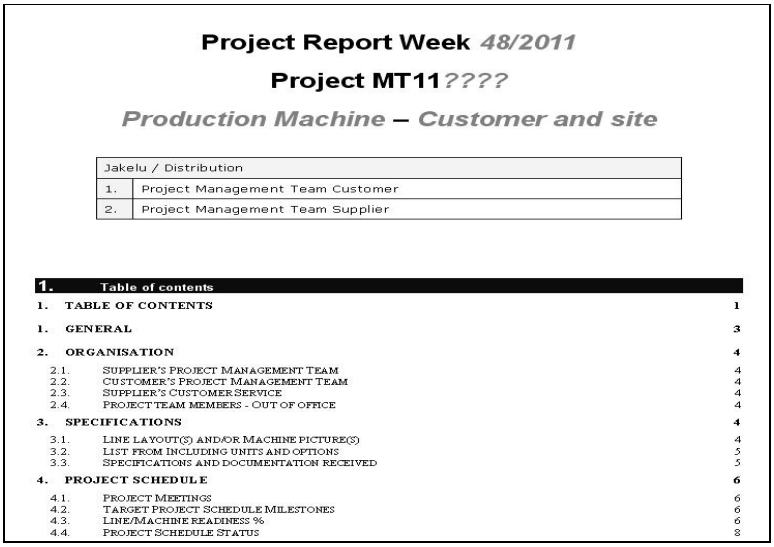
- **As a Temporary Organization:** this means that the organization is founded only to execute one specified activity, and dismantled after completion. It emphasizes the responsibility of the organization founded
- **As a Product and Work Structure:** this means that a project can be seen as a product which was an outcome from a project, or the work to be done through it. In this way both the product and its sub-products, and the project work can be described in a hierarchical form
- **As Tasks or Phased Process:** this means that a project can be seen as tasks and phases, and their inter-related dependencies in order to able to manage the project schedule

2.2.2 Project Management

Project management means applying management practices aiming to achieve the project's goals and targets. Management practices in this case mean all the available knowledge, knowhow, methods and tools that are needed for achieving the wanted project output. Project management consist of many different required knowledge skills such as management of the complex, extent, schedule, costs, resources, communication, risks, procurement and quality. The person responsible for the project needs a variety of above-mentioned project management-related skills, as well as technical, business and product-related knowhow (Artto, Martinsuo & Kujala 2006.)

Project Communication: project communication is handled with a project plan and an open point list "document" combination. These can be separate documents or founded in a web-based IT system. The other part of the communication consist of face-to-face intercourse in project kick-off meeting, interim reviewing and approval meetings, as well as agreed telecom meetings during the project delivery process. In IPTE a project plan and OPL will be delivered to the project organization within a specified time frame, for example on weekly basis to keep all up to date. This is due to the lack of a Project Management system allowing external project organization members usage.

Project plan (Figure 16) includes objectives, general level technical information, time schedule, resources, project organization with responsibilities and current status of the Project.



Project Report Week *48/2011*

Project MT11*????*

Production Machine – Customer and site

Jakelu / Distribution	
1.	Project Management Team Customer
2.	Project Management Team Supplier

1. Table of contents

Figure 16. Project plan table of contents (designed by author and used at IPTE)

Open point list (OPL) (Figure 17) includes all the technical details, with status info, that needs to be clarified before or during the project: customer process-related information, machine interfaces, human interfaces, customer product information, and possible spare parts included, for example.

New Topic | Close Topic | **Customer Assembly Unit** | 18

	Prio high	1								closed	C 7		
	Prio normal	2								in progress	P 4		
	Prio low	3								open	O 7		
Nr.	**Date Issued**	**Prio (1, 2, 3)**	**Keyword**	**Responsible**	**Topic, Action**	**Due Date**	**placed by**	**Done Date**	**Notice Result** (Results in blue type)	**Status C, P, O**	**Issue Nature: D(esign), P(roduction) or A(fter sales)**	**Issue Origin: E(xternal) or I(nternal)**
1			**Process related**									
1.1	31.12.11	1	Cycle time	Project Manager			Project Manager		**31.12.2011:** One second	C	D	I
1.2	31.12.11	1	In and out feeding	Project Manager			Project Manager		**31.12.2011:** Pallet conveyor	C	D	I
1.3	31.12.11	1	Uptime	Project Manager			Project Manager		**31.12.2011:** 99%	C	D	I
2			**Customer Products**									
2.1	31.12.11	1	2D-drawings	Project Manager			Project Manager		**31.12.2011:** No CAD drawings received	O	D	E
2.2	31.12.11	1	3D-files	Project Manager			Project Manager		**31.12.2011:** Files downloaded but not checked yet	P	D	I
2.3	31.12.11	1	Product samples	Project Manager			Project Manager		**31.12.2011:** Samples received	C	D&P	E
3			**Assembly Unit**									
3.1	31.12.11	1	HMI	Project Manager			Project Manager		**31.12.2011:** Not specified	O	D	E
3.2	31.12.11	2	Machine interfaces	Project Manager			Project Manager		**31.12.2011:** Not specified	O	D	I
3.3	31.12.11	2	Maintenance	Project Manager			Project Manager		**31.12.2011:** Not specified	O	D&A	I
4			**3rd Party Units**									
4.1	31.12.11	2	Feeder 1	Project Manager			Project Manager		**31.12.2011:** Tests not started yet	O	D	I
4.2	31.12.11	2	Robot 1	Project Manager			Project Manager		**31.12.2011:** Tests ongoing	P	D	I
4.3	31.12.11	2	Machine vision system 1	Project Manager			Project Manager		**31.12.2011:** Tests ready and approved	C	D	I
10			**Approval documentation**									
10.1	31.12.11	1	FAT and SAT documents	Project Manager			Project Manager		**31.12.2011:** No feedback received from customer	O	P	E
10.2	31.12.11	2	Requirement docs	Project Manager			Project Manager		**31.12.2011:** Documents under investication	P	P	I
10.3	31.12.11	2	ESD	Project Manager			Project Manager		**31.12.2011:** No special requirements.	C	D	E
11			**After Sales**									
11.1	31.12.11	3	Service agreement	Customer care			Project Manager		**31.12.2011:** Will be agreed later	O	A	I
11.2	31.12.11	2	First aid spare part kit	Customer care			Project Manager		**31.12.2011:** Will be quoted separately	P	A	I
11.3	31.12.11	2	Response time for onsite	Customer care			Project Manager		**31.12.2011:** Quoted separately	C	A	E

Figure 17. OPL (modified by author and used at IPTE)

Project Tools: the earlier presented project plan and OPL are project tools, which target to support the project organization. Today's highly developed information technology gives opportunities for IPTE to use very effective "Project tools", which are centralized all under one system. Through that system a project portfolio could be kept in order and statuses could be reviewed in real time via network connection, both internally and externally. These systems can also handle either all business processes or be connected to other systems handling related processes. At the moment IPTE does not have such a system in use.

It is very important, and many times forgotten, that a customer needs to have an access to check the project status information to see the project process general model, and to be able to add data and the documents required. This enables the continuum of the process flow. It reduces the work load of a Project Manager/Leader significantly when customers can access the needed information and carry out the necessary steps by themselves. This way all the documents can be easily found via the same user interface. A project organization sees in real time if the project is on hold

and why, which usually leads to results quite fast. The system needs to be able to handle Project portfolios, not only multiple projects separately at the same time. Again, IPTE does not have such a system in use, and the project status info is separately provided to the customer within a specified time frame. These points are important to write down to be taken into account in the future when evaluating the automation possibilities of processes and projects.

The future system should be able to support and guide the Project organization through all process phases from project order to approval, based on the project type. Below is a list of activities that need to be handled with the system either automatically or by a project team member based on given user rights:

- Show and modify general project process phases based on project type and current status of it in clear and simple way
- Enable project related documentation downloads, modifications and uploads
- Enable project approval and milestone procedures
- Enable data archiving and back up
- Enable version and revision handling
- Enable use of resource pool
- Enable interfaces with other business critical IT systems if separate ones. For example Product Data Management (PDM), Product Life Cycle Management (PLM), Supply Chain Management (SCM), Customer Relationship Management (CRM), and Enterprise Resource Planning (ERP) systems

Project Risk Management: According to ISO 31000, risk management is the identification, assessment and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor and control the probability and/or impact of unfortunate events, or to maximize the realization of opportunities.

The first and the second project related risk management evaluation in IPTE is made before the project has even started during the sales and order confirmation phases. The third project risk management round consist of pure and business risks, due the fact that the first and the second rounds include risk types later presented in this chapter. The third risk management evaluation will be made in the beginning of the project, but there will be a continuous risk management process ongoing through the whole project delivery process: changes in the plans and specifications-related problems, changes in design and its execution-related problems, unexpected equipment working environment and behavior problems, resource problems, supply chain problems, and time schedule and costs-related problems.

