STORK

A Fluor Company

UNIVERSITY OF TWENTE.

Reengineering the order to cash process

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Preface

For my bachelor graduation assignment, I have conducted my research from the last week of May until the 19th of August at Stork Colombia in Bogota. I would like to thank Drs. Rik Ellenbroek for giving me this opportunity abroad and the chance to do my final presentation for the senior management of Stork Colombia. Next, I would like to thank MSc. Bas Raemakers, my supervisor within Stork, for his guidance throughout my assignment. Further, I would like to thank MSc. Nicolas Isaza for taking the time to answer so many of my questions. Last, I would like to thank the SAP team for being such nice and kind colleagues.

I would also like to thank my UT-supervisors Prof. Dr. Maria Iacob and Dr. Lucas Meertens for their support, valuable input via the skype sessions and feedback on my (draft) reports.

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Management summary

One of Stork Colombia its key concerns regarding its Order to Cash (OTC) process is that employees often deviate from the standard processes. Besides this, resulting from all the labor intensive 'manual handling' frequently errors are being made. Based on these problems, the following main research question has been established:

> **"*How does an improved standardized order to cash (OTC) process look like for Stork Branch?".***

By definition, the OTC process starts from the moment an order is received and ends when payment has been received and credited.

During the bachelor assignment, and still ongoing, a SAP ByDesign implementation was/is happening in which I have also participated. The BPE method (BiZZdesign, 2008) has been used to search in a systematic way for aspects of the current OTC process that could be improved in order to answer my main research question. The BPE method consists of four phases: the innovation-, the analysis-, the (re)design- and the migration phase. For the last three phases, the main research question has been split into the following sub-questions:

1) *How does the current OTC process look like?*
2) *How can the current OTC process, with respect to the improvement goals of Stork, be analyzed?*
3) *How can the to-be situation of the OTC process be envisioned?*
4) *To what extend are the KPI's related to the extended balanced scorecard improved compared to the 'as is' situation?*
5) *To what extend do the SAP ByDesign implementation and business process reengineering changes contribute to Stork's improvement goals?*

At first a systematic literature review has been conducted in business process modelling notations (BPMN), business process reengineering best practices and business process performance measurement models, of which the results have been discussed in chapter 2. Next, Bizagi modeler, which uses BPMN, has been used to visualize the current OTC process. Because the OTC process is a large and complex process, it has been split up into 4 sub-processes which are explained at the start of chapter 3. The next step, was to design the 'to-be' OTC sub-process models. These have been created with Bizagi modeler as well, using the current OTC sub-process models as a basis with the following additional supporting inputs:

- *Input for bottle-necks from the departments involved in the OTC process.*
- *Flow charts of the OTC process from Stork Australia (which recently had a successful SAP ByDesign implementation).*
- *Input from SAP ByDesign itself (the to-be OTC process had to be supported by SAP ByDesign).*
- *Stork's improvement goals* as seen in section 1.3.
- *Identified problems within Stork.*

The redesigned sub-process models can be found in chapter 4. Each change has been numbered and provided with a description and explanation for change. To validate improvement, the extended balanced scorecard performance measurement model as seen in chapter 2 has been used. KPI's for each segment of the extended BSC relevant to the OTC process have been compared for the current and to-be situation. These KPI values have been obtained by both running simulations in Bizagi modeler simulation view and 'educated guesses'. A summary of the most important improvements per OTC cycle can be found in Table 1.

KPI per segment of extended BSC	Current situation	To-be situation
Customer performance		
Return rate	😐	☺
Time-related process performance:		
Process duration	137 days	128 days
Cost-related process performance:		
Process cost (COP)	18.9 mln COP	14,4 mln COP
Process-performance related to internal quality:		
Rework time	10.22 days	0.03 days
(Digital) innovation performance:		
Reduction processing time to computerization	-	45.69 hours
Employee performance:		
Resource utilization	See section 5.5	See section 5.5

Table 1: Most important improvements KPI values extended BSC

Next, to show how the SAP ByDesign implementation and business process reengineering changes are expected to contribute to Stork Branch its improvement goals, a business case has been written. The business case shows amongst other things a table with benefits for the OTC process in which individual benefits are linked to one or more of the improvement goals. Moreover, the business case shows that the SAP ByDesign investment for Stork Branch will break-even after 3.5 - 4.85 years. This is acceptable because the key justification for the project was compliance and the project has always been seen as a license to operate (LTO) project. Last, an implementation plan has been provided showing that the following needs to be carried out before SAP ByDesign can go live: the last remaining by key users identified problems need to be solved, two more data loads need to be transferred into the system, the integral testing needs to be carried out, authorizations need to be implemented, training content needs to be developed, user acceptance testing needs to be carried out and users have to be trained.

1. Introduction

1.1 Background Stork

Stork is a provider of a broad range of (technical) services which aims to improve its client's asset performance, safety and cost-efficiency. It is predominantly active in the following markets: oil and gas, chemicals and process, metals and mining, power, and manufacturing industries. Stork Colombia originated in 2012 when Stork acquired the last shares of the local Colombian Engineering and Maintenance company called MASA (Portafolio, 2007). Later, Stork Colombia expanded with another division called "Stork Branch". Stork branch provides exactly the same services as MASA but has been added because of the value Stork's reputation holds. To give an indication of the sizes of both divisions: MASA has over a hundred big contracts and Stork Branch has only six. The bachelor assignment has solely focused on Stork Branch and serves as a pilot for MASA later on (the latter won't be part of my bachelor assignment).

1.2 Problem description

At the moment, Stork Colombia experiences a discrepancy between the actual monthly income and associated cash collection versus its norm. In consultation with the CFO of Stork Americas, a problem cluster (Appendix A) has been created to see what/how problems contribute to this discrepancy. The main focus will be on the lack of standard processes as it appears twice in the problem cluster in both branches.

To solve this problem, the order to cash (OTC) process has been reviewed, which involves the activities and processes that take place from the time an order is placed by a customer until payment is received and credited (Technology training limited, sd). The problem has been tackled through application of business process reengineering (see section 1.4) to the current situation of the OTC process. Moreover, I have also participated in a SAP ByDesign implementation which was happening at the same time, from which certain requirements were also taken into account in (re)designing the to-be OTC process.

1.3 Research goal

The goal of this bachelor assignment was to create an improved, standardized order to cash process for Stork Branch. This improvement has been obtained through the application of business process reengineering with amongst other things a focus on Stork's improvement goals per pillar of its strategy which can be seen in Figure 1 below.

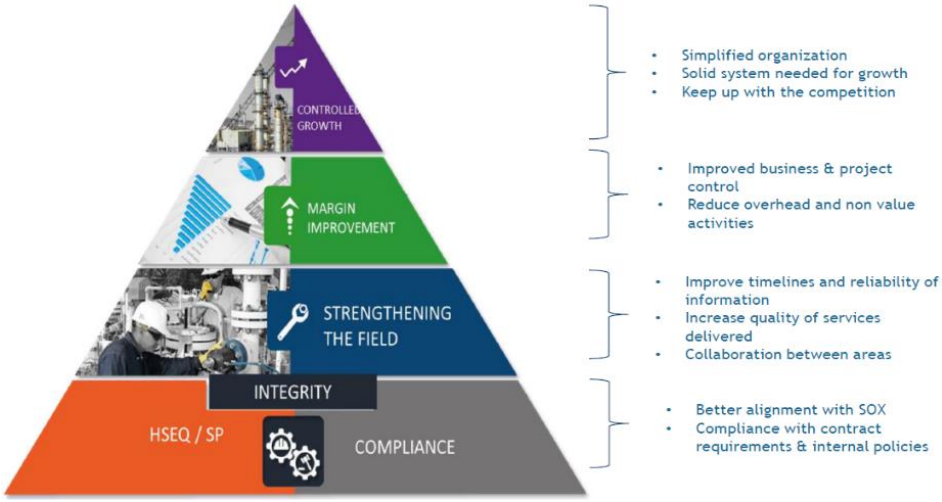


Figure 1: Improvement goals Stork per pillar of its strategy with the SAP/business process reengineering implementation.

1.4 Research methodology

The methodology used to improve the current OTC process is that of the BPE method of BiZZdesign (BiZZdesign, 2008):

> *The BPE method* (BiZZdesign, 2008) *is a business process reengineering methodology that consists of four phases: innovation, analysis, redesign and migration:*

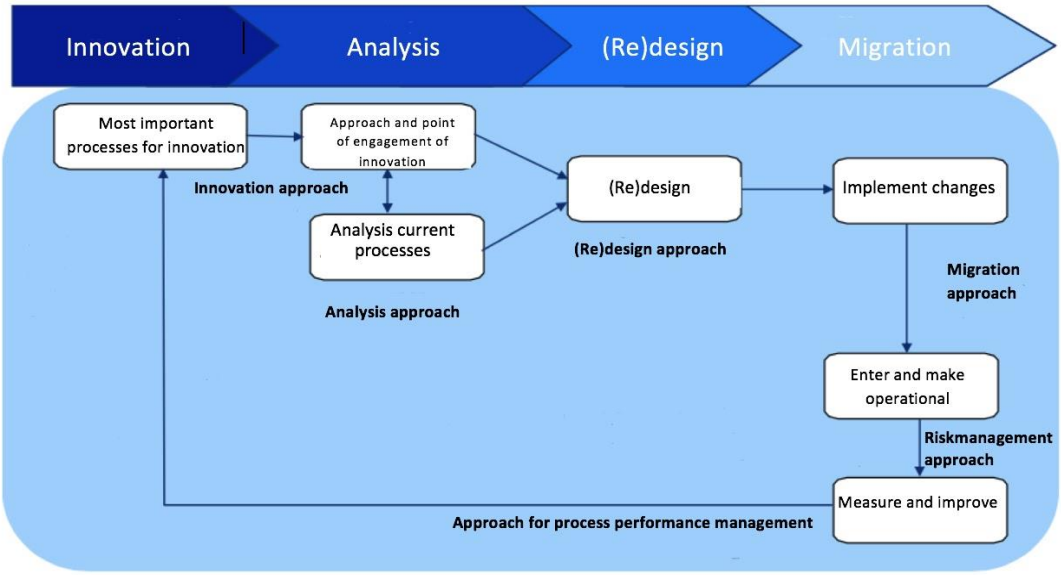


Figure 2: BPE method

- *The innovation phase gives a structured approach to generate ideas to renew, change or improve aspects of a business. In this case, the company already has identified the following problems "the lack of standardization of processes, lots of errors as a result of mostly manual tasks and labour intensity" which have been used as input for application of the BPE method.*

- *The analysis phase provides a structured approach to analyse the current situation. During this phase, a path of change has been created, analysis tools were determined and necessary process models of the current situation have been drafted. Next, these process models were analysed for bottlenecks and causes for the bottlenecks had been sought in the current way of business. Last, evaluation of these bottlenecks has taken place.*

- *The (re)design phase starts with determining the change. First, the essential process actions and dependencies were determined from the current situation models by talking to different departments. These were the basis for the to-be sub-processes. A more detailed description about how the redesigning process has taken place can be found at the beginning of chapter 4. Moreover, the redesigned sub-process models can be found throughout chapter 4 with explanation of- and for change.*

- *The migration phase is the last phase of the BPE method. During this phase, normally a plan for implementation of the redesigned process will be created, products will be developed and the redesigned process will be implemented. Because the actual SAP ByDesign- and process implementation will take place after this bachelor assignment, only an implementation plan (chapter 7) and improvement validation (chapter 5) have been created/carried out during this phase.*

1.5 Research questions

In this section, the main research question and sub-questions derived from it have been discussed. The main research question of my bachelor assignment was the following:

"***How does an improved standardized OTC process look like for Stork Branch?***"

Improved in this context means improvement according to the improvement goals set by Stork as seen in Figure 1. In order to be able to answer the main question a few sub-questions had to be answered first which have been listed below. For each sub question a short description is given of where the question will be answered and how.

1. *How does the current OTC process look like?*
   This question has been answered in chapter 3 where models and descriptions of all current sub-processes of the OTC process can be found.

2. *How can the current OTC process, with respect to the improvement goals of Stork, be analyzed?*
   In chapter 2 (the literature study) BPMN notations, business process reengineering best practices and performance measurement models and KPI's have been discussed which have been used to analyze the current OTC process.

3. *How can the to-be situation of the OTC process be envisioned?*
   This question has been answered in chapter 4. At the beginning of chapter 4 an explanation is provided of how the OTC process has been reengineered. Moreover, throughout the rest of chapter 4, Bizagi models of the to-be situation are shown in which the changes have been marked and reason for change has been explained. There are two types of changes in the to-be situation: SAP ByDesign changes (marked blue) and reengineering changes (marked red).

4. *To what extend are the KPI's related to the extended balanced scorecard improved compared to the 'as is' situation?*
   This question has been answered in chapter 5. In section 5.6, a table is provided that compares KPIs related to the extended balanced scorecard (as seen in Appendix B) for both the current and to-be situation. These KPI values have been obtained by both running simulations in Bizagi modeler and educated guesses for the KPIs on which the simulations did not produce data.

5. *To what extend do the SAP ByDesign implementation and business process reengineering changes contribute to Stork's improvement goals?*
   This question has been answered in chapter 6, in which a business case has been written. In this business case, amongst other things, a OTC benefit table has been provided in which each individual benefit is linked to one or multiple of Stork Branch its improvement goals.

1.6 Structure of the report

The structure of the report can be found in the table below: for each of the phases of the BPE method, the chapter in which the respective phase has been discussed and the sub-question that is related to the respective phase are shown.

	Innovation	Analysis	(Re)design	Migration
Chapter	1	2,3	4	5,7
Sub-question	-	1,2	3	4,5

Table 2: Report structure

2. Literature study

This chapter contains a literature study on the following topics. First of all, business process modelling notations have been discussed which have been used to visualize the current- and to-be OTC process. Next, business process reengineering best practices have been discussed. Last, there has been looked into business process performance measurement models and KPI's.

2.1 Business process modelling notations

In this section, BPM notations that could be used to model the OTC process have been investigated. Below an example of an order fulfilment process (Object management group (OMG), 2010), which is part of the OTC process, has been given in BPM notations. BPM notations have been explained by going through the example process below, from which lacking notations have been added at the end of this section.

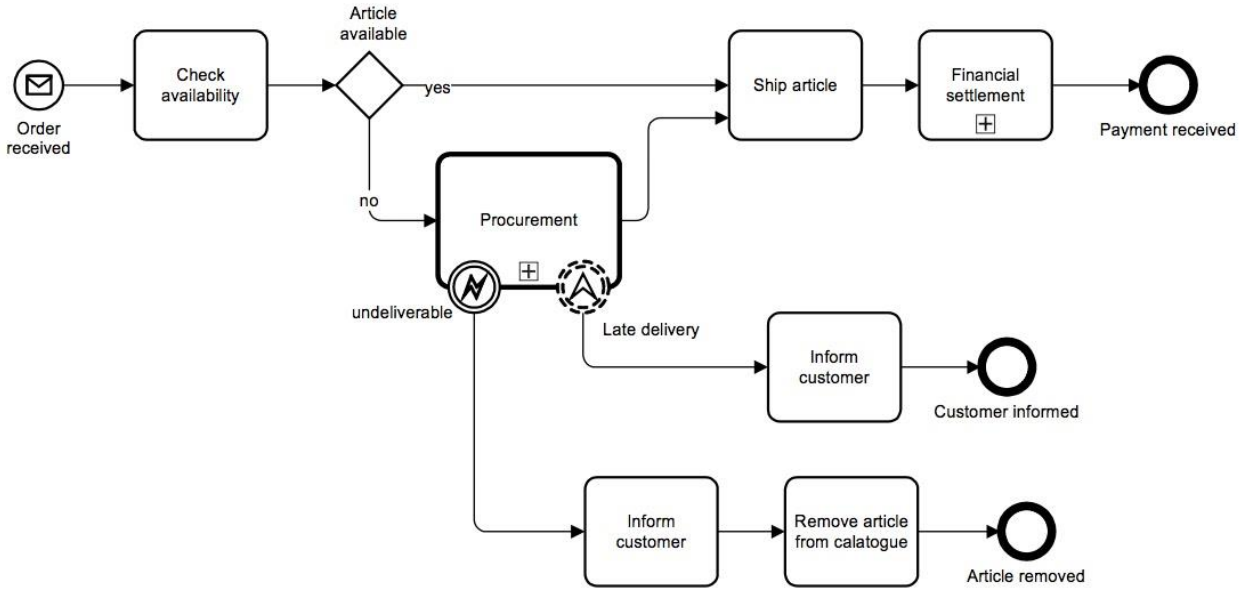


Figure 3: Example of order fulfilment process

Every process is initiated with an event, which is denoted as a circle and represents something that happens (compared to an activity, which is something that is done). There are three types of events: start-, intermediate- and end events. A start event is displayed as a circle with a single thin line and indicates where the process starts. An intermediate event is displayed as a double-lined circle and appears between the start- and end event. An end event is displayed as a circle with a thick line and indicates the end of a process.

Figure 4: Start-, intermediate- and end event

Icons within the circle denote the type of event (Stiehl), in this case the process starts with a message containing the order. Figure 5 on the page below shows all possible types of events (BPM offensive Berlin).

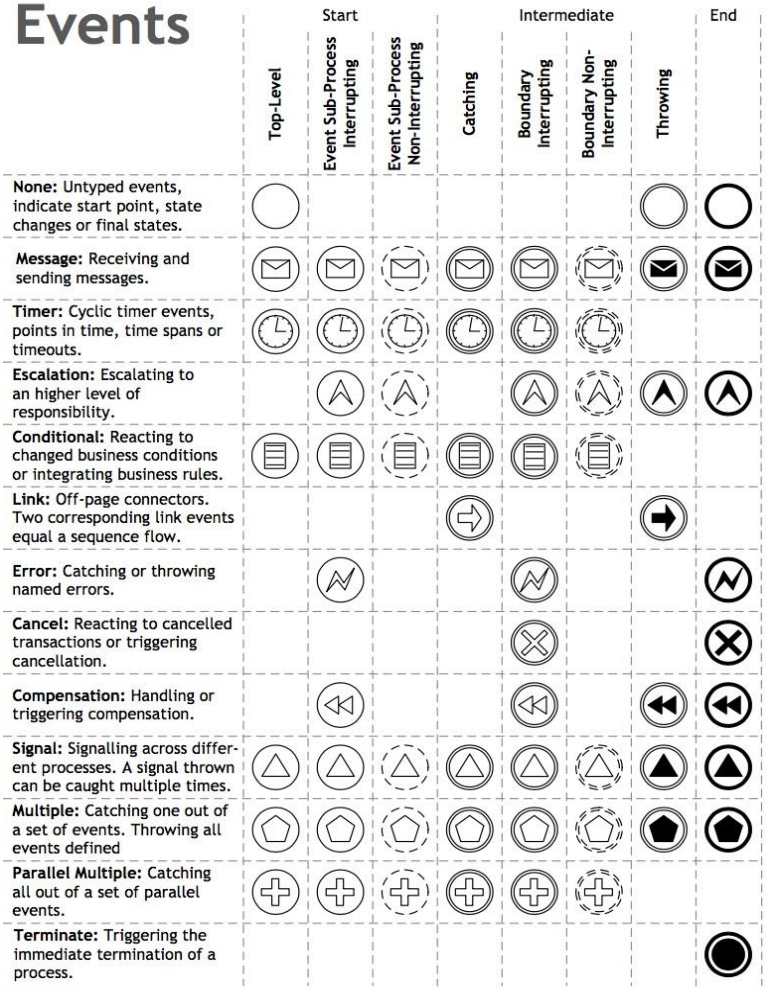


Figure 5: Types of events

Next, availability of the order will be checked. This is a task. Tasks are denoted as a square in which activity markers and task types can be specified with symbols as seen in Figure 6. Activity markers indicate execution behavior of tasks and their symbols are displayed at the bottom of a task square (BPM offensive Berlin). Task types specify the nature of the task to be performed and appear at the left top corner of a task square.

Figure 6: Activity markers and task types

The task types as seen in Figure 6 have the following meaning (Stiehl):

- Send task. This is used to model tasks of sending messages to process participants.
- Receive task. This task is used when a message must be received from process participants before continuing.
- User task. The user performs a task with the assistance of application programs.
- Manual task. These tasks are performed without any computer support.
- Business rule task. Business rules can be used to capture decision logic in preparation for gateway decisions, and to make the result available to the gateway. This way business rules can be changed easily and independent of the process model.
- Service task. This is a task that uses some sort of automated service which can be a web service or some other automated application function.
- Script task. This type of task enables scripts to run in the process engine itself and lets the task end once the execution of the script is completed.

After the order availability is checked in Figure 3, the process reaches a gateway which is denoted as a diamond. Gateways determine forking and merging of paths depending on the conditions expressed in the diamond. The diamond seen in Figure 3 is an exclusive gateway. When splitting, this gateway sends outgoing flow to one of the branches and when merging it awaits input from one branch before triggering outgoing flow. Besides the exclusive gateway, there are a few other gateways which are displayed in Figure 7. After the gateway in Figure 3 , the order fulfilment process follows one of three paths depending on the conditions as stated in the model. It passes a few more tasks before reaching the end event.

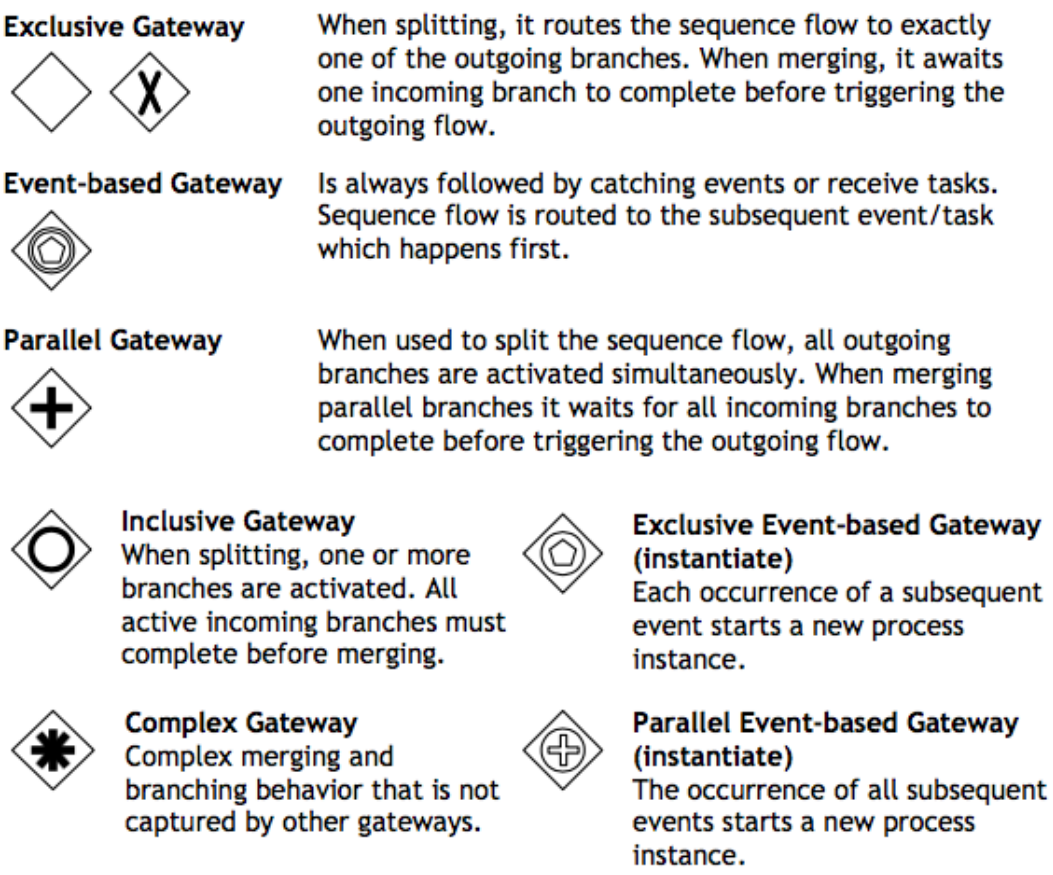


Figure 7: Types of gateways (BPM offensive Berlin)

Events, tasks and gateways are connected with arrows. Regular arrows (sequence flow) as seen in Figure 8 define the execution order of activities. Furthermore, default flow, conditional flow and message flow exist (BPM offensive Berlin). When default flow is used in a branch, the branch will only be chosen if the condition of the other branch(es) is evaluated to be false. When conditional flow is used, the respective branch that uses this will only be activated if the condition is met. Message flow is used to show the flow of messages between multiple processes (pools) and their collaboration.

Figure 8: Types of flow

It is very common that multiple different parties are involved in a process whom are responsible for the execution of certain tasks. These parties are represented in pools and lanes of which the latter is a subset of the first (Stiehl). A pool/lane can be an organization, a process, a role or a system. Information exchange between pools takes place through message flow.

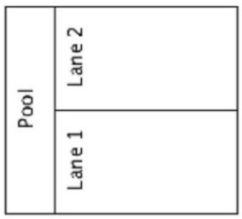


Figure 9: Symbol for pool and lanes

Furthermore, data objects and data store notations can be used in modelling the OTC process. A data object represents information flowing through the process. A data store is a place where a process can read or write data and persists beyond the lifetime of the process instance. The symbols for the data object and data store can be seen below (Stiehl).

Figure 10: The symbols for data store (left) and data object (right)

2.2 Business process reengineering best practices

Below a table is shown that lists best business process reengineering practices (Hanafizadeh, Moosakhani, & Bakhshi) to improve on both cost and time, which are two of Stork's improvement goals (improve timelines and keep up with competition). After this, a short description of each of these best practices will be given.

	Prompt response	Cost leadership
First priority	1. Centralization	1. Interfacing
	2. Outsourcing	2. Re-composition
	3. Interfacing	3. Triage
		4. Task composition
Second priority	4. Re-composition	5. Empower
	5. Flexible assignment	6. Integration
	6. Contact reduction	7. Control addition
	7. Task elimination	8. Task elimination
	8. Empower	
	9. Task automation	
Third priority	10. Integral technology	9. Order types
	11. Parallelism	10. Trusted party
	12. Order-based work	11. Outsourcing
		12. Knock-out

Figure 11: The best practices for redesigning, ranked to suitability with company strategy

The best practices seen in Figure 11 have the following meaning (Hanafizadeh, Moosakhani, & Bakhshi):

- **Contact reduction**. Reducing physical contact with customers and third parties.
- **Order types**. Determining the tasks that are related in an order and designing new processes if necessary.
- T**ask elimination**. Eliminating unnecessary tasks from a process (the tasks with no added value for customers).
- **Order-based work**. Eliminating the batch-processing and periodic activities from a process.
- **Triage**. Putting a part of a general task in two or more substitute duties or merging two or more substitute duties in one general task.
- **Task composition**. Synthesizing small tasks in composite tasks and breaking down big tasks into small practical ones.
- **Resequencing**. Task relocation to the proper areas.
- **Knock-out**. Recognizing the knock-out sections and maintaining them.
- **Parallelism**. Considering whether tasks can be done in a process in parallel.
- **Order assignment**. Letting the employees do the stages of single orders themselves if they have the required ability.
- **Flexible assignment**. Resource assignment in a way that maximizes the flexibility for the near future.
- **Centralization.** Dispersing the resources if they are geographically centralized.
- **Split responsibilities**. Avoiding submitting the tasks to the individuals of other units.
- **Customer teams**. Employing teams except departmental workers to completely handle special orders.
- **Numerical involvement or participation**. Minimizing the number of units, groups and individuals involved in a business process.
- **Specialization generalization**. Providing many general and professional resources.
- **Empower.** Entrusting most decision-makings to employees and reducing the middle management.
- **Control addition**. Controlling the completeness (entirety) and accuracy of inputs and controlling the outputs before distributing to customers.
- **Buffering**. Instead of receiving information from an external resource, make it safe by up-dating.
- **Task automation**. Automating the tasks will increase the speed of handling the orders with lower cost and better result.
- **Integral technology**. Efforts to omit physical constraints on a process by applying new technologies.
- **Trusted party**. Instead of making decisions based on your own information, use the results obtained by creditable sections.
- **Outsourcing**. Outsourcing a part of or the whole of a business process.
- I**nterfacing**. Standardized relations with customers and partners.

2.3 Business process performance

This section of the literature review aims at providing an approach to measure the performance of the OTC process in its current and to-be situation. This allows the impact of the bachelor assignment to be quantified.

2.3.1 Performance measurement models

There are multiple performance measurement models of which the most used one is the balanced scorecard (BSC). Other measurement models are: self-assessment excellence models such as EFQM, the models by Cross and Lynch, Kueng, Neely et al and Dumas et al (Looy & Shafagatova, 2016). The BSC, Cross and Lynch- and EFQM model focus on organizational performance while Kueng, Neely et al and Dumas et al. focus only a single business process.

The balanced scorecard (BSC) is developed by (Kaplan & Norton, 2001) and takes a four-dimensional approach to organizational performance: (1) financial perspective, (2) customer perspective, (3) internal business process perspective, and (4) "learning and growth" perspective (Looy & Shafagatova, 2016). Indicators belonging to the financial and customer perspectives are assumed to measure performance outcomes, whereas indicators from the perspectives of internal business processes and "learning and growth" are considered as typical performance drivers. The BSC helps translate an organization's strategy into operational performance indicators (also called performance measures or metrics) and objectives with targets for each of these performance perspectives (Looy & Shafagatova, 2016).

The EFQM model distinguishes enablers [i.e., (1) leadership, (2) people, (3) strategy, (4) partnerships and resources, and (5) processes, products and services] from results [i.e., (1) people results, (2) customer results, (3) society results, and (4) key results], and a feedback loop for learning, creativity and innovation.

(Cross & Lynch, 1988) offer a four-level performance pyramid: (1) a top level with a vision, (2) a second level with objectives per business unit in market and financial terms, (3) a third level with objectives per business operating system in terms of customer satisfaction, flexibility and productivity, and (4) a bottom level with operational objectives for quality, delivery, process time and costs.

The process performance measurement system of Kueng (Kueng, 2000) is also of high importance, which is visualized as a "goal and performance indicator tree" with five process performance perspectives: (1) financial view, (2) customer view, (3) employee view, (4) societal view, and (5) innovation view. Kueng (2000) thus suggests a more holistic approach towards process performance, similar to organizational performance, given the central role of business processes in an organization. He does so by focusing more on the different stakeholders involved in certain business processes.

Next, Neely et al. (2000) present ten steps to develop or define process performance indicators.

Last, according to Dumas et al. the performance perspectives of business process management are time, cost, quality and flexibility.

2.3.2 Criticism on performance measurement models above

Performance measurement models tend to give little guidance on how business (process) performance indicators can be chosen and operationalized (Shah, Etienne, Siadat, & Vernadat, 2012). They are limited to mainly defining performance perspectives, possibly with some examples or steps to derive performance indicators (Neely, et al., 2010) but without offering concrete indicators. To some extent, this lack of guidance can be explained by the fact that performance indicators are considered organization-dependent, given that strategic alignment is claimed by many measurement models such as the BSC (Kaplan and Norton 1996, 2001).

2.3.3 Criticism balanced scorecard

The BSC is criticized for appearing too general by managers who are challenged to adapt it to the culture of their organization (Butler, Letza, & Neale, 1997) or find suitable indicators to capture the various aspects of their organization's strategy. In addition, the BSC gets criticized for not being comprehensive; due to the exclusion of for example environmental aspects, supply-chain management aspects and/or cross-organizational processes (Looy & Shafagatova, 2016).

2.3.4 Solution

Looy and Shafagatova have conducted a literature review which resulted in a list of indicators which can be found in Appendix B (Looy & Shafagatova, 2016). In addition, the BSC has been extended in response to the criticism of missing perspectives (Looy & Shafagatova, 2016). To measure the performance of the OTC process, there has been made use of this extended BSC. This because the extended BSC allows improvement of the OTC process to be aligned best with the overall company strategy as it takes more perspectives into account than any of the other performance measurement models. However, for the OTC process the supplier performance and flexibility-related process performance segments are not applicable and will not be used. The supplier segment is not applicable because there is no supplier in the OTC process. Moreover, the flexibility-related process performance segment does not apply to the OTC process as is used to measure the amount of special cases/requests and within Stork every contract/project/sales order is very specific and completely different.

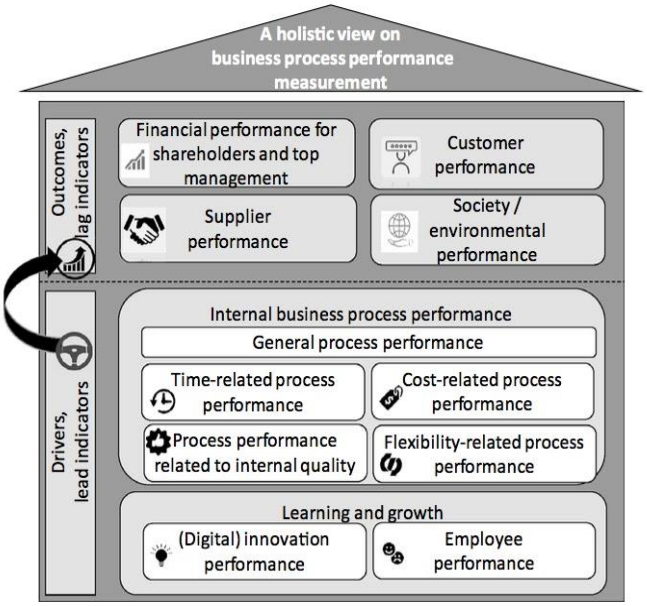


Figure 12: Extended BSC

3. Current situation analysis

The order to cash process is an umbrella term for multiple processes from the moment an order is received until payment has been collected (Technology training limited, sd). Stork has split the OTC process into four sub processes that can be seen at the top of the Figure 13. At the bottom of Figure 13, the starting- and end point of each of the four sub processes can be seen.