Very rarely do projects go as planned even when they are carefully planned. It is impossible to take into account or affect all the variables in the project process. That is why the prediction of possible risks and change management play the most important roles in the project management. With this kind of continuous risk management, the project organization will be as ready as possible for the coming surprises during the project, and in the best case scenario, have ready solutions for the occurring problems.

The biggest risks in this business field come from equipment deliveries which include new, unknown technology containing value-adding processes for the customer's production. When delivering equipment with known technology, even though it has some customer-specific parts, the risks are usually familiar and manageable. IPTE project risks can be divided into below presented types:

- **Pure risk:** accidents, injuries, damages or losses. Probability can be calculated on the basis of objective statistics. Pure risks can be affected more through indirect than direct means of leading and project management. Probability is very low, but the affect can be huge. Usually it is possible to take insurance for these kinds of risks
- **Business risk:** it can mean all the other than the above mentioned risks that can affect the project, its objectives and benefits. A few examples of business risks are the functionality and usability of a new developed product, demand for the product in the markets, generated revenue during the product life-time, and need of maintenance. Business risks also include technical problems faced during the project such as reliability of solutions, changed technology and technical solution, support of internal team and availability of needed resources, qualification and experience of the resources, lack of knowledge in the decision making phase, and conflicting expectations and objectives of the customer and the supplier. Usually it is not possible to take insurance for these kinds of risks
- **Financial risk:** it is related to project financial management. Financial risks are related, for example, to the project or IPTE's cash flow, financial systems and exchange rates. These kinds of risks can be minimized with financial market instruments, which are kinds of insurances. Cash flow can be secured and credit losses reduced with the bank guarantee arrangements and currency exchange rates for example with Futures or options
- **Regional risk:** it is related to conditions dependent on the geographic, political and administrative risks. Regional risks are related for example to war, terrorism, risks of disaster, legal, cultural and political environment and ecological conditions (Artto, Martinsuo & Kujala 2006.) The best way to insure regional risks is good groundwork before the business transition in the new area. Risk analysis will be done more thoroughly before the first delivery order confirmation for the new area, and after that, a lighter risk analysis process can be taken into use depending on the atmosphere in the region

Identification of risks consists of systematic methods of searching, defining and documentation of the risks, which can affect the project flow, but is always based on assumptions.

2.2.3 Project Interested Parties

Interested parties are individuals, groups and organizations which the project may affect, or that may affect the project. IPTE is using the following interested parties in the projects mentioned below in **bold** letters and optional ones are in *italic* (IPTE Project Plan presented earlier):

- *Project Director: person who usually works in large organizations and is responsible for projects' strategic aspects and risks. Manages Project Managers and Leaders, and in some cases Project portfolios. At the moment there is no Project Director in use at IPTE*
- **Project Leader:** does the right things when the manager does things right. Guides the Project Managers to the right direction, and participates also in the commercial discussions with customers
- **Project Manager:** person who is responsible for the project, achieving its objectives, and execution management. Handles the "micromanaging" of the projects.
- *Project Engineer/Main designer: person who supports the Project Manager/leader in technical issues related to the project*
- *Project Analyst/Secretary: person who provides critical data to support the technical team and a Project Manager/Leader, like financial issues, and project evaluation and monitoring, and performing any other analysis needed*
- **Project Management Team:** organization formed by people, groups and companies that is responsible for execution of project (internal and external management teams)
- **Internal Project Team:** internal team that executes the tasks inside the project
- **Customer Project Team:** includes customers sourcing, technical, production, operating and maintenance teams. Communication interfaces and tools are separately agreed upon with each customer and depend on their internal way of communication
- **Supplier:** component (make and buy part) suppliers and sub-contractors

2.2.4 Project Problem Areas Seen at IPTE

- Project tasks are not usually predictable or repetitive which makes them very complex
- Change management is continuous, and creativeness is needed from management
- The later project changes are made, the more expensive it becomes to change
- Communication, communication and communication internally, externally, between and across all the functional and/or processes organizational boundaries. Leading is nothing but communication and interaction
- The manager does not know how or does not want to share the work
- Lack of project work basics training
- The difficulty of killing the project when needed
- Lack of clear and simple-to-use project portfolio system for the whole organization, no matter whether it is an automatic IT system tool in a cloud server or a manually used excel sheet

2.2.5 Project Success Evaluation

Project success evaluation consists of output, budget, time schedule, lessons learned and potential use of the new founded technology reviews. It is good to remember that also a discontinued project can be a success, if it has produced enough new information to support the whole IPTE business planning.

3 Project Delivery Process

The starting point for this Project Delivery Process reengineering work was to unify and standardize the process globally to cover all factories, implement the standard product portfolio library usage to the process, update process to match today's global business environment, and enable the effective use of information technology in the future; automating the whole process or phases of it, and use the same product library data throughout the entire company organizations (Sales and Marketing, Design and R&D, Sourcing, Production, and After Sales and Customer Care). The scope of this work is to visually describe the Project Delivery Process which matches to the work extent requirements. The current project and delivery processes will not be kept as the basis of this work and will not be presented, but compulsory process phases will be copied without further notice.

In the business field that IPTE is working for, customer added value deliveries are divided into three different levels; the first level consist of deliveries that customer has requested by herself from IPTE, the second level consist of deliveries that IPTE have proposed to a customer as a solution based on knowhow and understanding of customer processes, and in the third level comes the partnership phase. In the partnership way of working both parties are trying to continuously improve the whole delivery chain from material suppliers to the end customer in cooperation. The third level is the long-term objective with all the customers. With this work IPTE facilitate the achievement of the objective by improving the customer satisfaction, as well as by reducing operational costs.

Project Delivery Process is a critical success factor of IPTE. Therefore the main questions to ask when starting the process improvement work is who our customers are and why; what the customer needs and expects from its own supply chain to be able to serve its own customers with maximum profit? After answering to the above question, customer value adding process phases, not value adding customer required process phases, and compulsory process phases will be defined. Compulsory process phases are related to laws, regulations, quality standards (ISO 9001 and OHSAS 18001), Information Technology (ISO/IEC 27001) safety, health, environment (ISO 14001), social (SA8000) and management (accounting, measuring and reporting).

The main problem with the process is the fact that a customer is only willing to pay for the value adding process phases, so the waste process phases need to be minimized

and simplified as much as possible without affecting the quality, delivery time and cost. These three things are the most important things for the customer when it comes to the Project Delivery Process output. Other important business field success factors for IPTE are active communication with the customers, understanding of customer's processes, as well as today's and tomorrow's needs, and the ability to develop the customer – supplier relationship towards the partnership model. Equally important with the close cooperation with the customers is the cooperation with suppliers which enables to achieve the objectives of quality, delivery time and cost. In this work suppliers and customers' processes are not presented due to confidentiality requirements though they do affect the results of this work.

Other critical points related to process work that need to be kept in mind are: specify key resources, identify possible disturbance inputs, and determine human interfaces for monitoring. Monitoring enables to get real time feedback from the processes with the support of Information technology. This part of the process work will not be described in the results and analysis of this work.

In the process we need to firstly define what kinds of inputs, activities and resources are needed to be able to achieve the wanted output, secondly to explain what inputs such as information, knowledge and materials are needed to carry out each individual process, and finally who the supplier for each input is. The following questions are asked when defining the Project Delivery Process inputs, activities, outputs, and organizational structure on the detail level (process activity tree, Appendix 4):

- How does customers' benefit from this action?
- Do we fulfill customers' real needs or not?
- Do we exceed customers' expectations too much?
- Have we really listened customers' and their needs enough?
- Is our every employee ready to communicate and help customers' when needed?
- Are we doing waste work so that we don't have any internal or external customer?

After a careful analysis of all the earlier presented background information related to processes and project business, it is obvious by now, that defining and describing only the reengineered Project Delivery Process does not provide the best possible result. To be able to achieve the primary objective of this work with maximum benefits, one needs to re-think through all the key processes since they are tightly tied together businesswise. Because of this newly generated secondary objective during this work, a

proposal for a completely new business process model will be provided including process map with core and support processes, as well as all the needed sub-processes. This enables the understanding of the whole, and gives tools and basis for the further business process reengineering work done in the future. At the moment Process Map level description is not made at all in the company, but operating model is, though it will not be presented in this work due to confidentiality requirements.

As the primary objective of this work remains the original Project Delivery Process reengineering. This can be implemented also to current processes of IPTE. However, achieving maximum benefit will require broader actions in the future. The work's next steps via the secondary and towards the primary objective of reengineered Project Delivery Process are:

1. Key Processes proposal
2. Core Processes proposal
3. Support Processes proposal
4. Process Map proposal
5. **Project Delivery Process top level Visual Description**

The hierarchical entity of the processes is called either the process tree or the process architecture. It is a good and visually clear method to describe processes, their sub-processes, and activities which are at the lowest level of the tree. The process map is the first and highest level view in the imagined tree. The process tree ends on a work flow level which describes the actual activities. : In this work processes in the work flow level are not described due to the scope of the work.