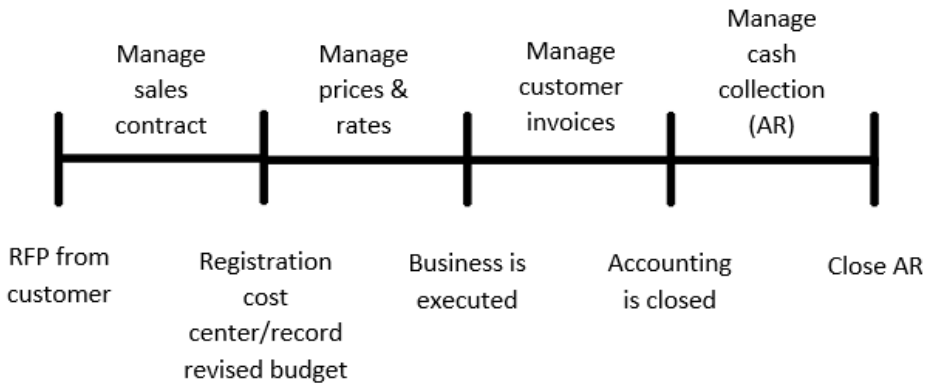


Figure 13: Sub-processes of the OTC process defined by Stork.

In this chapter, each of these sub-processes have been individually modelled and described. The reason the OTC process has been split up is because these sub-processes already are a big process on their own and if all would have been modelled together it would have been very difficult to interpret the complex model and keep the overview.

Description current systems
In the current OTC process four systems are used: CRM, Kactus, Seven and Xpress.

1) CRM, which stands for Customer Relationship Management, is a brand new system for Stork as it has been implemented in Stork worldwide last year November. This system is used by the commercial department in the opportunity exploration- and bidding phase. Also, in the current situation, all approvals for new contracts (except for some purchase orders which go in the Seven system) go through this system.
2) The Seven system is the current “ERP system”. In the current situation it is used purely for accounting and almost everything has to be done manually in the system.
3) Kactus is the pay-roll system. Per month this system automatically registers 45 hours work per FTE for which over-/under hours are added/subtracted manually with an Excel sheet.
4) Xpress, this is the tool used by the legal&compliance manager to do a legal check of a new client.

Description certain actors

In the current/to-be OTC process there are a few actors that have a similar function title: the project administrator, the project controller, the professional planner, the project coordinator, the project manager and the line operational manager. These roles have been discussed shortly below to prevent confusion.

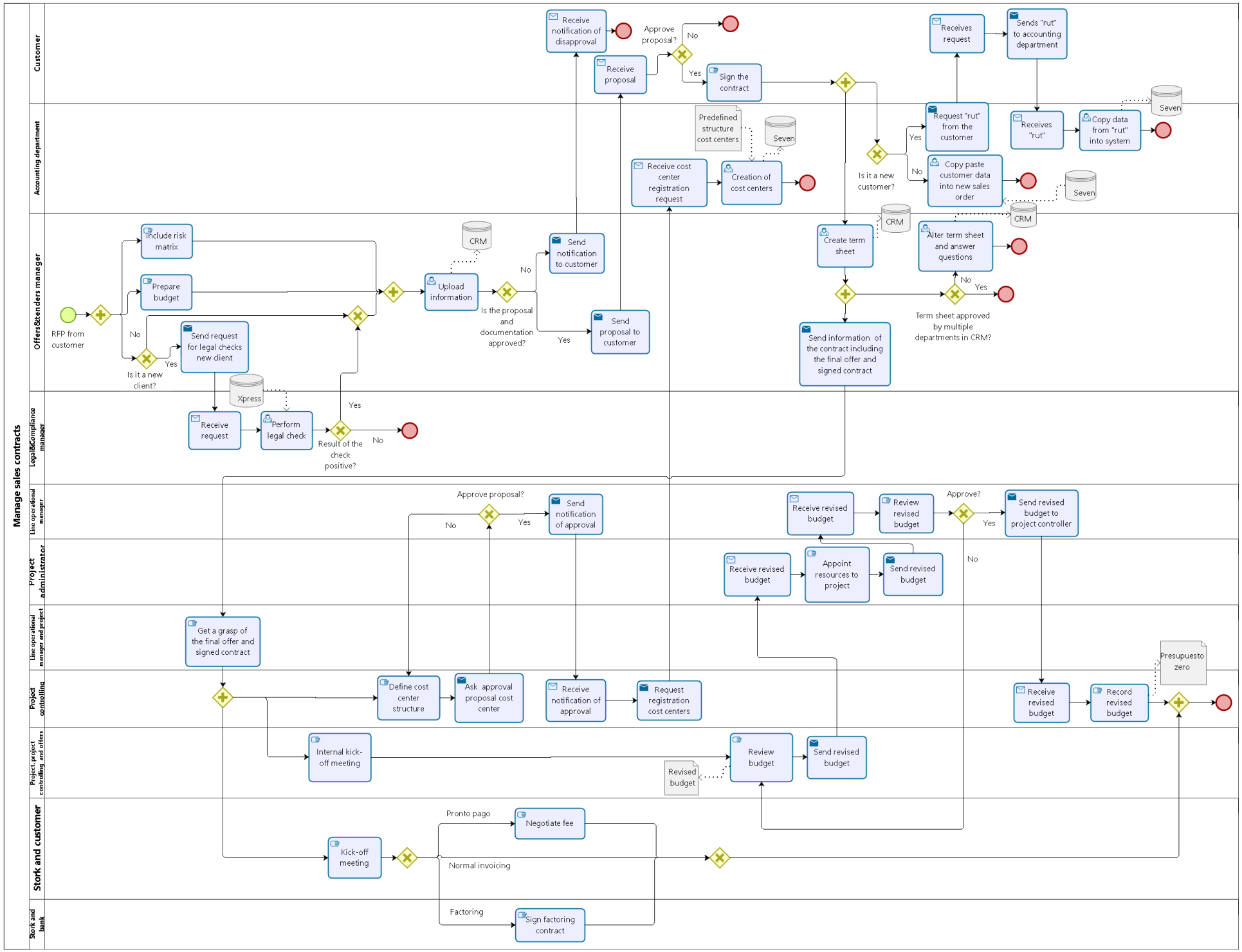
1) **Project administrator**. Every project has one project administrator independent of the project size. The project administrator is located in the field and does all the administrative- and financial tasks for a project.
2) **Project controller**. The project controller function is based in the main office in Bogota. The project controller checks financial statements for multiple projects.
3) **Professional planner**. The professional planner plans the whole project, makes sure that the resources are at the right time in the right place and makes sure that work is performed in the right order.
4) **Project coordinator**. The project coordinator function is below the project manager's in the hierarchy. He/she reports to the project manager and is responsible for a part of the project. A project can have multiple project coordinators depending on its size.
5) **Project manager**. The project manager is also based in the field together with the project administrator. Just like the project administrator function, every project has one project manager. Opposed to the project administrator which function is more internally, the project manager is more directed towards the customer and overall responsible for the successful and profitable delivery of the project.
6) **Line operational manager**. The line operational manager is the boss of all project managers. At the moment Stork Branch has three regions (Bogota, Yopal and Neiva) and for each region, except for Bogota, one line operational manager. The reason Bogota does not have a line operational manager is because there are no projects based in Bogota, only the main office with overhead employees.

3.1 Manage sales contracts

Description of the process
The manage sales contracts process starts when the customer sends a “request for proposal”. This is a document containing the information about the service/project the customer would like to have fulfilled. Once Stork receives this document it does a few tasks simultaneously: a risk matrix for the project is included, a budget is prepared and a legal check, if it is a new client, will be performed. This legal check will be performed in a tool called Xpress. Once these three tasks have been performed, the outcome is uploaded in CRM to which multiple departments of the company, depending on the contract size, have access too. These parties have to approve the information that has been uploaded in CRM, if they don’t approve it, the customer receives a notification of disapproval in the form of a polite letter and the process ends. However, if the information does get approved, a proposal will be send to the customer. The customer receives this proposal and reviews it, if he/she doesn’t approve it, the process ends. If the customer does approve the proposal, he/she signs the contract and two things will happen simultaneously afterwards.

First a customer is created in Seven. There will be looked if it is a new customer or an existing one. If it is an existing customer, data from previous sales-/project orders will be copy-pasted into the new order. If it is a new customer, which happens on average two times per year, the accounting department will request the rut from the customer. This is a Colombian Tax document that contains all information about the customer. The customer sends this document to the accounting department who will then copy its data into the Seven system after which this branch of the sub-process ends. Second, a term sheet is created by the offers&tenders department which is uploaded in CRM. After which both simultaneously, an approval of the term sheet from multiple departments is required again in CRM (depending on the size/complexity) and information is send to the line operational manager and project about the final offer and signed contract. If the term sheet is not approved or questions are raised, the term sheet has to be altered and/or the questions have to be answered until it is approved.

After the line operational manager and project have got a good grasp of the final offer and signed contract, three things happen simultaneously. First, project controlling defines a cost/profit center structure which will be send to the line operational manager for approval. If the line operational manager does not approve the structure, the project controller has to alter the defined cost/profit center structure and send it for approval again. If it is approved, notification is send to project controlling who then requests the creation of the cost/profit centers by the accounting department. Once the accounting department creates the cost/profit center, this side branch of the sub-process ends. Second, an internal kick-off meeting is held between the project, project controlling and offers&tenders department. In this meeting the revised budget is determined which is send to the line operational manager who reviews the revised budget and gives an approval. If it’s not approved, the revised budget has to be altered in order to get it approved. If the revised budget is approved by the line operation manager, it will be send to project controlling who will record the revised budget. From this moment the revised budget is called presupuesto zero (zero budget). Third, a kick-off meeting is held between Stork and the client. In this kick-off meeting, amongst others things, there will be agreed on regular payment terms, factoring or pronto pago. Factoring is selling an approved customer invoice to the bank against a fee to get the money directly instead of having to wait the customer payment terms. Pronto pago is the same as factoring except that now the customer will pay immediately against a fee instead of the bank. Once the internal kick-off meeting, the kick-off meeting with the client and the revised budget have been recorded, the manage sales contract sub-process ends.


Manage sales contracts
Customer
Accounting department
Offers&tenders manager
Legal&Compliance manager
Line operational manager
Project administrator
Line operational manager and project
Project controlling
Project, project controlling and offers
Stork and customer
Stork and bank
Receive notification of disapproval
Approve proposal?
No
Receive proposal
Yes
Sign the contract
Receives request
Sends "rut" to accounting department
Predefined structure cost centers
Seven
Receive cost center registration request
Creation of cost centers
Is it a new customer?
Yes
Request "rut" from the customer
Receives "rut"
Copy data from "rut" into system
No
Copy paste customer data into new sales order
CRM
Create term sheet
Alter term sheet and answer questions
Include risk matrix
Prepare budget
RFP from customer
Upload information
Is the proposal and documentation approved?
Send notification to customer
Send proposal to customer
Send request for legal checks new client
Is it a new client?
Send information of the contract including the final offer and signed contract
Term sheet approved by multiple departments in CRM?
Xpress
Receive request
Perform legal check
Result of the check positive?
Approve proposal?
Send notification of approval
Receive revised budget
Review revised budget
Approve?
Send revised budget to project controller
Appoint resources to project
Send revised budget
Get a grasp of the final offer and signed contract
Define cost center structure
Ask approval proposal cost center
Receive notification of approval
Request registration cost centers
Presupuesto zero
Record revised budget
Internal kick-off meeting
Revised budget
Review budget
Send revised budget
Kick-off meeting
Pronto pago
Negotiate fee
Normal invoicing
Factoring
Sign factoring contract

3.2 Manage prices and rates

Description of the process
The manage prices&rates sub-process starts once the cost center and revised budget have been established. Operations sends a progress report with quantities executed and measurement and acceptance criteria for each activity to the project administrator. The project administrator reviews this report and creates a forecast of costs and revenue to receive based on it. After this, a meeting is held with the line operational manager, project manager and project controller in which a forecast is determined for the variables in the budget. Next, the project manager determines if there is a change of scope. If there is a change of scope, approval is required from both Stork and the customer. If Stork or the customer disapproves, the sub-process ends. If both approve or there were no changes in the variables, a report will be send to project controlling. Project controlling receives the report and four series of tasks will happen simultaneously.

First, the percentage of completion (PoC) excel sheet is updated by the project controller which the project controller leader reviews. Second, if there are changes in the variables of the forecast, the project controller updates the forecast and budget. Third, the project controller compares actual costs with the budget per type in the project controller worksheets. After this he/she reviews if the actual costs are booked properly and on the right cost center in Seven. Next, the project controller reviews if actual costs are in line with budget/forecast. If there are deviations, these have to be explained in an excel sheet called “Resumen por contrato”. Last, the project administrator determines the WIP and revenue recognized for not yet invoiced services. He/she also determines the cost recognized but not yet invoiced by the supplier/vendor and sends a cost backlog report to the project controller. The project controller checks this report for consistency, after which the closure meeting is held. If the WIP and cost backlog are consistent, the project controller books the final WIP and cost backlog in Seven. If it is not consistent, the project controller changes the WIP and/or cost backlog and sends it to the project manager for approval. If the project manager approves the changes, notification is sent to the project controller who then books the final WIP and cost backlog in Seven. If the changes are not approved, the project controller has to make changes to the WIP and/or cost backlog again in order to get approval.

Once all these four tasks have been completed, a performance review analysis meeting (PRAM) takes place between the project administrator and project controller in which status of changes of margin, WIP and cost backlog status of service orders and projects are reviewed. If there are no changes, the operational performance review meeting will take place between the line operations manager, project manager and project controller. If there are changes, the project administrator will update the forecast of costs and revenue to receive and send them to the project controller. The project controller receives this forecast and assesses its substantiation and underlying assumptions. If these are not correct, the project administrator has to update the forecast again. If it is correct, the project controller consolidates the project in the “close files month year”. After this the operational performance review meeting takes place. In this meeting important deviations are explained and recorded in the “close files month year”. Last, the PRM meeting is held with senior management after which the manage prices&rates sub-process ends.

Besides the main process, the manage prices&rates sub-process also contains three control processes which will be described below:

1. After accounting is closed and the final WIP and cost backlog are booked in Seven, the project controller creates a project control worksheet “EP earning profit”.
2. Before the closure meeting, the project administrator manually prepares the worksheet "Formato para informe de control de costos operativos.
3. During the PRAM meeting, the project manager reviews the risk&opportunity for critical projects and updates them.

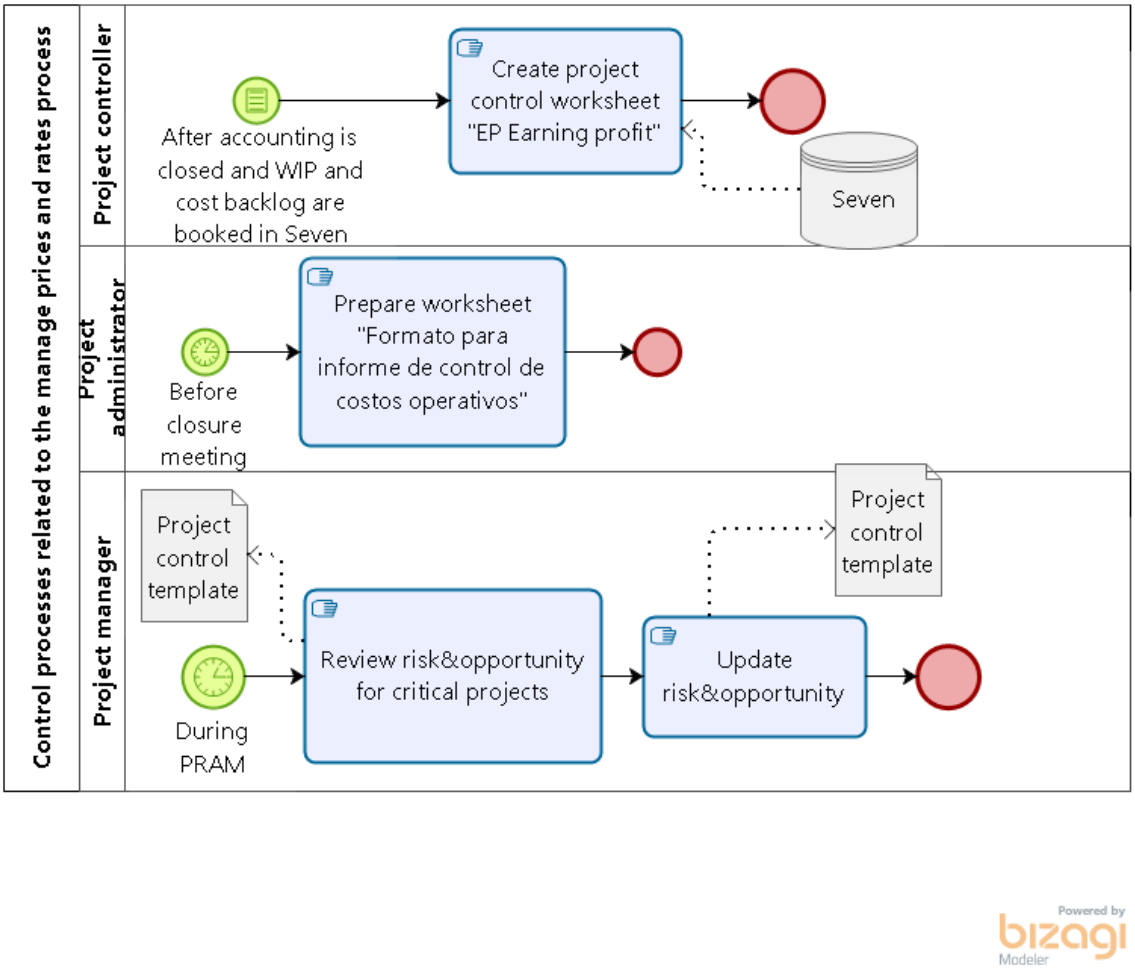
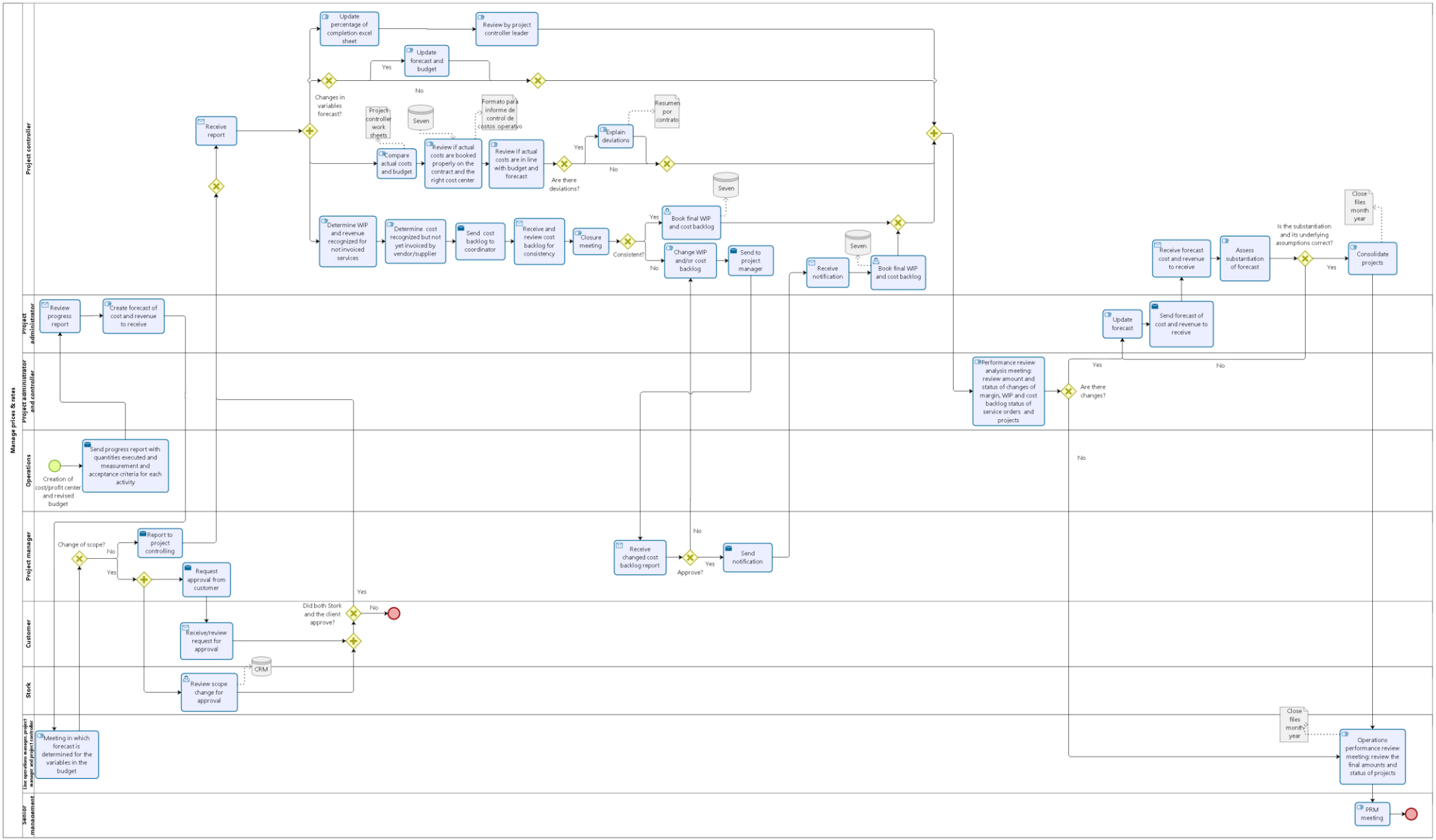


Figure 14: Control processes related to the current manage prices&rates sub-process


Manage prices & rates
Project controller
Project administrator
Project administrator and controller
Operations
Project manager
Customer
Stork
Line operations manager, project manager and project controller
Senior management
Update percentage of completion excel sheet
Review by project controller leader
Update forecast and budget
Yes
No
Changes in variables forecast?
Receive report
Project controller work sheets
Seven
Formato para informe de control de costos operativo
Compare actual costs and budget
Review if actual costs are booked properly on the contract and the right cost center
Review if actual costs are in line with budget and forecast
Are there deviations?
Explain deviations
Resumen por contrato
Determine WIP and revenue recognized for not invoiced services
Determine cost recognized but not yet invoiced by vendor/supplier
Send cost backlog to coordinator
Receive and review cost backlog for consistency
Closure meeting
Consistent?
Book final WIP and cost backlog
Change WIP and/or cost backlog
Send to project manager
Receive notification
Review progress report
Create forecast of cost and revenue to receive
Creation of cost/profit center and revised budget
Send progress report with quantities executed and measurement and acceptance criteria for each activity
Change of scope?
Report to project controlling
Request approval from customer
Receive/review request for approval
Did both Stork and the client approve?
Review scope change for approval
CRM
Meeting in which forecast is determined for the variables in the budget
Receive changed cost backlog report
Approve?
Send notification
Performance review analysis meeting: review amount and status of changes of margin, WIP and cost backlog status of service orders and projects
Are there changes?
Update forecast
Send forecast of cost and revenue to receive
Receive forecast cost and revenue to receive
Assess substantiation of forecast
Is the substantiation and its underlying assumptions correct?
Close files month year
Consolidate projects
Close files month year
Operations performance review meeting: review the final amounts and status of projects
PRM meeting

3.3 Manage customer invoices

Description of the process
The invoicing process starts when business is executed. The project administrator requests the pre-numbered invoicing formats for the billing process from the accounting department. The accounting department receives this request, retrieves the requested formats and sends them back to the project administrator. Next, depending on the type of contract, the project administrator will perform different actions. There are three types of contracts which will be discussed below: fixed price, unit rate and reimbursable.

Fixed price
A fixed price contract is a contract in which a fixed price is charged for provided services per month or based on milestones. With this type of invoice there is no need for customer approval because of which the project manager can immediately start creating the progress/milestone statement.

Unit rate
If the project was a unit rate contract, the project administrator creates a list of all the units that are produced. A unit rate is a composition of hours and equipment/materials used. In such a contract the client pays the amount of specific units executed times the respective price for each unit. It is possible that the customer requires to sign the list of units produced, if this is the case, this list of units produced will be send to the customer for approval. The customer reviews this list. If the customer disapproves, the project administrator has to create the list of produced units again/alter it with the customer's input. If the customer approves the list, a notification will be send to the project manager who will then create the progress/milestone statement.

Reimbursable
A reimbursable contract is a contract in which the customer pays for costs plus a mark-up. If this type of contract is used, the project administrator first checks if the customer requires supporting documentation. If the customer does not require this, the project manager starts creating the progress statement. If the customer does require documentation, the project administrator sends this to the customer. The customer reviews the supporting documentation and approves or disapproves it. If the customer disapproves the supporting documentation, the project administrator has to send additional supporting documentation. If the customer does approve it, the project manager will be notified and can start creating the progress statement.

Once the progress/milestone statement has been created, a meeting is held between the customer and the project manager to review the statement. If the customer disapproves it, the project manager changes it. If the customer approves it, notification of approval is send by the project manager to the project administrator. The project administrator receives the notification and calculates and prints the invoice before sending it to the customer. The customer receives the invoice and can approve or disapprove it. If the invoice is disapproved, the project administrator will recalculate, print and send the invoice again to the customer for approval. If the invoice is approved, the customer stamps the invoice. Next, the stamped invoice is send to the project administrator who receives it. Once the project administrator receives the stamped invoice two things happen simultaneously, the stamped invoice is send to the accounting department and, if there was agreed upon factoring, to the treasury department. Once the accounting department receives the stamped invoice, they will book it in Seven and store it for tax- and legal

purposes. Also, they will request all the pre-numbered invoices back from the project administrator if these had not yet been returned. Once all pre-numbered invoices have been returned, the accounting department closes accounting in Seven after which the sub-process ends. Once the treasury department receives the stamped invoice and supporting documentation (if there was agreed upon factoring), they will send it to the bank after which the sub-process ends.

Besides the main process, the invoicing process also contains three control processes which will be described below:

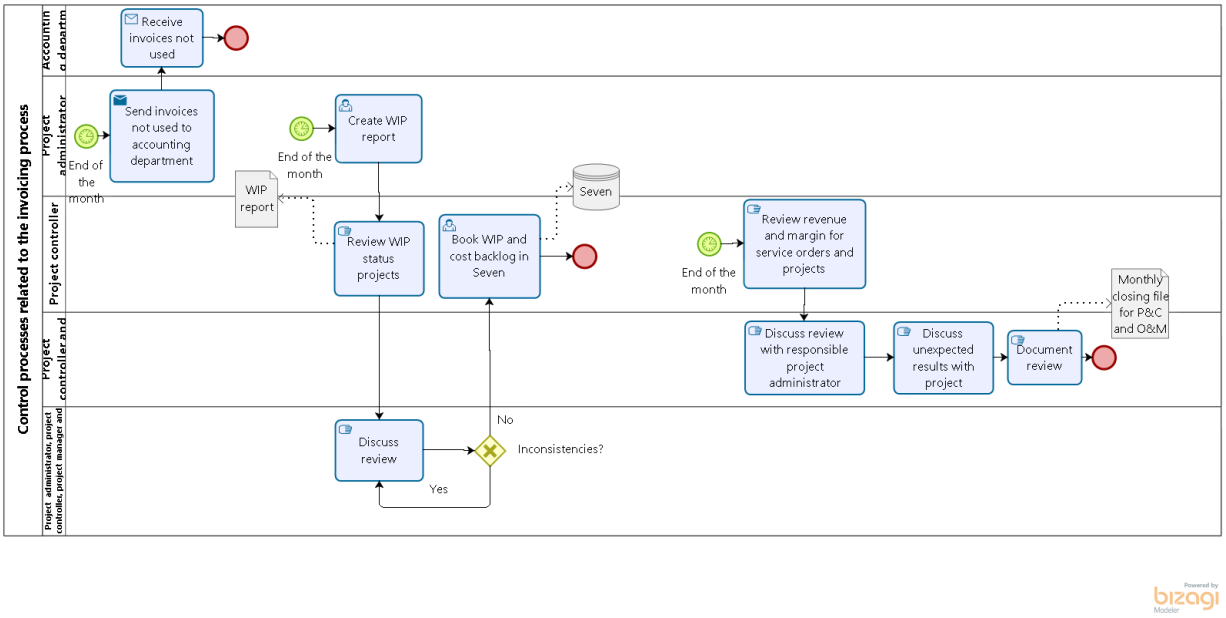
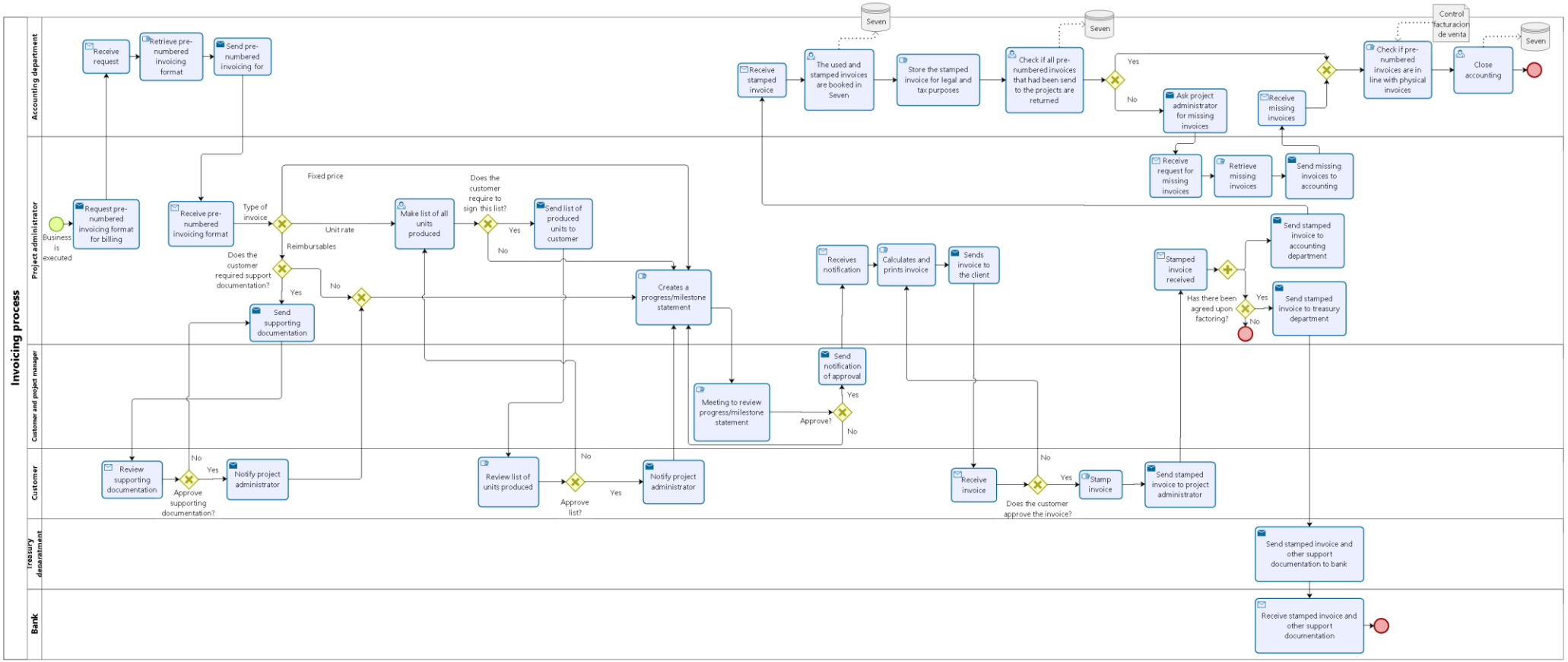


Figure 15: Control processes related to the current invoicing process

1) At the end of the month, the project administrator sends the invoices which were not used back to the accounting department. These pre-numbered invoicing formats are used to control the manual invoicing and prevent employees from sending additional invoices with their own bank account number to the customer.
2) At the end of the month, the project administrator creates a WIP report, which is reviewed by the project controller and later on discussed with the project administrator, project controller, project manager and line operations manager for inconsistencies. If there are no inconsistencies, the project controller books the WIP and cost backlog in Seven after which the control process ends. If there are inconsistencies, these have to be discussed and adjusted/explained.
3) At the end of the month, the project controller reviews the revenue and margin for service orders and projects after which this is discussed with the responsible project administrator. Unexpected results are discussed with the respective project and the review is documented in the monthly closing file for P&C and O&M.


Invoicing process
Accounting department
Project administrator
Customer and project manager
Customer
Treasury department
Bank
Receive request
Retrieve pre-numbered invoicing format
Send pre-numbered invoicing for
Seven
Receive stamped invoice
The used and stamped invoices are booked in Seven
Store the stamped invoice for legal and tax purposes
Check if all pre-numbered invoices that had been send to the projects are returned
Yes
No
Ask project administrator for missing invoices
Receive missing invoices
Check if pre-numbered invoices are in line with physical invoices
Control facturacion de venta
Close accounting
Receive request for missing invoices
Retrieve missing invoices
Send missing invoices to accounting
Business is executed
Request pre-numbered invoicing format for billing
Receive pre-numbered invoicing format
Type of invoice
Fixed price
Unit rate
Reimbursables
Make list of all units produced
Does the customer require to sign this list?
Yes
No
Send list of produced units to customer
Does the customer required support documentation?
Yes
No
Send supporting documentation
Creates a progress/milestone statement
Receives notification
Calculates and prints invoice
Sends invoice to the client
Stamped invoice received
Has there been agreed upon factoring?
Yes
No
Send stamped invoice to accounting department
Send stamped invoice to treasury department
Meeting to review progress/milestone statement
Approve?
Yes
No
Send notification of approval
Review supporting documentation
Approve supporting documentation?
No
Yes
Notify project administrator
Review list of units produced
Approve list?
No
Yes
Notify project administrator
Receive invoice
Does the customer approve the invoice?
No
Yes
Stamp invoice
Send stamped invoice to project administrator
Send stamped invoice and other support documentation to bank
Receive stamped invoice and other support documentation

3.4 Manage cash collection

Description of the process
The manage cash collection process starts when accounting has been closed in Seven. The professional planner checks the bank statement and clears the invoices that have been paid from Seven. If there was not agreed upon factoring, the professional planner downloads the AR report from Seven and reviews it for overdue invoices. The professional planner contacts the debtor for the status of the overdue invoice. The debtor can respond with one of the following: there is a dispute, actions are required to get the invoice approved or “everything is okay”. If there is a dispute, the professional planner contacts the project coordinator to see whether the dispute is correct, incorrect, known or unknown. The project coordinator checks if the dispute is acknowledged or not. If it is not, the debtor is contacted to solve the issue with the project coordinator. After this, the debtor will again review the delayed invoice and send payment if it is approved. If it’s not approved, the debtor will again be contacted about the status of the invoice. If the potential dispute is acknowledged, the dispute will be reviewed and pending documentation to solve the dispute will be send to the debtor after which he/she will review the invoice again and send payment if it's approved. The debtor will be contacted about the status of the invoice again if it's disapproved. If the invoice was overdue because of a lack of support documentation, the professional planner will send this to the debtor. After, the delayed invoice will be reviewed with supporting documentation again and if it is approved payment will be send. If it's not approved the debtor will be contacted again for the status of the invoice. If everything was okay, the debtor sets a new date of payment for which Stork will wait. If payment has then not been received, Stork will inquire with the debtor again about the status of the invoice. Once the payment appears available in the banking system, the treasury department will close the accounts receivable (AR) in Seven, which is the end of this sub-process.