In this work processes will be visually described based on Business Process Modeling Notation (BPMN) standard symbolism from Object Management Group (OMG). The objective for this standard is to provide understandable notation for all the organizations, both internal and external; process workers, designers, developers, implementers, monitors and managers, as well as customers and suppliers. It enables, by means of a common modeling language, communication between all related parties. There are several standards used in this business field for process modeling purposes. BPMN is globally the most common one, and that is why these symbols are used also at IPTE.

3.1 Key Processes Proposal

As a conclusion, the critical and only question is: what business processes must we have to satisfy company owners and add value to customers' manufacturing processes in this project in process-type of business field? The answer to the question can actually be found quite easily, when focusing our minds on business requirements:

- Customer relationship management: understanding of customer's processes to be able to provide added value and create the interfaces between needed parties enabling the partnership type of cooperation in the longer term
- Deliver added value with quality, in time and with the market price; improving, standardizing, unifying and streamlining the global Project Delivery Process
- Continuous improvement of all three strategically important areas; value added (technology, product and service), economics and human resources
- Global product portfolio library to be used through all business organizations; standardization of the added value to be delivered, and released products availability for all organizations in real time to use their own purposes

From this we can conclude, that the correct path to recognize a company's Key Processes is to analyze the customer's processes. The key processes should serve the customer operations, and be incorporated in the customer's processes. This simply means that we need to change the requirements of the customer, IPTE management, and compulsory requirements to operational functions.

When all the included background information, and previous conclusions are taken into account, business processes can be defined. These describe the primary value streams of the whole IPTE group. We will call them as Key processes:

- Business Planning and Control Process (BPCP)
- **Customer Relationship Management Process (CRMP)**
- **Project Delivery Process (PDP)**
- **Business Development Process (BDP)**
- **Product Portfolio Life Cycle Management Process (PPLMP)**
- Human Knowledge Management Process (HKMP)
- Information Technology Management Process (ITMP)
- Supply Chain Management Process (SCMP)
- Infrastructure Management Process (IMP)
- Quality Management Process (QMP)

The key processes' functions and relations will be presented in more detail in the following chapters when dividing them into core and support processes.

3.2 Core Processes Proposal

Core processes are selected from the Key Processes based on the fact that they have direct connection to the customer interfaces, and which are recommended not to be outsourced in this business field. Sub-Processes, functions and activities under the Core Processes can be outsourced based on company, business, process and project needs. The main reasons why these processes were selected can be found from the list of business requirements on the previous page.

3.2.1 Customer Relationship Management Process

This core process is quite obvious in this specified business field because the only reason for companies to exist is customers, whose needs are understood. Holistic Customer Relationship Management plays a major role in this business field. The primary objective for this process is to create and enable inputs for the below processes:

- Project Delivery Process, which is the short-term financial performance in IPTE, as well as long-term, by carrying out the Business Development Projects
- Business Development Process, which is the long-term financial performance in IPTE
- Product Portfolio Life Cycle Management Process, which is the long-term competitiveness performance in IPTE

A secondary objective for this process is to communicate with the Business Planning and Control Process related to short and long-term planning and budgeting of the IPTE group, as well as with the Quality Management Process related to quality of products, based on feedback from the markets.

This process, with the support of other Core Processes, is responsible for the acquisition of new customers and orders, and retention of existing customers. The process gathers vital information from the business field regarding new business possibilities and new technology requirements in the future. Based on this information, the management can make long-term business planning which results in satisfied customers also in the future. It is important to emphasize that all the employees at IPTE are customer servants, and should act like ones. However, most of the responsibility of customer satisfaction has been officially given for the Customer Relationship Management and Project Delivery Process organizations.

After sales and Customer care are also located under this Core process. If special technical support is needed from the specialists, a project will be created by sending the customer request information as an input, including urgency priority flag, to the Project Delivery Process. Appendix 2 describes the Customer Relationship Management Process tree.

3.2.2 Project Delivery Process

The input of this process is the external or internal customer order. When a customer places an order he or she expects that the output fulfils the agreed quality, delivery time and cost requirements. This is the only IPTE process that delivers added value directly to the external customer's production processes in the form of products and/or services, as well as maintains the company's competitiveness by means of business development projects. The primary target for this process is to maintain IPTE's short-term cash flow; external customer projects need to be closed in the schedule and within the budget to enable the continuity for the business. This short-term business success factor assists the management in long-term business development planning and in project-oriented execution.

Delivery process is handled as a project and organization is established for each project separately. A long-term objective for this process, among others specified earlier in this work, is to get rid of manufacturing or buying anything into stock to commit capital, but to improve the supply chain and production processes to the level which can meet the delivery time and budget targets.

Project Delivery Process needs to be able to handle a variety of projects as seen on the list of examples in appendix 3. We can call this list as a project tree, instead of process tree. When Project Delivery Process receives the input, which is an order from the customer, a new project number will be opened based on customer type. From this moment all the costs, starting from the invoice sending and order confirmation work flow, will be allocated to this specific project. In the present project process, cost allocation starts after the order confirmation. This is the first step to allocate all the costs related to the project properly. If order is not confirmed based on the results of risk analyses, which rarely happens, the project will be closed. The situation is the same when a project would have been decided to be discontinued in a later project delivery process phase. In both cases mentioned there will be costs without the customer, in other words waste work, but allocated correctly for management review.

This is part of the risk management activity that we presented in the previous Project business review chapter.

As mentioned earlier, there are many different types of projects. All the described project phases and activities in appendix 4 are not needed in every project, and are just left without any actions in those cases. This is easy to handle when using automated projects in the processes' type of management system, which allows the definition of the project type in the creation phase, and then leaves unnecessary phases out automatically. The Project Delivery Process visual description will include all the top level processes, not all the sub-processes and activities seen in the process tree.

It is no use comparing new Project Delivery Process description directly to any of the used ones at IPTE. None of them describes the whole process from customer input to customer output. In general, a few points can be highlighted that recur in most of the used models compared to the new process description: the reviews of the product portfolio library, existing delivered solutions library and standard parts library are new process phases. Customer Acceptance milestones (FAT and SAT), Customer design reviews and Project closing process were missing process phases, but are implemented in real life. All of them are added to this new process tree description. The project opening and the first invoice sending to the customer are re-located in the new process tree.

One important point that is often forgotten is the effect of the totally new technology use in the project deliveries. This is the reason why it is mentioned separately in this work in the process tree under the project internal kick-off meeting process. The biggest mistake is to assume that the same designer(s) can handle the new technology design within the same time frame than the standard design task of known technology.

It might give an impression that this work is going to the opposite direction than was planned by adding process phases instead of removing them, but this is not the case in real life. Adding the process phases to the tree, which are critical success factors for the project, will help the project team not to forget them. This way a considerable amount of extra work will also be avoided by not having to solve the points afterwards. The most important matter in this Project Delivery Process reengineering work is an understandable and visually clear process flow including all the critical phases and activities.

3.2.3 Business Development Process

The reason for the Business Development Process to be one of the core processes is the need to emphasize the importance of continuous improvement of all the activities in IPTE. This is due to the changing requirements from internal and external customers, new improved products and services from competitors, and continuously changing global market environment. This kind of constantly changing business environment creates the need to maintain competitiveness by means of developing all three strategically important areas; added value (technology, product and service), economics and human resources. Business Development Process tree is described in appendix 5.

In this work it is thought that projects are primary tools for business development. They create added value to the business itself and to the customer by means of improved effectiveness and the renewal of operations, as well as by the direct customer orders of research and development projects.

3.2.4 Product Portfolio Life Cycle Management Process

The last but not the least core process is the Product Portfolio Life Cycle Management Process. This process is responsible for the creation, management and publication of all the product and service data from the solutions that IPTE has delivered all over the world, as well as from the portfolio of standard solutions that offers to the markets. The product portfolio can be divided into separate parts, products, product families, services, business units or into a combination of these. IPTE uses business units to divide the product portfolio into different categories at the top level. The Product Portfolio Life Cycle Management Process tree is described in appendix 6.

At the moment IPTE does not have any global system for product portfolio life cycle management, but it is under consideration as a part of the global standardization project. This kind of system would also help linking the project-related data to the projects. It is a standard and easy way to find what have been delivered and to whom, for example in a situation when receiving a request for quotation (RFQ) from a machine update which was originally delivered 5 years ago. General machine directives also demand this kind of data management in the form of technical construction file from all production equipment delivered. The required file would be made automatically with the product portfolio life cycle management system.