If there was agreed upon factoring, a different path is followed depending on the type. The two types of factoring are: with and without a warranty. If the type of factoring is without a warranty, the process goes immediately to waiting for date of payment after the professional planner has checked the bank statement and cleared the invoices paid. After waiting for the date of payment, the sub-process is followed as described above. If there was agreed upon factoring with a warranty, a different path is followed depending if the debtor paid the bank in time or not. If the debtor did not pay the bank in time, Stork has to pay the bank the entire amount and contact the debtor for the status of the overdue invoice (after which the sub-process is followed again as described above). If the debtor did pay the bank in time, the process ends. This because if the debtor paid the bank in time, Stork already received the money from the bank before the process started and no further actions have to be taken by Stork after the professional planner cleared the invoice from accounts receivable.

Besides the main manage cash collection process there are also a few controls attached to this process which can be seen in the model below.

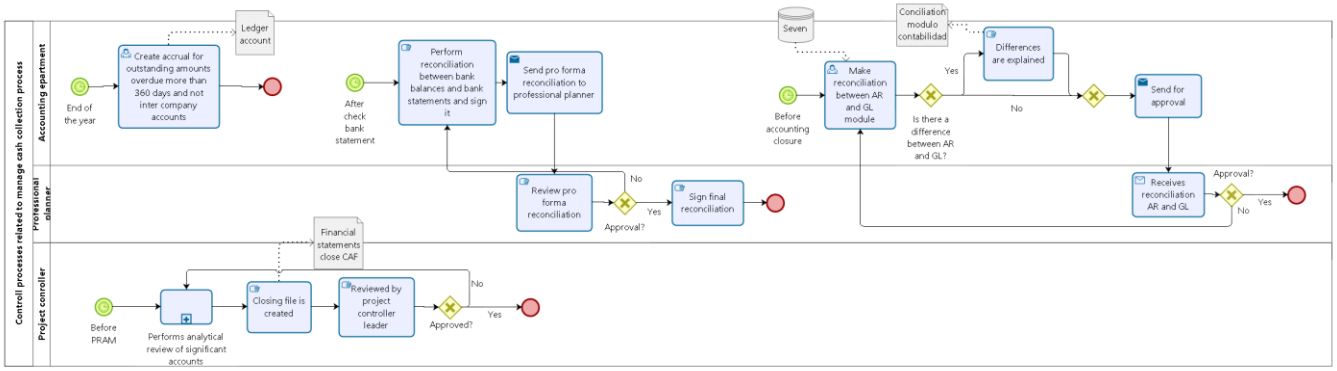


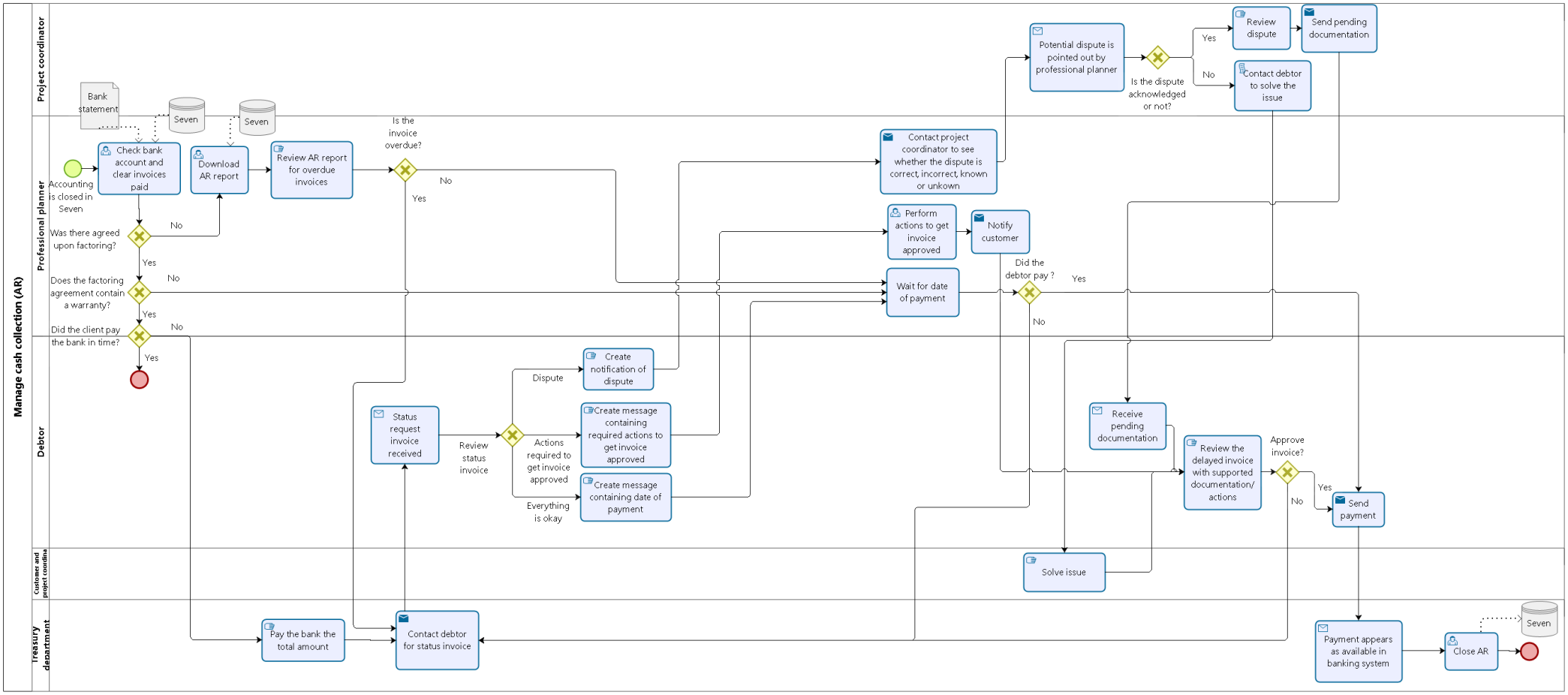
Figure 16: Control processes related to the current manage cash collection process

- At the end of the year the accounting department creates an accrual for outstanding amounts overdue more than 365 days and not intercompany accounts. With intercompany accounts is meant money transfers between for example MASA and Stork Branch.

- Before the PRAM meeting, the project controller performs an analytical review of the significant accounts. In this review he/she specifies, substantiates and reviews the consistency of the AR accounts, reimbursable accounts, inventory accounts and fixed assets accounts. After this, he/she creates the closing file “financial statements close CAF” which will be reviewed by the project controller leader. If he/she approves, the control process ends. If he disapproves, the project controller has to perform the analytical review of significant amounts and create the closing file again.

- After the bank statement has been checked, the accounting department makes a reconciliation between the AR and general ledger (GL) module in Seven. If there is a difference, it is explained in the “Concilicacion modulo contabilidad”. This reconciliation is then send to the professional planner who approves or disapproves it. If it is disapproved, the reconciliation has to be made again by the accounting department. If it is approved, the control process ends.

- Before the closing of accounting, the accounting department performs a reconciliation between the bank balances and bank statements which they have to sign. This reconciliation, which is a pro forma reconciliation, is then send to the professional planner for approval. If the professional planner does not approve it, the accounting department has to perform the reconciliation again. If it is approved, the professional planner signs and the document becomes the final reconciliation. The control process ends after the professional planner its signature.


Manage cash collection (AR)
Project coordinator
Professional planner
Debtor
Customer and project coordina
Treasury department
Bank statement
Seven
Seven
Check bank account and clear invoices paid
Download AR report
Review AR report for overdue invoices
Is the invoice overdue?
No
Yes
Accounting is closed in Seven
Was there agreed upon factoring?
No
Yes
Does the factoring agreement contain a warranty?
No
Yes
Did the client pay the bank in time?
No
Yes
Dispute
Create notification of dispute
Status request invoice received
Review status invoice
Actions required to get invoice approved
Create message containing required actions to get invoice approved
Everything is okay
Create message containing date of payment
Pay the bank the total amount
Contact debtor for status invoice
Contact project coordinator to see whether the dispute is correct, incorrect, known or unkown
Potential dispute is pointed out by professional planner
Is the dispute acknowledged or not?
Yes
No
Review dispute
Send pending documentation
Contact debtor to solve the issue
Perform actions to get invoice approved
Notify customer
Wait for date of payment
Did the debtor pay ?
Yes
No
Receive pending documentation
Review the delayed invoice with supported documentation/ actions
Approve invoice?
Yes
No
Send payment
Solve issue
Payment appears as available in banking system
Close AR
Seven

4. Solution design: Business process reengineering

In this chapter the current OTC process has been reengineered, which took place with the following inputs:

- *Input from the departments involved*. Interviews with departments involved in the OTC process have been conducted in order to identify bottle-necks.
- *Stork Australia*. Stork Australia recently had a successful SAP ByDesign implementation from which flow charts of their implemented OTC process are available. These flowcharts differ a lot from Stork Colombia's process but also have a few similarities which have been taken into account in the reengineering of the OTC process.
- *SAP ByDesign*. The to-be OTC process had to be supported in SAP ByDesign and therefore there has been walked through the system to see what was and what was not possible.
- *Business process reengineering best practices* as seen in chapter 2.
- *Stork's improvement goals* as seen in Figure 1.
- *Identified problems within Stork* as seen in section 1.2

All of these inputs can be classified under either SAP ByDesign changes or business process reengineering changes. Changes because of the SAP ByDesign implementation have been marked in blue boxes in the models of the to-be situation and business process reengineering changes in red boxes. The change boxes have been numbered and for each a description of the change together with the reason/advantage have been provided in a short paragraph.

In the current process, a lot of tasks were performed manually and as a result a lot of control processes/tasks were required to make sure these manual tasks were performed properly. With the implementation of the SAP ByDesign system, a lot of tasks will be automated and as a result control processes/tasks are eliminated. As a consequence, some of the beginning and ending points of sub-processes have changed/shifted. These changes have been marked with blue squares in Figure 17, which shows the timeline of the OTC to-be situation.

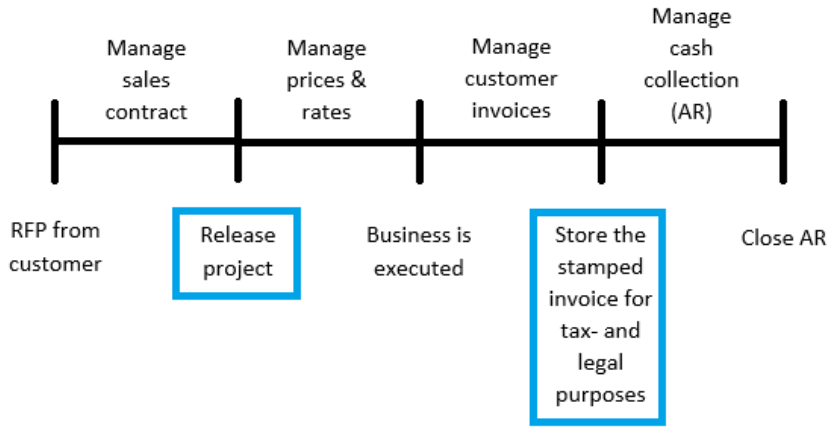


Figure 17: OTC timeline to-be situation

Description to-be systems

Besides the fact that SAP will now replace Seven, the systems that are used in the current situation will remain the same in the to-be situation (CRM, Kactus and Xpress). There is however a change in the way Kactus will be used. Previously Kactus (the pay-roll system) was the only system in which time was recorded. In the to-be situation, time will be recorded in SAP ByDesign as well because this allows actual labor costs to be assigned to a project/cost center. At the moment and in the to-be situation, Kactus records 45 hours' standard per week per FTE, in which over-/under hours need to be added/subtracted manually. In the to-be situation, a report from SAP will be send to Kactus with over-/under hours and if there are none, nothing needs to happen.

4.1 Manage sales contract

Changes as a result of SAP implementation

The first change comes after the creation of the profit- and cost center. In the new situation a sales order will be created by the commercial department after which it will be released and a project will be created. The reason the commercial department has been assigned to create and release sales orders is because they know/have all information about the sales order, which is the best business process reengineering practice called *resequencing* (Hanafizadeh, Moosakhani, & Bakhshi). Because they have all information/knowledge about the sales orders, the commercial department is the only department authorized in SAP ByDesign to create sales orders/projects. After the project has been created, the project administrator will appoint resources to the project. The advantage of having a sales- and project order opposed to the previous situation in which Stork did not have this, is that the work to be executed will become more clear. In the current situation, it could occur that work was being carried out before there was a service order. As a result, the customer could then refuse to pay, saying the work carried out was not desired. This will not happen anymore in the to-be situation. Also, the appointing of labor, equipment and materials will be done in SAP ByDesign in contrast to the current situation in which this is done manually in an Excel sheet by the project administrator. The advantage of this is that SAP ByDesign is accessible for everybody, it is updated real time and SAP ByDesign can create reports automatically. After this, standard cost rates will be calculated and the budget will be created. The budget will then be send to project controlling who will check and if they approve, release the project once the kick-off meeting with the client has finished. Once the project has been released, this sub-process ends. The reason for project controlling to release the project is because they can create the appropriate structure of the project order. They will also check the budget created by the project administrator which is the preceding task of releasing the project. This because involving as less actors as possible is a best business process reengineering practice: *numerical involvement* (Hanafizadeh, Moosakhani, & Bakhshi).

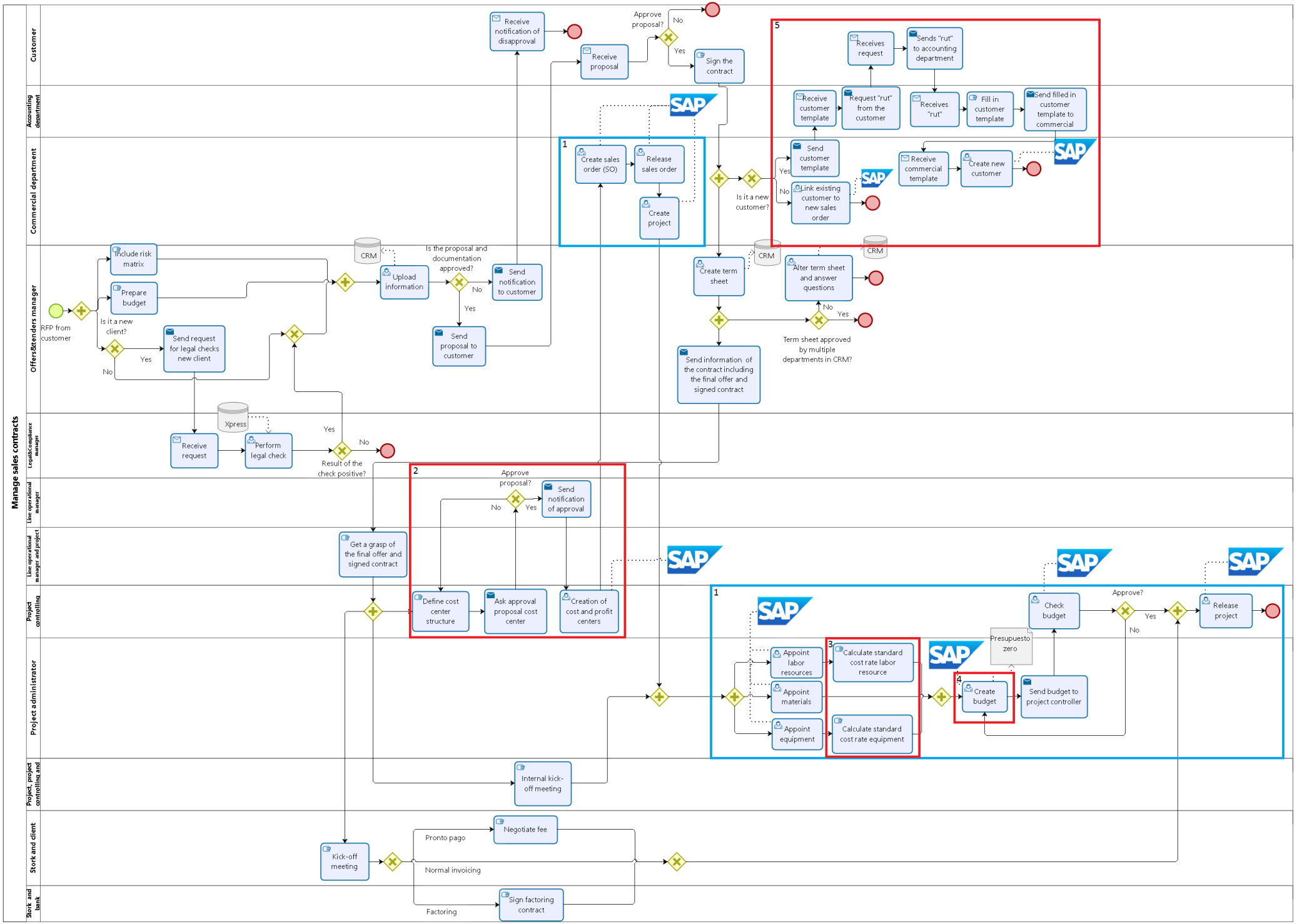
Changes as a result of business process reengineering

The second change is in the part in which the cost/profit center structure is defined and created. The creation of the cost- and profit centers is now done by project controlling instead of the accounting department. This because project controlling also defines the profit- and cost centers and having them create the profit- and cost centers as well eliminates the task of requesting the set-up of the profit- and cost centers (*split responsibility*) from the accounting department. In addition, project controlling can, with the aid of SAP, do this in a more detailed way compared to the previous situation and as a result will allow Stork to analyze their margins at a deeper level.

The third change is the introduction of the tasks of calculating the standard cost rate for both labor and equipment. This has been introduced to enable Stork to see their costs per project before the actual costs are recognized. The standard cost rates are an estimation of how much the labor and/or equipment for a project will cost. Once the actual costs are available, they can be compared to the standard cost rates for over- and under absorption per project.

The fourth change, is that in the to-be situation the creation of the budget will be assigned to a single person which will be the project administrator. In the previous situation, the budget was created in the internal kick-off meeting. Because there was not a single person who had the responsibility for the creation of the budget zero, it was skipped in some cases. The budget zero is an estimation of costs by operations in which they explain and justify all expected costs. When this is not done there is no justification of costs and it will not be possible to do a good analysis between budget and actual costs. Because the creation of budget zero is now assigned to a single person and uploaded in SAP ByDesign it will not be possible to skip its creation anymore.

The fifth change in this sub-process compared to the previous situation is in the creation of a customer. Besides the fact that this previously used to happen in Seven and now in SAP, some tasks have been added and the commercial department has been involved to align the SAP and CRM system in the to-be situation. The commercial department is added because this department already creates the customer in CRM in the opportunity exploration phase. In the previous situation data in CRM and Seven could differ as the commercial department registered potential clients in CRM and the accounting department created the actual customer in Seven, both without consulting each other. In the to-be situation there will only be one department responsible for the creation of the customer in the systems to make sure both are aligned. Tasks have been added around sending and filling in a customer template, which is created to make sure that the right data from the rut is entered in the system by the commercial department. The accounting department cannot be eliminated from the creation of the customer as it requires the rut for tax- and legal purposes. It is good to note that a new customer is created on average only twice a year and therefore the advantage of improved data quality outweighs the extra time of the added tasks and the involvement of an extra department.


Manage sales contracts
Customer
Accounting department
Commercial department
Offers&tenders manager
Legal&Compliance manager
Line operational manager
Line operational manager and project
Project controlling
Project administrator
Project, project controlling and
Stork and client
Stork and bank
Receive notification of disapproval
Receive proposal
Approve proposal?
No
Yes
Sign the contract
5
Receives request
Sends "rut" to accounting department
Receive customer template
Request "rut" from the customer
Receives "rut"
Fill in customer template
Send filled in customer template to commercial
SAP
1
Create sales order (SO)
Release sales order
Create project
Send customer template
Receive commercial template
Create new customer
Is it a new customer?
Link existing customer to new sales order
Include risk matrix
Prepare budget
RFP from customer
Is it a new client?
Send request for legal checks new client
CRM
Upload information
Is the proposal and documentation approved?
Send notification to customer
Send proposal to customer
Create term sheet
Alter term sheet and answer questions
Term sheet approved by multiple departments in CRM?
Send information of the contract including the final offer and signed contract
Xpress
Receive request
Perform legal check
Result of the check positive?
2
Approve proposal?
Send notification of approval
Get a grasp of the final offer and signed contract
Define cost center structure
Ask approval proposal cost center
Creation of cost and profit centers
Appoint labor resources
Appoint materials
Appoint equipment
3
Calculate standard cost rate labor resource
Calculate standard cost rate equipment
4
Create budget
Presupuesto zero
Send budget to project controller
Check budget
Approve?
Release project
Internal kick-off meeting
Kick-off meeting
Pronto pago
Negotiate fee
Normal invoicing
Factoring
Sign factoring contract

4.2 Manage prices and rates

Changes as a result of SAP implementation
The first change is at the beginning of the sub-process. In the to-be situation, cost assignment rules will be created by the project administrator, after which the recording of labor, equipment, materials and receipt of goods&services will take place. The latter is the entire operations part of a project which in the to-be situation is recorded in SAP by the project administrator opposed to the previous situation in which this was done manually in an Excel sheet by operations. The advantage of this is that the recordings will be accessible for everyone with the right authorization and are updated real time.

Changes as a result of business process reengineering
The second change is that after an approved change of scope by both the client and Stork, in the previous situation four series of tasks had to be performed. A description of these four tasks can be found in the second paragraph of section 3.2. In the to-be situation these four series of tasks are eliminated because SAP ByDesign can automatically calculate the WIP and cost backlog (in the current situation these had to be calculated manually). The combination of cost assignment rules with running the revenue recognition allows SAP to allocate the costs from the WIP to the sales order related to the project task in one of the four categories: service, material, product category and GL account rendering the four series of tasks unnecessary. The advantage of this is that a lot of processing time of tasks within the project controlling department will be eliminated.

Changes in the control processes
The SAP ByDesign implementation also influenced the control processes related to the manage prices&rates sub-process. In the previous situation there were three control processes of which two have been eliminated because of the SAP implementation in the to-be situation. The two control processes that have been eliminated were about the creation of a project controlling worksheet called “EP earning profit” and the preparation of a worksheet called “Formato para informe de control de costos operativos”.

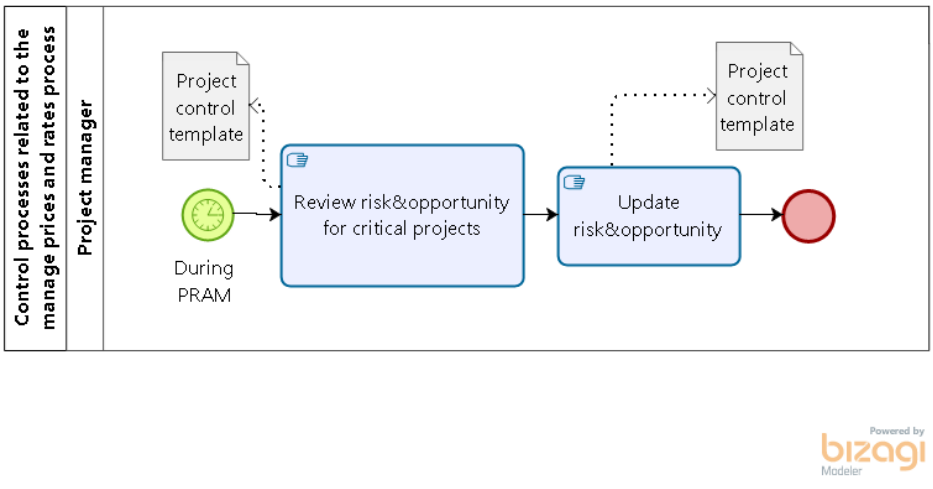
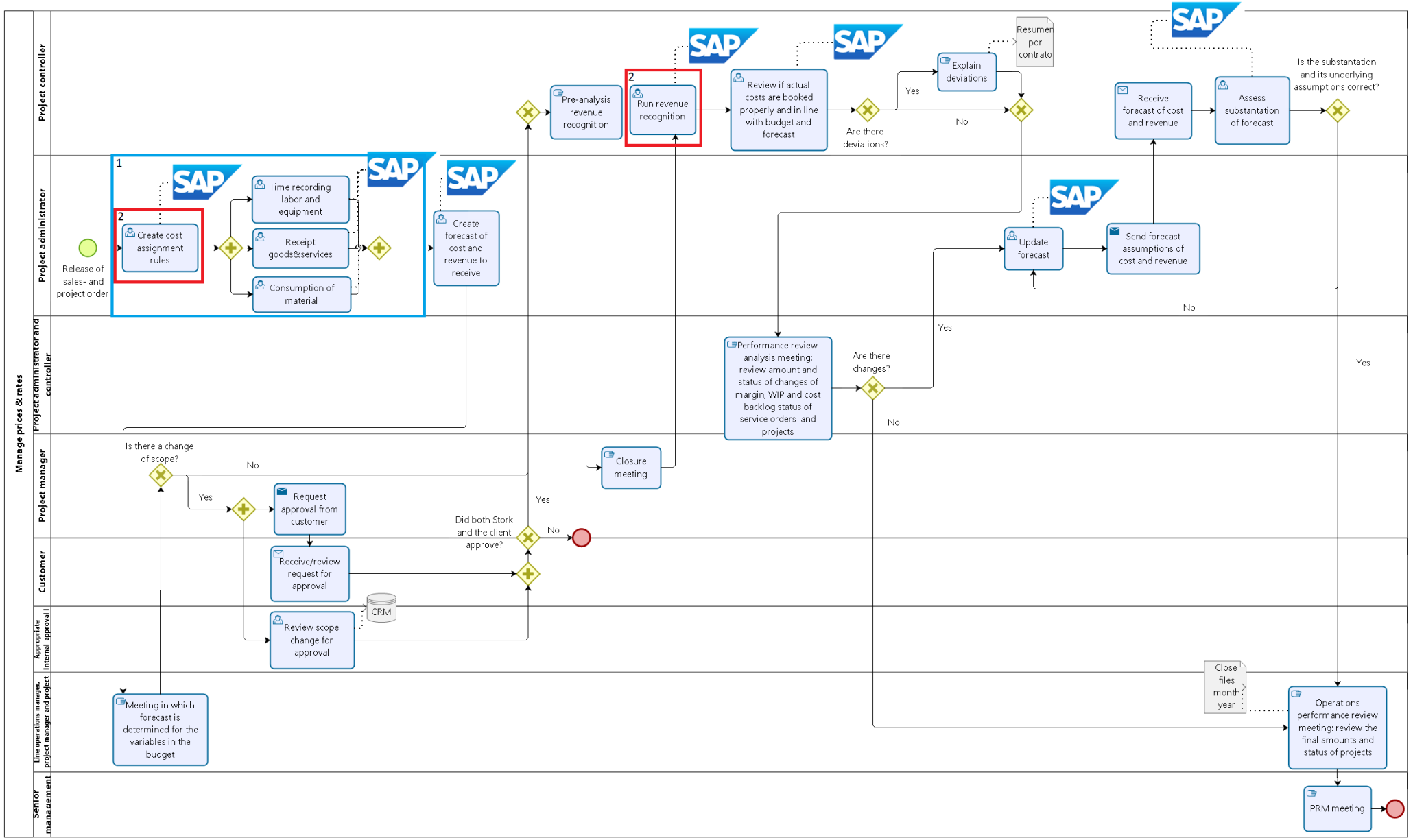


Figure 18: Control process related to the manage prices&rates sub-process to-be situation

The control process about creating the “EP earning profit” worksheet was done in order to align the reports that were created manually with the Seven system. However, as with the SAP ByDesign implementation all data will be in the system and reports retrieved from it, there is no longer a need to align the system/reports and therefore this control process is eliminated in the to-be situation.

The control process about the preparation the worksheet “Formato para informe de control de costos operativos” has been eliminated as this worksheet was used by operations to fill in the executed quantities. Because in the to-be situation the project administrator records these quantities himself in SAP ByDesign, this control process is no longer required.


Manage prices & rates
Project controller
Project administrator
Project administrator and controller
Project manager
Customer
Appropriate internal approval
Line operations manager, project manager and project
Senior management
Release of sales- and project order
Create cost assignment rules
Time recording labor and equipment
Receipt goods&services
Consumption of material
Create forecast of cost and revenue to receive
Pre-analysis revenue recognition
Run revenue recognition
Review if actual costs are booked properly and in line with budget and forecast
Are there deviations?
Yes
No
Explain deviations
Resumen por contrato
Receive forecast of cost and revenue
Assess substantation of forecast
Is the substantation and its underlying assumptions correct?
Update forecast
Send forecast assumptions of cost and revenue
Performance review analysis meeting: review amount and status of changes of margin, WIP and cost backlog status of service orders and projects
Are there changes?
Closure meeting
Is there a change of scope?
Request approval from customer
Receive/review request for approval
Review scope change for approval
CRM
Did both Stork and the client approve?
Meeting in which forecast is determined for the variables in the budget
Close files month year
Operations performance review meeting: review the final amounts and status of projects
PRM meeting

4.3 Manage customer invoices

Changes as a result of SAP implementation
The first change is in the creation of the list of units produced for the customer to sign if he/she requires this. In the previous situation, this list was created manually in Excel by operations opposed to the new situation in which time/labor/equipment/materials are recorded in SAP ByDesign (at the beginning of the prices&rates sub-process). From SAP ByDesign, a list of units produced can now be retrieved. The advantage of this is that it will be updated real time and accessible for everybody (with the right authorization) instead of only the owner of the Excel sheet.

The second change is in the creation of the invoice part. In the previous situation the project administrator used to calculate and print the invoice before sending it to the customer. With the SAP ByDesign implementation, a project invoicing request has to be created by the project administrator which after approval from the accounting department will be released. Next, the project administrator processes the final invoice in SAP and sends it to the customer. The advantage of this change is that the invoice is less likely to contain errors because all data required for the invoice is in the SAP ByDesign system and will be retrieved from it.

Besides the numbered changes as seen in the to-be model, 6-11 tasks have been eliminated from the previous situation. These eliminated tasks all were regarding the use of pre-numbered invoicing formats. In the previous situation, these formats were used to prevent misuse since invoicing was done manually. Without pre-numbered invoices someone could for example send an invoice to a customer with his/her own bank account. With the implementation of SAP ByDesign all invoices are processed in the system and therefore all tasks that involve these pre-numbered invoice formats have been eliminated in the to-be situation.

Changes as a result of business process reengineering
The third change is the inclusion of an extra approval step after the creation of the project invoice request. This segregation of duties is done in the first place to make sure the invoice is accurate before being processed in SAP ByDesign and send to the customer. Another advantage of this change is that the extra approval will also prevent eventual misbehavior of the project administrator opposed to the previous situation in which there was no approval and the invoicing was done manually. In the to-be situation this is not possible anymore, because of both the extra approval step and when a sales/project order is created and costs are booked, it cannot simply disappear from the SAP ByDesign system.

Changes in the control processes

Regarding the control processes, of which the to-be situation can be seen below, two control processes have changed. First, one of the control processes has been eliminated which was about sending the pre-numbered invoices back to the accounting department. This because in the to-be situation, in which there is no manual invoicing anymore, the pre-numbered invoices are no longer required. Second, a task has been eliminated from the control process about the creation of the WIP report and its review/discussion. This task was related to booking the WIP and cost backlog in the old Seven system as this had to be done manually. Because the SAP system will calculate and book the WIP and cost backlog automatically in the to-be situation, this task will also be eliminated.