With today's IT, the product portfolio life cycle management system enables the use of 3D-files as well as product and project data through all the organizations of the whole IPTE group, from sales to after sales. Other practical benefits of the system are:

- Possible integration to suppliers and customers systems
- Possible outsourcing of the production
- Re-inventing the wheel removal by global standardization and design sharing
- Documents in one location, not in the several different folders which are in the worst case located in different servers or employees' personal hard disks
- Reducing the chaos during the changes in the products
- Possibility for late variation of modules in the projects
- Possibility for centrally managed product structures
- Possibility for designation-based operation mode

An increasingly important matter in the future will be the green values of deliveries. These values are related, and considered in the product portfolio life cycle management process, as well as in the selection of production location compared to the customer location. Design and production of the value added needs to be able to be carried out in any IPTE site, which again justifies the use of a global product portfolio system. Green values that customers are interested in:

- Total energy used in the production of value added
- Materials used in the value added
- Recycling of the materials used in the value added and packaging
- Waste Transportation of value added
- Total in-use energy consumption of the delivered value added

3.3 Support Processes

Defined support processes generate infrastructure services and conditions for core processes in IPTE.

3.3.1 Business Planning and Control Process

Business Planning and Control Processes defines the IPTE's Mission, Values, Vision, Strategy and Quality policy. The process is also responsible for the business planning and controlling in order to be able to maintain the long-term competitiveness; measuring, reporting, controlling and improving. The Business Planning and Control Process tree is described in appendix 7.

3.3.2 Human Knowledge Management Process

This process enables the right resource on the right time in the right place. It also maintains and develops the knowledge of employees, and is also responsible for their well-being, and personal work tools management. The Human Knowledge Management Process tree is described in appendix 8.

3.3.3 Information Technology Management Process

Today's information technology management is more like competitiveness improving technology management. Information Technology Systems improves efficiency, and supports business processes and employees. An IT System enables employees to concentrate on value-adding work, and produces real-time monitoring capabilities which helps the top management in business planning and control process.

At the moment IPTE does not have an IT system which supports global business management through all organizations. A long-term IPTE IT system objective is to enable integration of all the internal business systems globally, as well as enable the integration of suppliers, partners and customers. Business processes become the basis for communication with the support of IT systems. A process tree describes the future objective. The Information Technology Management Process tree is described in appendix 9.

3.3.4 Supply Chain Management Process

Management of the supply chain is a critical success factor of the Project Delivery Process, as well as the standardization process of the parts, sub-assemblies, modules and machines. This process is also responsible for the selection of approved suppliers in cooperation with the technical specialist. The Supply Chain Management Process tree is described in appendix 10.

3.3.5 Infrastructure Management Process

Infrastructure Management Process is responsible for the factories and sales offices globally by following up that they fulfill the specified requirements. The process also continuously monitors the fixed costs from heating, water, electrics, and facilities' rent costs. Infrastructure Management Process tree is described in appendix 11.

3.3.6 Quality Management Process

The Quality Management Process ensures that the organization's and the customer's added value are consistent. Quality management focuses on both the quality of customer value added and the means to produce it. The Quality Management Process tree is described in appendix 12.

3.4 Process Map Proposal

The Process map describes the organization's core and support processes, which were reasoned in earlier chapters, as well as the governance, the key stakeholders and the organization's name. The aim is to conceptualize the organization's core operations with a logical visual diagram.

All the included background information, and previous conclusions were taken into account while describing the Process map. This Process map serves the customers needs best by having a clear interface for all the competitiveness factors of both IPTE and customer in order to deepen the cooperation in products and services. In this work have already been defined the core and support processes, as well as their relations to customers, which will now only be implemented to the Process map diagram.

A brief summary of the arguments made in the past regarding the selection of processes:

- Core processes are directly in contact with customers, and are functions that are proposed not to be outsourced. These are the company's primary value streams
- Support processes do not directly add any customer value, but are necessary to be able to produce it. Support processes are not directly in contact with the customer

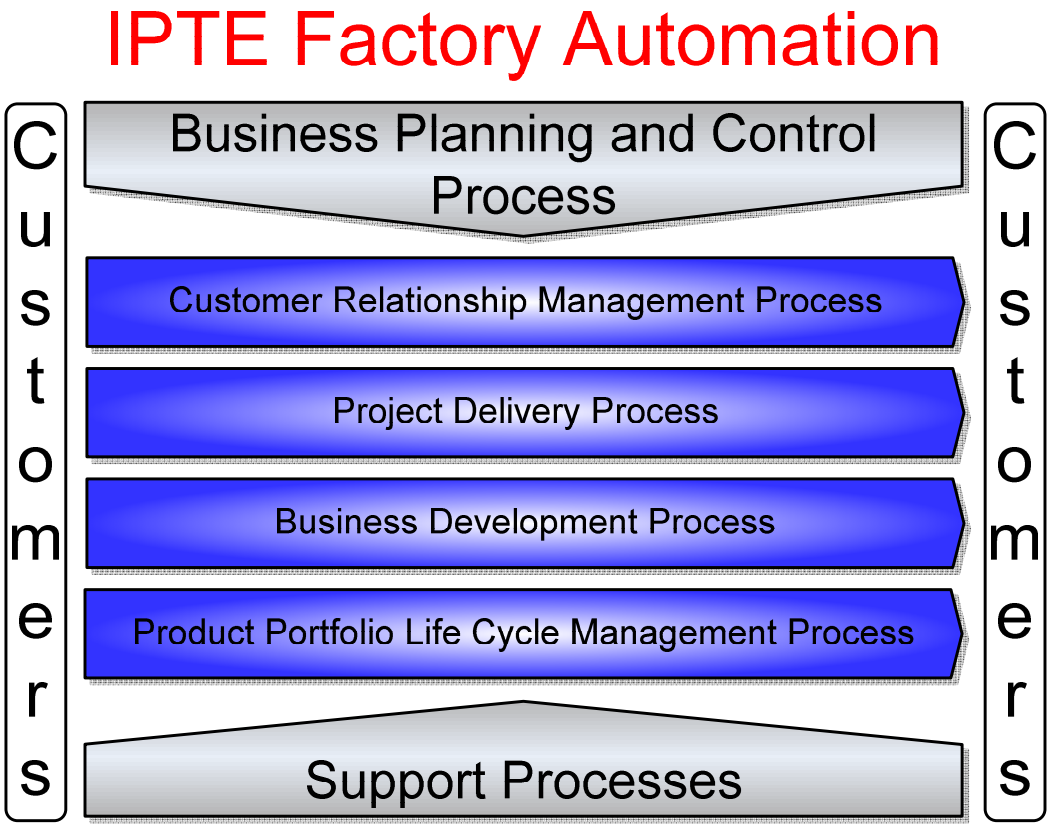


Figure 18. IPTE Process map proposal

In Figure 18 customers are located on the left side of the diagram as a process input and on the right side where the process outcome is. Core processes are described in blue and their direction of flow is from left to right by adding customer value. On the bottom side there are support processes which enable the flow of core processes, and on the top side there is Business Planning and Control Process.

3.5 Project Delivery Process Top Level Visual Description

Project Delivery Process description visualizes the organization's functions in the form of a flowchart. In the process flowchart the progression of the process is described in phases from top to down. The flowchart begins from an order input from the customer, internal or external, and the output is the project closing. The phases of the process are described in the order of their appearance from top to down. The phases are also numbered. A "plus" sign in the lower-center of the activity block indicates that the activity is a sub-process and has a lower level of detail. More detailed information regarding the symbols can be found from the Business Process Modeling Notation (OMG 2011). Version numbering, and other general level characters will be left out from this work because that this is not the official Quality Manual of IPTE.

The Project Delivery Process primary processes in the order of execution can be found on the list below, which is derived from the groundwork made with the process tree (appendix 4). The process tree was necessary to do to fully understand what process phases and activities it includes. Without that knowledge it is not possible to develop, reengineer or design any processes. Arrow marking (→) in the list describes the interface to other phases and processes. This list is made to assist in visualizing the actual Project Delivery Process description in the next phase:

1. Order Handling Process → Customer if order not accepted or if info is missing
2. Internal Kick-of Meeting Process (Project plan and OPL creation)
3. Kick-off Meeting Process
4. Design and Documentation Process → SMC/Production/FAT/Logistics
5. Internal Design Review Process (no 1, 2, 3… loop) → Design
6. Customer Design Review Process (no 1, 2, 3… loop) → Design
7. Supply Chain Management Process
8. Production Process → Design
9. Internal Ramp-Up and Test Run Process → Design
10. Customer Pre-Acceptance Process (FAT) → Design
11. Logistics Process → Customer
12. Customer Final Acceptance Process (SAT) → Design
13. Project Closing Process → BPC, PPLM and CRM process/Customer

In Figure 19 the "full" Delivery Project Process with all possible process phases in use is seen. Unneeded process phases will be left out automatically from the delivery process based on project type. In Figure 20 we can see the spare part delivery process where activity marked with light grey is not needed in this type of delivery project. Project Manager/Leader is responsible for the execution of the whole project delivery process, from input to output. Responsibilities of Sub-Processes are not described in this work.