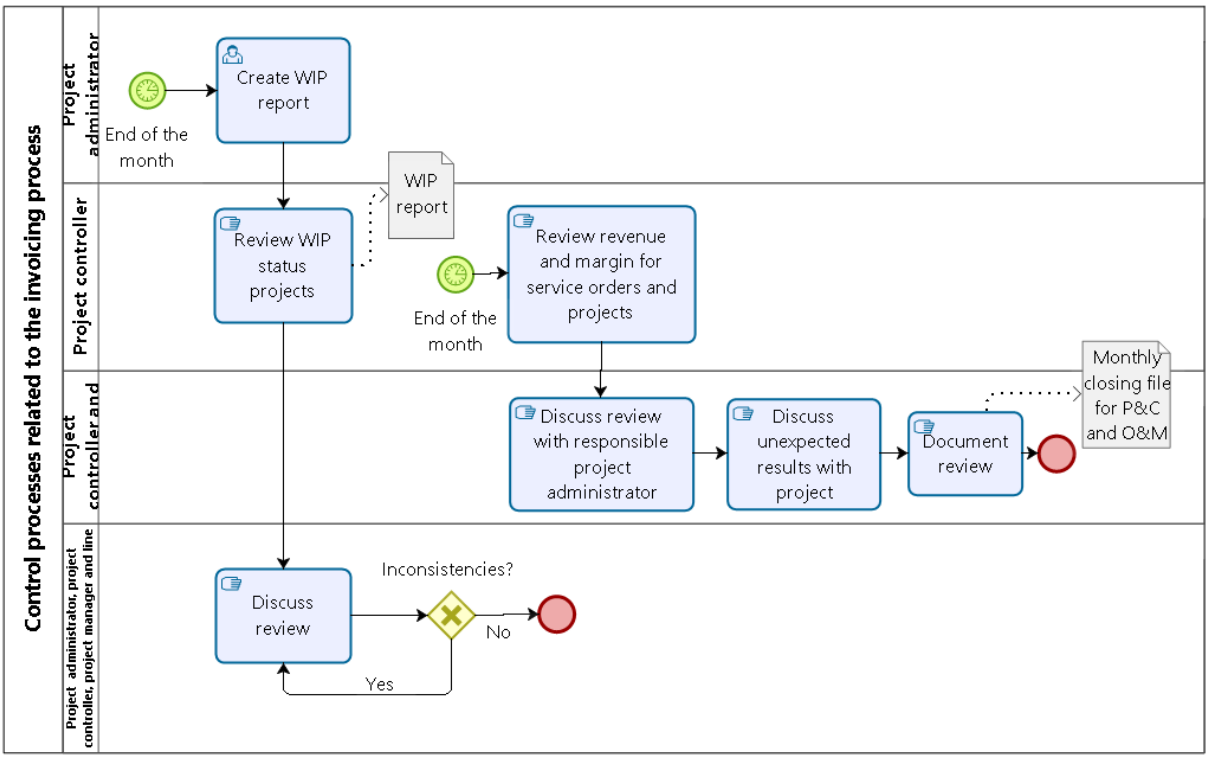
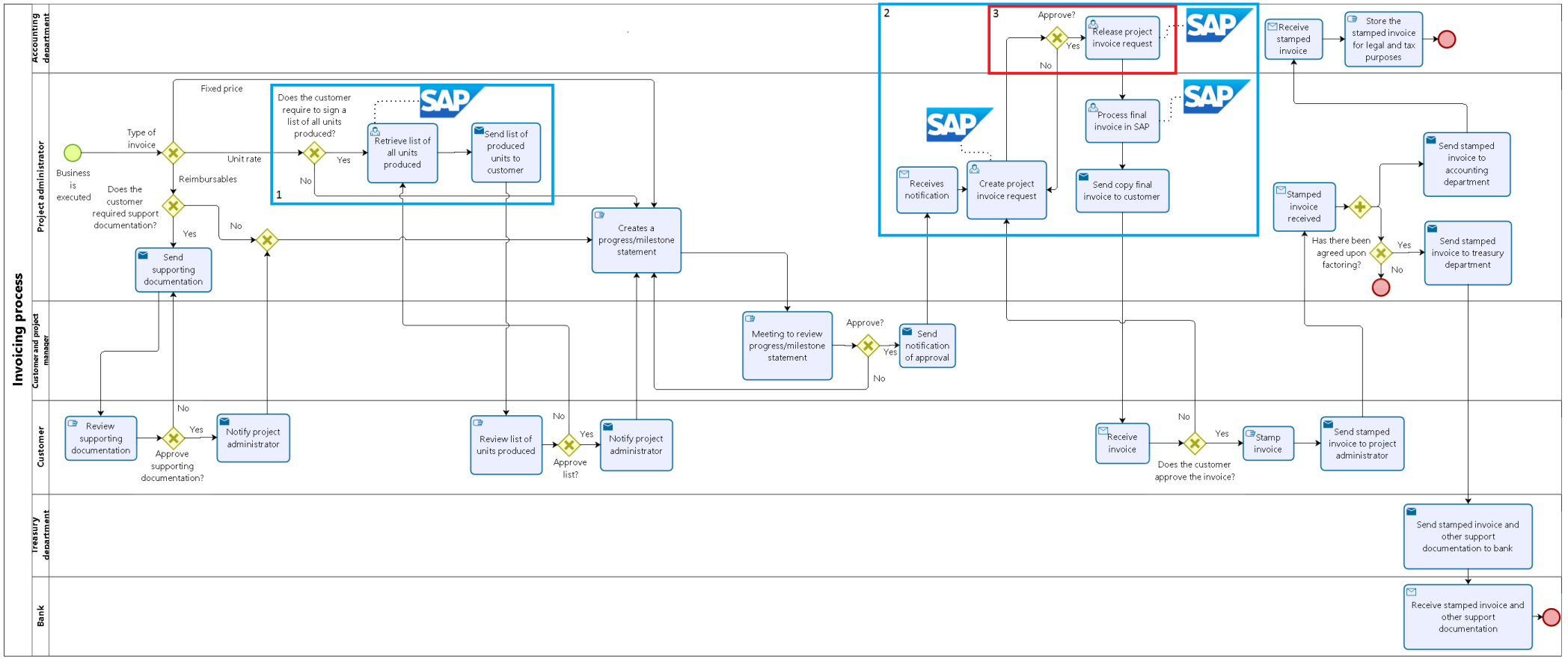


Figure 19: Control processes related to the invoicing sub-process in the to-be situation


Invoicing process
Accounting department
Project administrator
Customer and project manager
Customer
Treasury department
Bank
Business is executed
Type of invoice
Fixed price
Unit rate
Reimbursables
Does the customer required support documentation?
Yes
No
Send supporting documentation
Review supporting documentation
Approve supporting documentation?
No
Yes
Notify project administrator
1
Does the customer require to sign a list of all units produced?
Yes
No
Retrieve list of all units produced
Send list of produced units to customer
Review list of units produced
Approve list?
No
Yes
Notify project administrator
Creates a progress/milestone statement
Meeting to review progress/milestone statement
Approve?
Yes
No
Send notification of approval
2
3
Receives notification
Create project invoice request
Approve?
Yes
No
Release project invoice request
Process final invoice in SAP
Send copy final invoice to customer
Receive invoice
Does the customer approve the invoice?
No
Yes
Stamp invoice
Send stamped invoice to project administrator
Receive stamped invoice
Store the stamped invoice for legal and tax purposes
Stamped invoice received
Has there been agreed upon factoring?
Yes
No
Send stamped invoice to accounting department
Send stamped invoice to treasury department
Send stamped invoice and other support documentation to bank
Receive stamped invoice and other support documentation
SAP

4.4 Manage cash collection

This process has neither changed as a result of the SAP ByDesign implementation nor because of business process reengineering changes. The only difference is that now steps that in the previous situation used to be performed in Seven will now be carried out in SAP. The reason for this is that most of the time this process is, after checking the bank statement and clearing the invoices paid, downloading the AR report and reviewing it for overdue invoices, about waiting for payment. The other tasks in this process are necessary controls for in case payment is not received in time in which there currently are no bottle-necks. The control processes related to the cash collection sub-process, which can be seen in the figure below, have not changed as well.

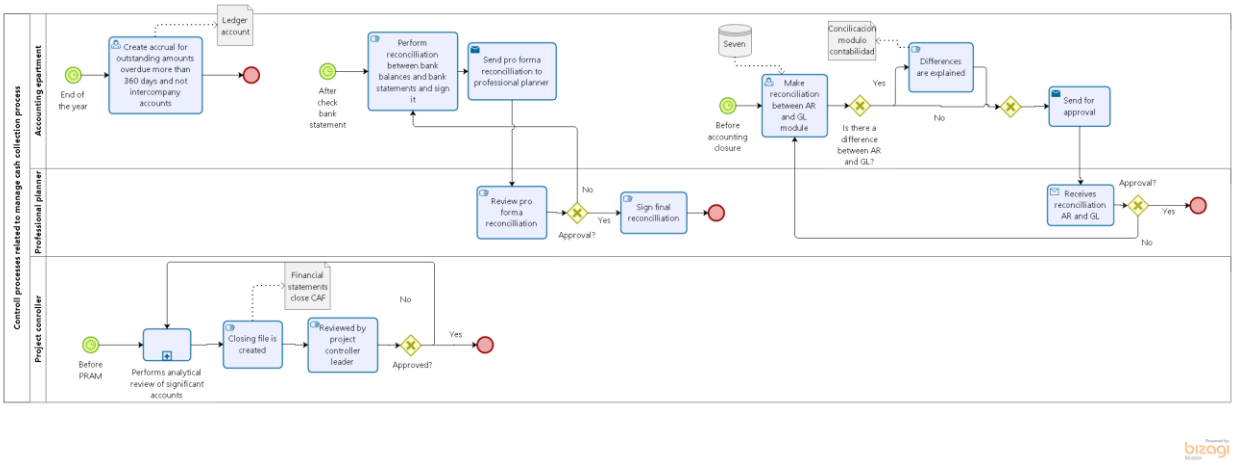
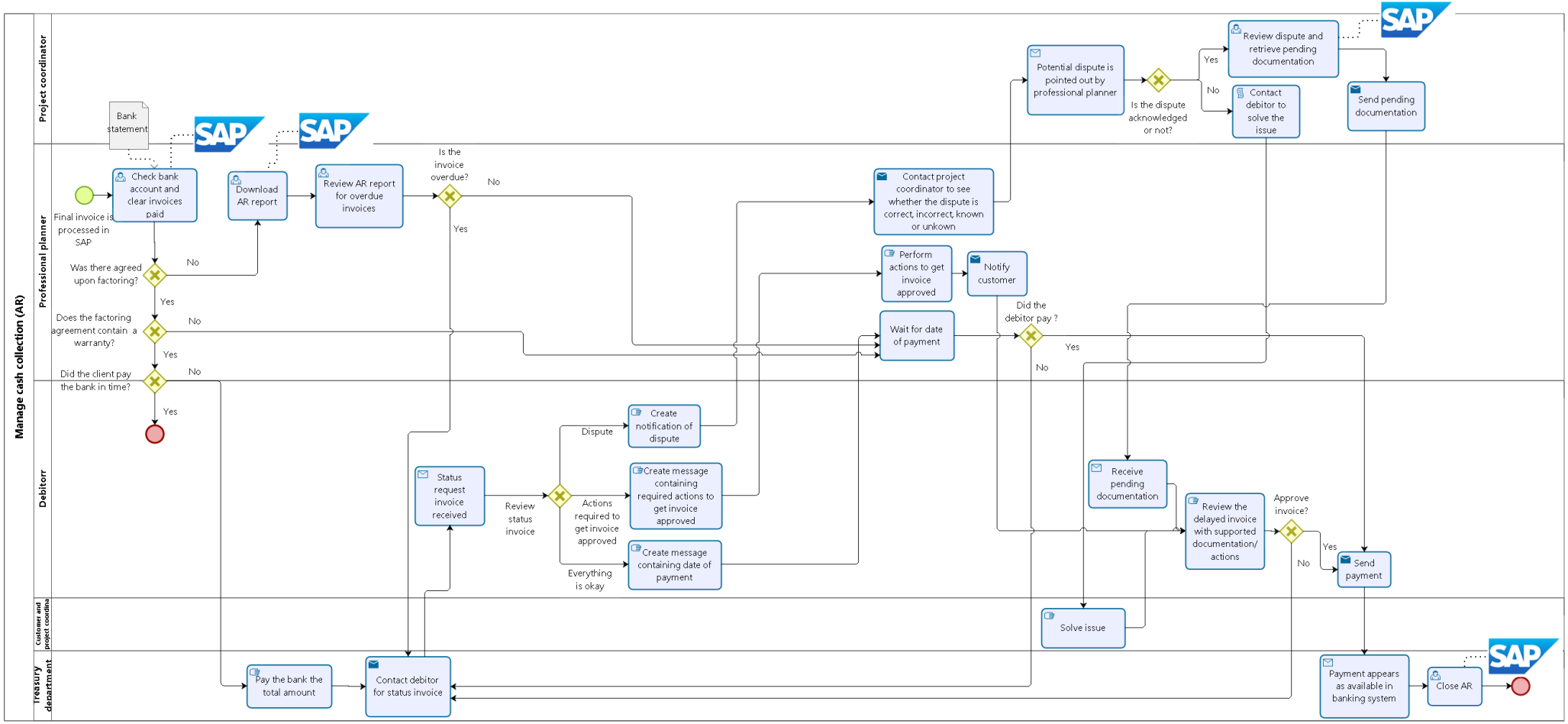


Figure 20: Control processes related to the cash collection sub-process to-be situation


Manage cash collection (AR)
Project coordinator
Professional planner
Debitorr
Customer and project coordina
Treasury department
Bank statement
Check bank account and clear invoices paid
Final invoice is processed in SAP
Was there agreed upon factoring?
No
Yes
Does the factoring agreement contain a warranty?
No
Yes
Did the client pay the bank in time?
No
Yes
Download AR report
Review AR report for overdue invoices
Is the invoice overdue?
No
Yes
Status request invoice received
Review status invoice
Dispute
Create notification of dispute
Actions required to get invoice approved
Create message containing required actions to get invoice approved
Everything is okay
Create message containing date of payment
Pay the bank the total amount
Contact debitor for status invoice
Contact project coordinator to see whether the dispute is correct, incorrect, known or unkown
Potential dispute is pointed out by professional planner
Is the dispute acknowledged or not?
Yes
No
Review dispute and retrieve pending documentation
Contact debitor to solve the issue
Send pending documentation
Perform actions to get invoice approved
Notify customer
Wait for date of payment
Did the debitor pay ?
Yes
No
Receive pending documentation
Review the delayed invoice with supported documentation/ actions
Approve invoice?
Yes
No
Send payment
Solve issue
Payment appears as available in banking system
Close AR
SAP
SAP
SAP
SAP
bizagi

5. Improvement validation

In this chapter improvement of the to-be situation over the “as is” situation has been validated. This has been done for KPI’s chosen from Appendix B for each of the extended BSC segments relevant to the OTC process. KPI’s values have been obtained through the use of both simulations and educated guesses. The reason simulations have been used is that November 1st the SAP ByDesign implementation is scheduled to go live and simulating allows improvement to be validated in this short remaining time span.

5.1 Bizagi modeler simulation view input data

In this section, input data for the simulations has been specified and a manual of Bizagi modeler simulation view with screenshots has been provided. Bizagi modeler simulation view consists of four simulation levels, which in successive order are the following: process validation, time analysis, resources analysis and calendar analysis (Bizagi, 2002-2017). The levels will be explained below together with their respective input data.

Level one: process validation
In the first level of the simulation view, data can be entered in the start event and gateways. In the start event, the green circle at the beginning of each process model as seen in Figure 21, the max. arrival count (amount of times you want to run the process) and the arrival interval (time between each arrival) can be entered. The arrival count for the sub-processes has been set a 6 because Stork Branch has on average 6 contracts per year and the OTC process models are contract based. As a consequence, the inter-arrival time has been set at 1/6 of a year.

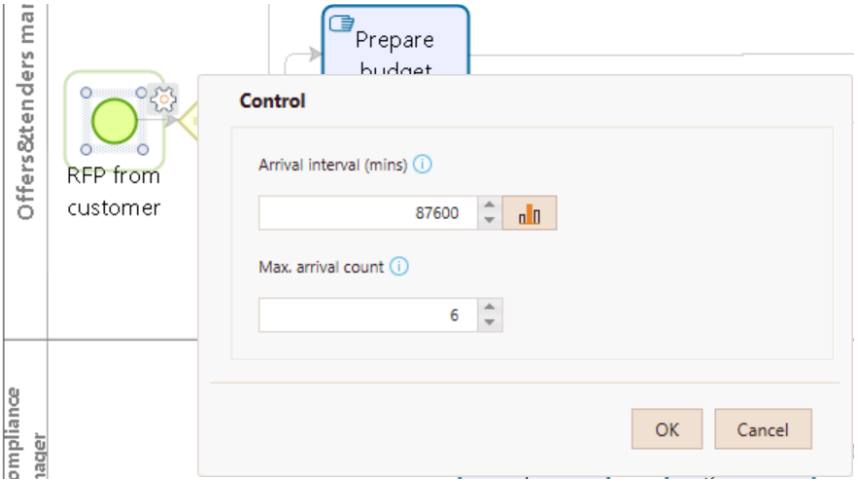


Figure 21: Screenshot Bizagi simulation view start event

Next, probabilities can be entered in exclusive gateways. Exclusive gateways are gateways that allow flow to continue based on the outcome to a condition mentioned in the exclusive gateway. An example can be seen below in Figure 22. The condition here is “is it a new client?” and depending on the outcome, to which a probability is assigned, a different path will be followed. These probabilities have been obtained from talking to the responsible departments.