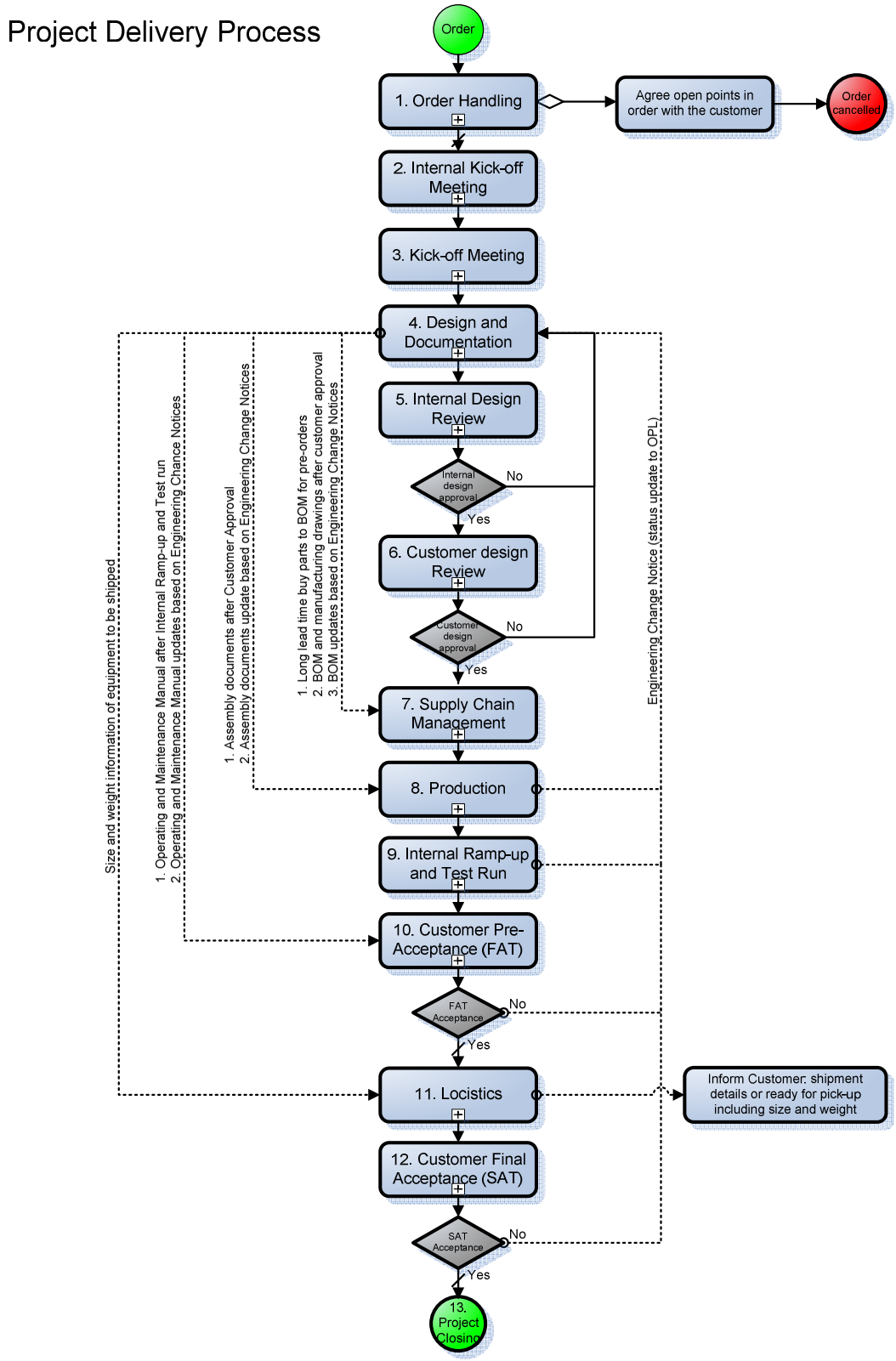


Figure 19. Project Delivery Process top level visual description

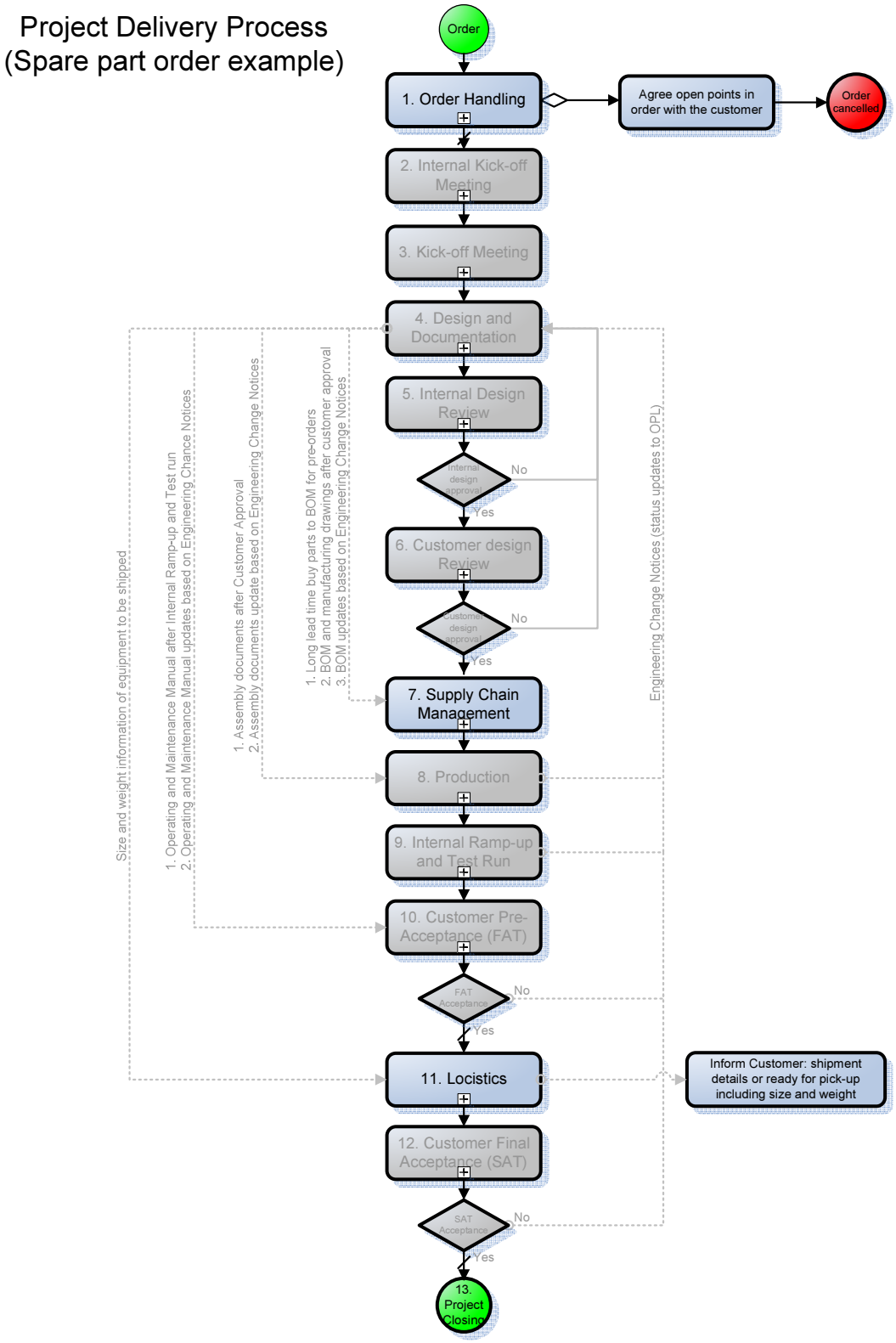


Figure 20. Spare part delivery example

4 Conclusions

The significance of processes standardization becomes emphasized when IPTE wants to change to a genuinely global. A process enables to create a common operational framework for business. This again enables a uniform customer service model, product portfolio management system, fast sharing and implementation of best practices and products, and cost effective system architecture. Global processes are not yet implemented to IPTE despite their undeniable advantages. There are many challenges on the IPTE's road to successful design and implementation of global processes:

- IPTE's business units, subsidiaries, customers, sub-contractors and suppliers in different countries have alternative practices and cultures
- Conflicts coordination between IPTE's global and local interests
- Difficulties with spreading the necessity of change understanding through all organizations to maintain IPTE's competitiveness
- Difficulties with the change management; lack of discipline, follow up and monitoring

The correct path to a successful coherence program of processes in every company is to start with the re-evaluation of Mission, Values, Vision, Strategy and Quality Policy. They guide and create the standards for the operational development activities. IPTE business success is affected by margin, but it should be driven by the customer. Customers define the success in the end. IPTE, as one of the best companies in the field, make their customers' lives easier, simpler and more successful. Technology should be implemented when it adds customer value, not for fun or because everyone else is doing it. Everything should be aligned towards the customer.

The most important matter for a successful process way of working is the commitment of IPTE's top management with unquestionable responsibilities. Continuous improvement of processes should become a part of the everyday work at IPTE to maintain the competitiveness in this rapidly chancing global business environment. On the other hand, when thinking of IPTE's core activities, the most important implementers are the employees. They are supported through processes, with or without automation.

Continuous development of IPTE's business needs to be monitored by a responsible party with *correctly* defined meters and interfaces. One important part of the monitoring is the interviewing and observing of the employees working in the process phases

while walking through the processes. Business monitoring enables IPTE's top management to obtain real-time information from the processes to support the short and long-term decision-making, and business control and planning. As a proposal, IPTE's Chief Information Officer (CIO) should be seen as Chief Improvement Officer from now on.

The description of IPTE's processes needs to be technically good and evaluated by the management and process owners (not in the scope of this work). It should follow the operating principles of the organization with acceptable definitions of responsibility. The process key personnel should approve them as an operational base. All the employees related to processes need to understand their roles in it; clear justification and effective communication is the key for success.

When thinking about IPTE's activities and functions as projects, it is easier for the top management to monitor, analyze and draw conclusions when costs are allocated correctly. Allocation of costs in more detail will give a better picture of the companies' profitable operations and resource needs, and improve companies' consistent reliability of the indicators used in the future decisions. Projects have two primary targets: customer satisfaction which enables more projects to IPTE, and economically productive execution which is the lifeline of IPTE's.

The new, improved Project Delivery Process looks promising in theory by the IPTE evaluation team of this work. Process describing benefits were reflected in the fact that it increased the transparency of operations through IPTE's organizations. Activity was previously considered to be very transparent, nevertheless, more transparency was produced. The Project Delivery Process description clarified especially the process interfaces, and the description can be utilized in the training of the employees. New process description makes it easier to understand the whole. The Project Delivery Process phase's overview description will serve as a guideline at IPTE globally, and will be supplemented, if necessary, by separate documents and sub-process descriptions in the future.

All the processes and their relations are tightly tied together, which affects the obtainable benefits from the process work. Therefore, a proposal for a new Process map including all core and support processes is also made.

The new reengineered Project Delivery Process described in this work includes all process phases, responsibilities and interfaces between customer input and output.

This work slightly exceeded the IPTE's expectations due to the proposals made for the secondary objective generated during the process. The process which was the primary objective looks very good in theory, but due to the scope of the work, there are no actual results from the process implementation phase available.

The next steps for the process work at IPTE are:

- Specify the process owner
- Define meters
- Simulate process by "walking-through" a test project through all the phases from input to output
- Evaluate effects on the whole, and prepare solutions for all different kinds of expectable problems in advance
- Implement the process by testing it in one factory first, progressing step by step towards full roll-out
- Alongside the above points, evaluation of the new proposed process model, which was the generated secondary objective, will be carried out

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APPENDICES

1. New product design process **(Primary Process)**
    1.1. Product specification process **(Sub-process)**
        1.1.1. Hardware specification **(Activity)**
            1.1.1.1. Mechanics specification
                1.1.1.1.1. Machine standard part definition
                1.1.1.1.2. Customer product specific hardware definition
                1.1.1.1.3. Pneumatic hardware definition
                1.1.1.1.4. …
            1.1.1.2. Electrics and Control system specification
                1.1.1.2.1. Master and slave control system for the whole product (PC/Embedded PC/PLC/ Micro controller/IO) definition
                1.1.1.2.2. Other electric components definition
                1.1.1.2.3. All electric components energy consumption (V/W/A) definition and connection specifications
                1.1.1.2.4. Inputs(D/A)/outputs(D/A) definition
                1.1.1.2.5. Bus definition and connection specification
                1.1.1.2.6. …
            1.1.1.3. Factory Interface specification process
                1.1.1.3.1. Energy consumption (V/W/A + air) specification
                1.1.1.3.2. …
        1.1.2. Software specification
            1.1.2.1. Used software languages definition
            1.1.2.2. User interface requirements definition
            1.1.2.3. Factory network etc. customer requested communication between machine and their equipment definition
            1.1.2.4. Statistic requirements definition
            1.1.2.5. Error situation handling requirements definition
            1.1.2.6. ...
    1.2. Product design process
        1.2.1. Risk Analysis (whole design team participates)
            1.2.1.1. Determination of the limits of the machine
            1.2.1.2. Hazard identification
            1.2.1.3. Risk estimation
            1.2.1.4. Risk evaluation
            1.2.1.5. Risk reduction with required level safety devices
        1.2.2. Concept design (whole design team participates)
            1.2.2.1. Determination of the product process concept
            1.2.2.2. List of the core components
        1.2.3. Mechanic design
            1.2.3.1. 3D-modeling
            1.2.3.2. Internal evaluation
            1.2.3.3. 3D-modeling
            1.2.3.4. Customer evaluation
            1.2.3.5. 3D-modeling finalizing
            1.2.3.6. Part design drawings
            1.2.3.7. Module based Bill Of Material (BOM) for sourcing
            1.2.3.8. Module based assembly design drawings
            1.2.3.9. Total air consumption definition and assembly drawings

1.2.4. Pneumatics design
1.2.4.1. Related to point 1.2.3, where functional components have been defined, and based on those will be calculated the suitable main and other valves etc.
1.2.4.2. Pneumatic diagram drawings
1.2.5. Electric design
1.2.5.1. Electric concept definition
1.2.5.2. Main electric circuit diagram drawing
1.2.5.3. Module based diagram drawings
1.2.5.4. I/O (Field etc.) connection diagram drawings
1.2.5.5. Control system diagram drawing
1.2.5.6. Plain PWB drawings
1.2.5.7. PWB assembly drawings
1.2.5.8. Make cable drawings
1.2.5.9. PWB diagram drawing
1.2.5.10. Emergency stop circuit diagram drawing
1.2.5.11. Handshake diagram drawing
1.2.5.12. Module based Bill Of Material (BOM) for sourcing
1.2.6. Software design
1.2.6.1. Software platform(s) and base selection
1.2.6.2. Communication interfaces between internal platforms (example PLC ←→ PC) and with customer network
1.2.6.3. Software design with clear commenting
1.2.7. Test plan design
1.2.7.1. Manual mechanical function of all modules separately and together
1.2.7.2. Electrics connections
1.2.7.3. Air connections
1.2.7.4. Software
1.2.7.5. Power up and ramp-up
1.2.8. User and maintenance manual design
2. New product release process
2.1. Product verification process
2.1.1. Quality standards verification
2.1.2. Functional requirements verification based on specification
2.1.3. Looks requirements based on specification
2.1.4. Conformance Audit declaration
2.2. Product validation process
2.2.1. Customer related validation

1. Customer Relationship Management Process
    1.1. Orders Acquisition Process (sales related)
        1.1.1. Order Intake Process (Sales and After sales)
        1.1.2. Customer Visit Process
        1.1.3. Monitoring of the Products Competitiveness Process
    1.2. Customers Acquisition Process (marketing related)
        1.2.1. Marketing Process
            1.2.1.1. Customer Direct Contact Process
            1.2.1.2. Advertising in the Industry Publication Process
            1.2.1.3. Participation in Exhibition Process
            1.2.1.4. New Product Release Process
            1.2.1.5. Company Website Update Process
        1.2.2. Market Research and Monitoring Process
            1.2.2.1. Potential Customers Survey Process
            1.2.2.2. Customer Needs Survey Process
            1.2.2.3. Competitors Survey Process
            1.2.2.4. Products Survey Process
                1.2.2.4.1. Competitors products
                1.2.2.4.2. Competitiveness of own products and services
    1.3. Customer Care Process
        1.3.1. Customer Support Request Handling Project Process
            1.3.1.1. Warranty Delivery Process
            1.3.1.2. Service Support Delivery Process
            1.3.1.3. Customized Service Agreement Process

Project Delivery Process project types:

1.1. External Customer Delivery Project
- 1.1.1. Standard or Copy Equipment Delivery Project
- 1.1.2. Customer Specific Equipment Delivery Project
  - 1.1.2.1. Line Delivery Project
  - 1.1.2.2. Machine Delivery Project
  - 1.1.2.3. Product Specific Hardware Delivery Project
  - 1.1.2.4. Current solution upgrade delivery Project
- 1.1.3. After Sales Delivery Project
  - 1.1.3.1. Spare Part Delivery Project
  - 1.1.3.2. Warranty Delivery Project
  - 1.1.3.3. Service Support Delivery Project
  - 1.1.3.4. Customized Service Agreement Delivery Project

1.2. Internal Customer Delivery Project
- 1.2.1. Business Development Project
  - 1.2.1.1. Added Value Development Project
    - 1.2.1.1.1. New Technology Development Project
    - 1.2.1.1.2. Product Development Project
    - 1.2.1.1.3. Service Development Project
  - 1.2.1.2. Economics Development Project
    - 1.2.1.2.1. Acquisition Project
    - 1.2.1.2.2. Investment Project
    - 1.2.1.2.3. The Financial Restructuring Project
  - 1.2.1.3. Human Knowledge Management Development Project
    - 1.2.1.3.1. Human Resources Management Project
    - 1.2.1.3.2. Human Resources Development Project
  - 1.2.1.4. Management Development Project
    - 1.2.1.4.1. Process Development Project
    - 1.2.1.4.2. Information Technology Development Project
    - 1.2.1.4.3. Supply Chain Development Project
    - 1.2.1.4.4. Infrastructure Development Project
    - 1.2.1.4.5. Quality Development Project
- 1.2.2. Business Enable Delivery Project
  - 1.2.2.1. Information Technology Support Delivery Project
  - 1.2.2.2. Infrastructure Support Delivery Project

1. Project Delivery Process
   1.1. Order Handling Process
      1.1.1. Order receiving input
      1.1.2. Project opening
         1.1.2.1. Project number assignment
            1.1.2.1.1. Project cost allocation
            1.1.2.1.2. Project documentation allocation
         1.1.2.2. Invoice to customer (this is the first payment milestone)
      1.1.3. Internal order details confirmation
         1.1.3.1. Customer production process and product specifications factors
            1.1.3.1.1. Product specification
            1.1.3.1.2. Product handling
               1.1.3.1.2.1. Specifications
               1.1.3.1.2.2. Needed processing is unknown technology (R&D)
         1.1.3.2. Delivery time confirmation factors
            1.1.3.2.1. Technology specification
            1.1.3.2.2. Resource availability
               1.1.3.2.2.1. Project Management
               1.1.3.2.2.2. Design and R&D
               1.1.3.2.2.3. Sourcing
               1.1.3.2.2.4. Production
               1.1.3.2.2.5. Documentation
         1.1.3.3. Sales price confirmation factors
            1.1.3.3.1. Technology specifications
            1.1.3.3.2. Available resources and need of overtime work
         1.1.3.4. Project risk analysis
      1.1.4. Customer order confirmation
         1.1.4.1. Specifications and approval requirements
         1.1.4.2. Delivery time
         1.1.4.3. Sales price
   1.2. Internal Kick-off Meeting Process (Project plan and OPL creation)
      1.2.1. Project Management team allocation
      1.2.2. Project technical review
         1.2.2.1. Review of the customers process environment
         1.2.2.2. Review of the customers products
         1.2.2.3. Review of the customer specifications
         1.2.2.4. Review of the approval requirement specification
         1.2.2.5. Review of the standard product portfolio library as a base for partial or whole solution
            1.2.2.5.1. Machines
            1.2.2.5.2. Modules
            1.2.2.5.3. Control systems
            1.2.2.5.4. Software's
            1.2.2.5.5. Product specific interfaces
         1.2.2.6. Review of existing delivered solutions library as a base for partial or whole solution
            1.2.2.6.1. Machines
            1.2.2.6.2. Modules
            1.2.2.6.3. Control systems
            1.2.2.6.4. Software
            1.2.2.6.5. Product specific interfaces

1.2.2.7. New value adding technology review
1.2.2.7.1. Estimation of needed work
1.2.2.7.2. Input to new technology development process (Appendix 1)
1.2.2.7.2.1. Specification
1.2.2.7.2.2. Schedule
1.2.2.7.2.3. Budget
1.2.2.7.2.4. Resource allocation
1.2.2.7.3. Output from new technology development process
1.2.2.7.3.1. Technology ready to implement by the design team
1.2.2.7.3.2. New library component release request to Product Portfolio Lifecycle Management process
1.2.3. Project team allocation
1.2.3.1. Project Management resources
1.2.3.2. Design and R&D resources
1.2.3.3. Sourcing resources
1.2.3.4. Production resources
1.2.3.5. Documentation resources
1.2.4. Project Scheduling
1.2.4.1. Design and documentation (Appendix 1)
1.2.4.1.1. Product risk analysis
1.2.4.1.2. Concept design
1.2.4.1.3. Pre-order possibility for long lead time components
1.2.4.1.4. Mechanics
1.2.4.1.5. Pneumatics
1.2.4.1.6. Electrics
1.2.4.1.7. Software
1.2.4.1.8. Quality verification plan
1.2.4.1.9. Operational and maintenance manual
1.2.4.2. Supply Chain Management Process(bought as an assembled entities; all components for one module at once to enable smooth production process and minimize the waste in the production)
1.2.4.2.1. Buy parts
1.2.4.2.2. Make parts
1.2.4.2.3. 3rd party machines/units/modules
1.2.4.2.4. Sub-assemblies
1.2.4.2.5. Packing, if outsourced
1.2.4.3. Production
1.2.4.3.1. Production Planning
1.2.4.3.2. Module based material acquiring
1.2.4.3.3. Module based assemblies
1.2.4.3.4. Machine based assemblies
1.2.4.3.5. Quality verification checklist
1.2.4.3.5.1. Machine safety
1.2.4.3.5.2. Wiring and markings
1.2.4.3.5.3. Mechanical functionality test
1.2.4.3.5.4. Electric components and I/O test
1.2.4.3.5.5. Pneumatic components test and adjustments
1.2.4.3.5.6. Type plate
1.2.4.3.5.7. Company stickers
1.2.4.3.6. Customer product samples availability check

1.2.4.4. Internal Ramp-Up and Test Run
1.2.4.4.1. Software upload
1.2.4.4.2. Mechanical functionality with manual control
1.2.4.4.3. Process functionality
1.2.4.4.4. User interface experience evaluation
1.2.4.4.5. Ergonomics evaluation
1.2.4.4.6. Modifications based on test run loop
1.2.4.4.6.1. Input either to design and/or production team
1.2.4.4.7. CE release signing
1.2.4.5. Customer Pre-Acceptance (FAT) (shipping approval)
1.2.4.5.1. Output is acceptance document
1.2.4.5.2. Invoice to the customer (second payment milestone)
1.2.4.6. Logistics
1.2.4.6.1. Packing
1.2.4.6.2. Documentation
1.2.4.6.3. Shipping or ready to pick-up
1.2.4.7. Customer Final Acceptance (SAT)
1.2.4.7.1. Unpacking
1.2.4.7.2. Installation, ramp-up and test runs
1.2.4.7.3. Customer Final Acceptance test runs
1.2.4.7.3.1. Output is acceptance document
1.2.4.7.3.2. Invoice to the customer (final payment milestone)
1.2.4.7.4. Training
1.2.5. Open Points Marking (Project Plan and OPL to be reviewed in the Project kick-off meeting with the customer)

1.3. Kick-off Meeting Process
1.3.1. Project plan review
1.3.1.1. Project organization with responsibilities and contact information
1.3.1.2. General level technical description
1.3.1.3. Project objectives
1.3.1.4. Project time schedule with current status
1.3.2. Open point list (OPL) review
1.3.2.1. All the machine(s), process and product related technical specs
1.3.2.2. After sales; spare part kits etc. points if customer has any
1.3.2.3. Customer care; special agreements needed
1.3.3. Delivery approval requirements specification review

1.4. Design and Documentation Process (see point 1.2.4.1)

1.5. Internal Design Review Process (no 1, 2, 3… loop)
1.5.1. Design reviews and re-design loop is done as many times as needed to internally agree that the design meets the IPTE quality standards

1.6. Customer Design Review Process (no 1, 2, 3… loop)
1.6.1. Design reviews and re-design loop is done as many times as needed to receive design approval release from the customer
1.6.2. Individual machines and modules can be released separately to the supply chain management process, if approved by the customer.
1.6.3. Standard machines do not need any customer approval, and can be released after order confirmation. Only the possible product specific applications and interfaces need to be reviewed with the customer.

1.7. Supply Chain Management Process (see point 1.2.4.2)

1.8. Production Process (see point 1.2.4.3)

1.9. Internal Ramp-Up and Test Run Process (see point 1.2.4.4)

1.10. Customer Pre-Acceptance Process (FAT) (see point 1.2.4.5)
1.11. Logistics Process (see point 1.2.4.6)
1.12. Customer Final Acceptance Process (SAT) (see point 1.2.4.7)
1.13. Project Closing Process
1.13.1. Customer satisfaction questionnaire
1.13.2. Time schedule review
1.13.3. Budget review
1.13.4. Lessons to learn review
1.13.5. Project budget closing
1.13.6. Design release
1.13.6.1. Input to Product Portfolio Life Cycle Management Process
1.13.6.2. Transferring the responsibility to After sales and Customer care

1. Business Development Process
    1.1. Added Value Development Process
        1.1.1. New Technology Development Project Process
        1.1.2. New Product Development Project Process
        1.1.3. Product Development Project Process
        1.1.4. Service Development Project Process
    1.2. Economics Development Process
        1.2.1. Acquisition Project Process
        1.2.2. Investment Project Process
            1.2.2.1. Internal Investment Project Process
                1.2.2.1.1. Production equipment improvement or change
                1.2.2.1.2. Production facilities improvement or change
                1.2.2.1.3. …
            1.2.2.2. External Investment Project Process
                1.2.2.2.1. Profit-seeking investments
                1.2.2.2.2. Protective against losses investments
                1.2.2.2.3. …
        1.2.3. The Financial Restructuring Project Process
    1.3. Human Knowledge Management Development Process (referring to Appendix 1)
        1.3.1. Human Resources Management Project Process
        1.3.2. Human Resources Development Project Process
    1.4. Management Development Process
        1.4.1. Process Development Process
            1.4.1.1. Process design project process
            1.4.1.2. Process development project process
            1.4.1.3. Process reengineering project process
        1.4.2. Information Technology Development Project Process
        1.4.3. Supply Chain Development Project Process
        1.4.4. Infrastructure Development Project Process
        1.4.5. Quality Development Project Process

1. Product Portfolio Life Cycle Management Process
    1.1. Sales Portfolio Management Process
        1.1.1. Test Business Unit Product Process
        1.1.2. Systems Business Unit Product Process
        1.1.3. Assembly Business Unit Product Process
        1.1.4. Solar Business Unit Product Process
        1.1.5. Service Process
    1.2. Design Library Portfolio Process
        1.2.1. Machine Standardization Process
        1.2.2. Module Standardization Process
        1.2.3. Buy parts Standardization Process
        1.2.4. Make parts Standardization Process
    1.3. Product data and 3D-files Accessibility Management Process
        1.3.1. Sales and Marketing material use
        1.3.2. Design and R&D use
        1.3.3. Supply chain management use
        1.3.4. Production use
        1.3.5. Customer documentation use
        1.3.6. After Sales and Customer care use

1. Business Planning and Control Process
    1.1. Defining of Values
    1.2. Defining of Vision
    1.3. Defining of Mission
    1.4. Defining of Quality Policy
    1.5. Defining of Environmental Policy
    1.6. Defining of Health and Safety Policy
    1.7. Defining of Security Policy
    1.8. Defining of Legal Policy
    1.9. Defining of Strategy Process
        1.9.1. Defining the Strategy Map
            1.9.1.1. Human resources perspective
            1.9.1.2. Process perspective
            1.9.1.3. Customer perspective
            1.9.1.4. Economic perspective
            1.9.1.5. Business unit / product perspective
        1.9.2. Evaluation of the Changes in the Markets
            1.9.2.1. Recognize the driving forces
            1.9.2.2. Identify stakeholders' needs
            1.9.2.3. Perform internal SWOT
            1.9.2.4. Evaluate and define the objectives
            1.9.2.5. Create an action plan (input to yearly planning)
            1.9.2.6. Follow the realization
            1.9.2.7. Make necessary changes (output updated action plan)
        1.9.3. …
    1.10. Yearly Planning
        1.10.1. Competitor Analyses
        1.10.2. Investing In People (IIP) development discussions
        1.10.3. Management Review
        1.10.4. Supply Chain Evaluation
        1.10.5. Arrange activity with customers and potential customers
        1.10.6. Customer satisfaction evaluation
        1.10.7. EFQM-evaluation
        1.10.8. Budget definition
        1.10.9. External auditing
        1.10.10. Management review
        1.10.11. Business plan confirmation
        1.10.12. Budget confirmation
        1.10.13. Preliminary balance sheet
        1.10.14. Internal auditing
        1.10.15. Employees meeting
        1.10.16. Employees satisfaction evaluation
        1.10.17. Balance sheet
        1.10.18. …
    1.11. Defining of Meters
        1.11.1. Customer and/or Business Unit account monitoring objectives
        1.11.2. Strategic monitoring objectives
        1.11.3. Operative monitoring objectives
        1.11.4. Personnel monitoring objectives

1. Human Knowledge Management Process
    1.1. Human resource management process
        1.1.1. Recruitment process
            1.1.1.1. Definition of job description process
            1.1.1.2. Recruitment permission applying process
            1.1.1.3. Determination of recruitment channels and methods
            1.1.1.4. Apply process
            1.1.1.5. Selection process
                1.1.1.5.1. Classification of applications process
                1.1.1.5.2. 1. interview (e.g. the top 10) process
                1.1.1.5.3. 2. interview (e.g. the top three) process
                1.1.1.5.4. Suitability tests process
                    1.1.1.5.4.1. External process by sub-contractor
                1.1.1.5.5. Final interview and contract signing process
        1.1.2. New employee training process
        1.1.3. Work tool management process
        1.1.4. Performance monitoring and rewarding process
        1.1.5. Resource allocation process
        1.1.6. Travel and assignment process
        1.1.7. Work well-being and safety process
        1.1.8. Termination of employment process
    1.2. Human resource development process
        1.2.1. Resource needs and skills of forecasting process
        1.2.2. Investing In People and feedback process
        1.2.3. Training process
        1.2.4. Career planning and recycling process

1. Information Technology Management Process
    1.1. Business Management Systems Process
        1.1.1. PDM system
        1.1.2. Warehouse Management system
        1.1.3. Working hours register system
        1.1.4. Production planning system
        1.1.5. …
    1.2. Information Technology Tools Maintenance Process
        1.2.1. Intranet
        1.2.2. Extranet
        1.2.3. Internet
        1.2.4. VPN connection
        1.2.5. Servers
        1.2.6. Hardware
            1.2.6.1. Personal computers
            1.2.6.2. Mobile phones
            1.2.6.3. Video projectors
            1.2.6.4. Telecom meeting equipment
            1.2.6.5. Electronic keys
            1.2.6.6. Other accessories
                1.2.6.6.1. Mouse
                1.2.6.6.2. Keyboard
                1.2.6.6.3. Hands free
                1.2.6.6.4. Battery chargers
                1.2.6.6.5. etc
        1.2.7. Software’s and critical updates
            1.2.7.1. Office software
            1.2.7.2. Business software’s
            1.2.7.3. Design software’s
    1.3. IT Support Request Process
        1.3.1. Problem description with priority
        1.3.2. Problem analyzing
        1.3.3. Problem solving
            1.3.3.1. Internally
            1.3.3.2. Externally
        1.3.4. Providing a solution
        1.3.5. Support request closing after confirmation

1. Supply Chain Management Process
    1.1. Suppliers Selection Process
        1.1.1. Definition of Selection Criteria's Process
            1.1.1.1. Buy parts
                1.1.1.1.1. Control components
                1.1.1.1.2. Mechanic components
                1.1.1.1.3. Electric components
                1.1.1.1.4. Pneumatic components
                1.1.1.1.5. Production equipment
                1.1.1.1.6. …
            1.1.1.2. Make parts
                1.1.1.2.1. Sheet metal parts
                1.1.1.2.2. Machining parts
                1.1.1.2.3. Cast parts
                1.1.1.2.4. Plastic parts
                1.1.1.2.5. …
            1.1.1.3. Sub-contractors
                1.1.1.3.1. …
        1.1.2. Identifying Potential Suppliers Process
        1.1.3. Evaluate the Criticality Process
        1.1.4. Experimental Order and Evaluation Process
        1.1.5. Supplier Release Process
        1.1.6. Continuous Monitoring and Evaluation Process loop
    1.2. Sourcing
        1.2.1. Request For Quotation (for approved suppliers)
        1.2.2. Selection of the supplier based on price, delivery time and quality
        1.2.3. Order
        1.2.4. Order received to IPTE warehouse
        1.2.5. Quality check
        1.2.6. Move to correct project shelf
        1.2.7. Supplier invoice approval

1. Infrastructure Management Process
    1.1. Factories
        1.1.1. Europe
            1.1.1.1. …
        1.1.2. America
            1.1.2.1. …
        1.1.3. Asia
            1.1.3.1. …
    1.2. Sales and Support offices
        1.2.1. Europe
            1.2.1.1. …
        1.2.2. America
            1.2.2.1. …
        1.2.3. Asia
            1.2.3.1. …
    1.3. New Factory or Office Establishment Request Process
        1.3.1. Technical requirements
        1.3.2. Location
        1.3.3. Time schedule
        1.3.4. Budget
            1.3.4.1. Rent facilities
            1.3.4.2. Build new facilities
        1.3.5. Green values
    1.4. Infrastructure Maintenance Request Process

1. Quality Management Process
   1.1. Quality Planning
   1.2. Quality Control
   1.3. Quality Assurance
   1.4. Quality Improvement