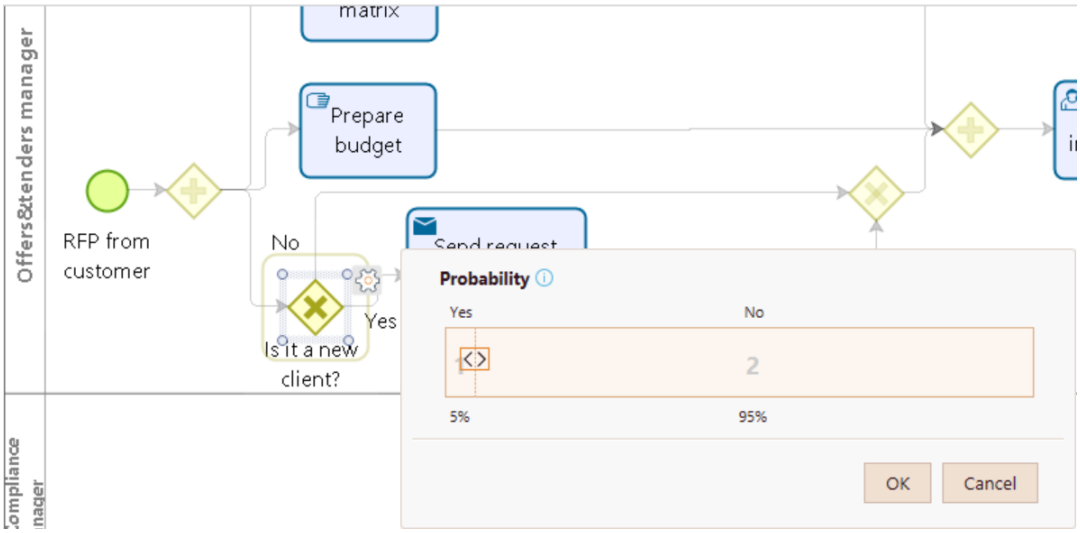


Figure 22: Screenshot Bizagi simulation view exclusive gateway

Level two: time analysis

In this level, processing time and wait time can be assigned to tasks. The process- and waiting times per task for the current OTC models have been obtained from talking to the employees whom perform the respective tasks. These process-/waiting times are averages, estimated by the respective departments as Stork does not record process-/waiting times per task. For the to-be situation, process-/waiting times from tasks that do not change have been copied from the current OTC models. The process-/waiting times for new tasks or tasks that are now performed in SAP ByDesign have been estimated both in consultation with the respective departments that perform them and SAP consultants.

Bizagi modeler simulation view allows statistical distributions to be assigned to process-/waiting times but because Stork does not collect process-/waiting time data there could not have been made use of this option.

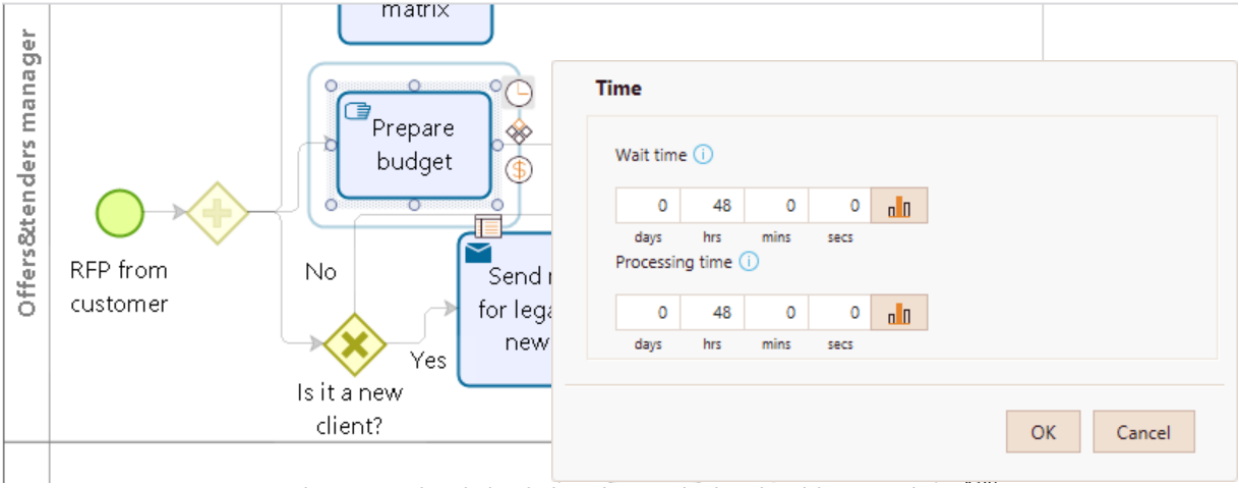


Figure 23: Bizagi simulation view assigning time(s) to a task

Level three: resources analysis
In the next level, resources and activity costs can be assigned to tasks. Before a resource can be assigned to a task, it has to be created and the available quantity of the resource has to be set. Figure 24 shows how resources can be assigned to a task, here a single or multiple (different) resources can be assigned to a task.

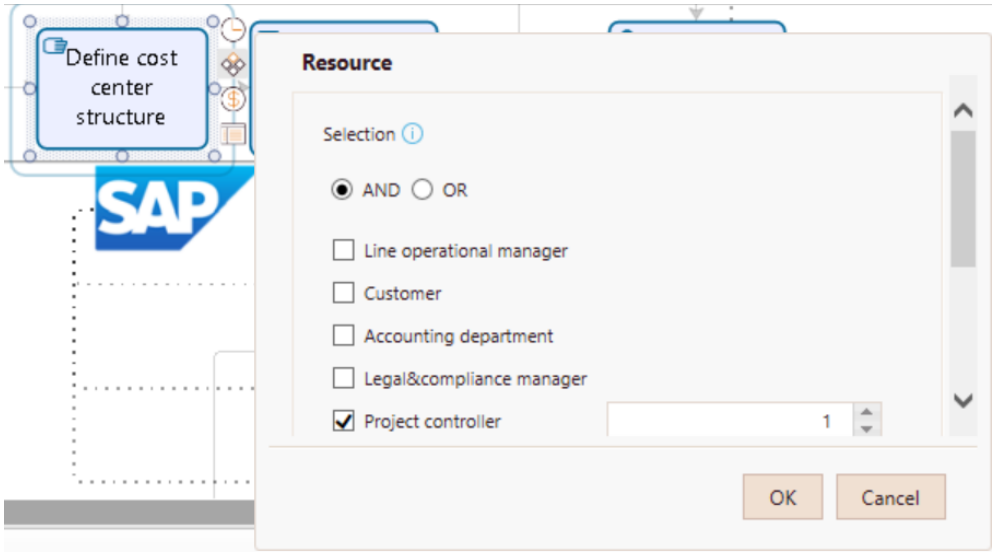


Figure 24: Bizagi simulation view assigning resources to a task

Next, in this level costs are introduced as well. There are two types of costs: activity and resource costs. Of the latter, there are two types: fixed- and hourly cost. Fixed costs are costs that are made for every task a resource processes. Hourly costs are costs a resource makes every hour, in this case, hourly wage of employees will be assigned here. The hourly costs per resource have been obtained by dividing the average total costs Stork pays per employee function per month (salary and benefits) by 180, which is 4 weeks of 45 hours (FTE) and can be seen in Figure 26. Activity costs are costs that are made in order to be able to perform a certain activity. Both fixed resource costs and activity costs are zero as they are not applicable to Stork Branch its OTC process.

Further, for the resources of customer, bank and senior management hourly costs are not assigned. The reason that the bank and the customer don't have hourly costs assigned is because Stork does not pay these entities and their internal hourly costs do not matter since this simulation is carried out for Stork Branch. Senior management does not have hourly costs assigned because these are first of all private but moreover they only appear once in the current and to-be process model, in the same task for the same amount of time and therefore are not interesting in identifying change.

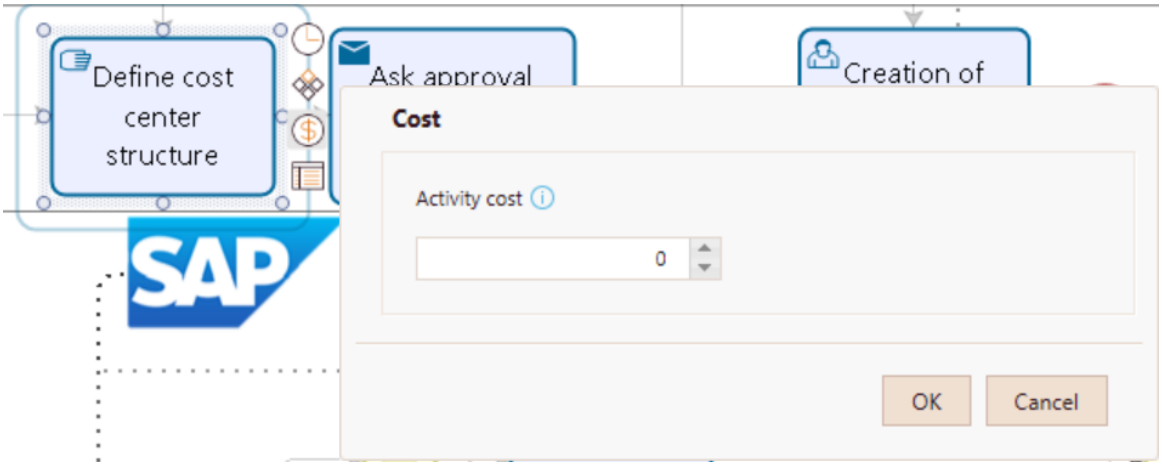


Figure 25: Bizagi simulation view assigning activity cost to a task

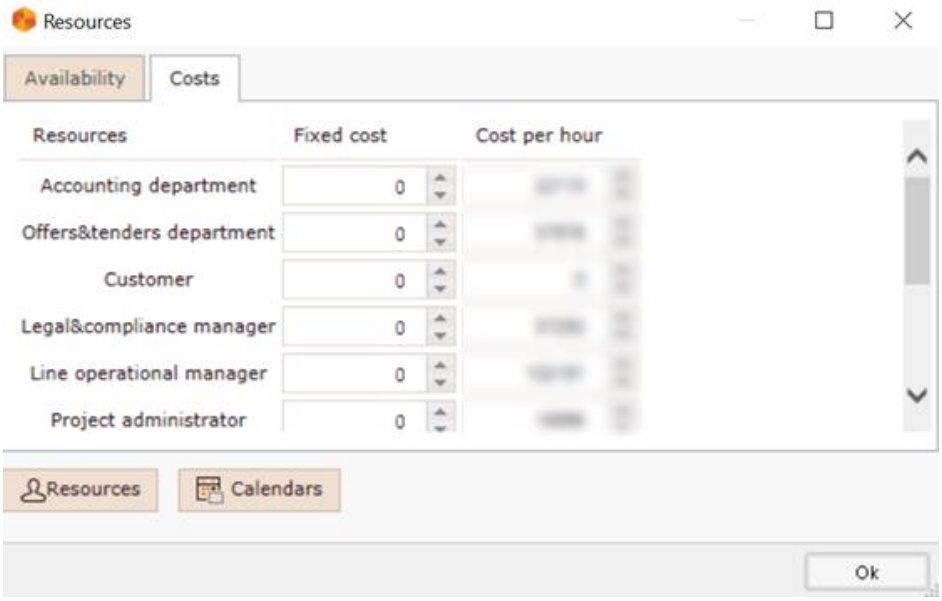


Figure 26: Bizagi simulation view assigning costs to resources

Level four: calendar analysis

Last, calendars have been assigned to show the effect of time constraints on resources. To each employee a morning- (8-12) and afternoon (13-18) shift has been assigned with an hour lunch break in between. Moreover, Colombia has 18 public holidays and therefore has the most public holidays in the entire world. Besides these 18 public holidays, Colombians are by law entitled to 15 days off per year. This has been taken into account by having the calendars range from January 1st to November 28 (33 days off at the end of the year). Figure 27 shows the window in which a calendar is created in which a start time, duration, recurrence pattern and range of recurrence can be set. Figure 28 shows how calendars can be assigned to resources. Under default quantities the amount of available employees per department is set. Next to this, the amount of resources from this default quantity to which certain calendars apply can be filled in (this can never be more than the default quantity).

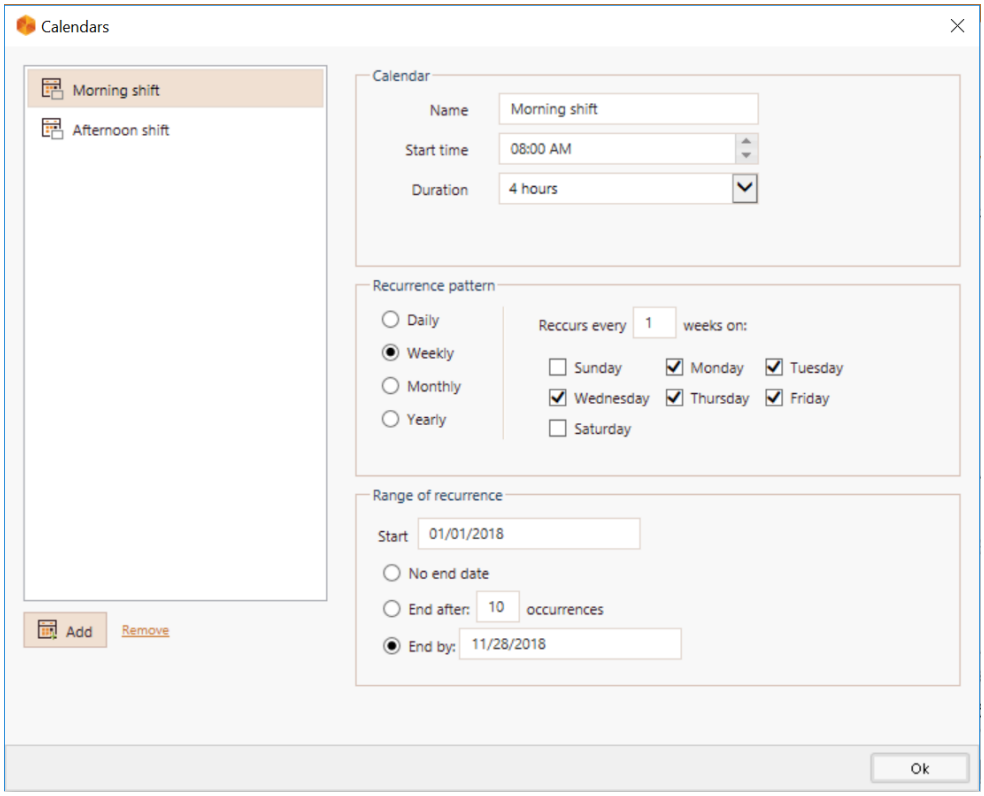


Figure 27: Bizagi simulation view creating a calendar

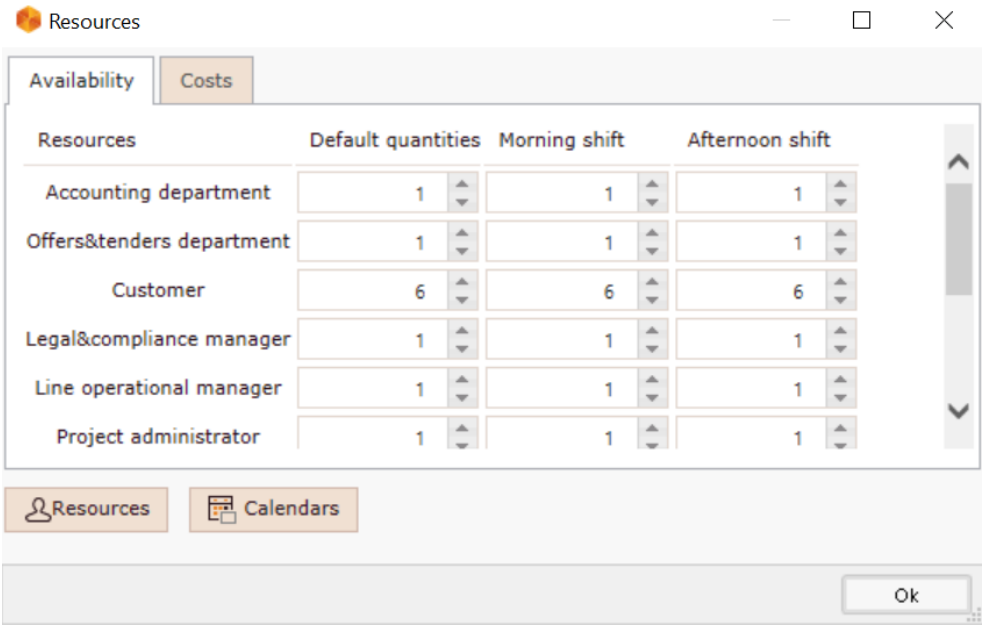


Figure 28: Bizagi simulation view assigning calendars to resources

After simulations have been ran, data can be exported from Bizagi to Excel for analysis/interpretation.

5.2 Assumptions

Because reality is far too complex to encompass with a model, the following assumptions had to be made in order to do an approximation:

1) First, each department has one employee available for the OTC process. The reason this assumption can be justified is that on every task in the OTC process at maximum one employee per department works. Moreover, the employees are part of a lot more processes because of which their utilization will be below 100%. Simulation results support this assumption.
2) Furthermore, assumed is that every day an employee works 9 hours per day and has a 1-hour lunch break (from 12-13 PM). 45 hour weeks are very common in Colombia which justifies this assumption.
3) Next, Colombia has the most public holidays in the world which in total are 18. Moreover, by law, Colombians are allowed to have 15 days off per year. Assumed is that employees use all 15 days and therefore do not work 33 days per year. This has been taken into account using calendars.
4) Last, assumed is that the bottle-neck is never with the customer. Therefore, although one customer might have multiple contracts with Stork Branch, is assumed that different employees within the customer company will be working on the different contracts. Therefore, the amount of tokens that are ran through the process will equal the amount of customer “resources”.

5.3 Model validation

To verify that the models produce accurate data, process duration data that Stork does collect has been compared with output from simulations of the current OTC sub-processes models. Stork does collect data about the days sales outstanding (DSO) and the days WIP outstanding (DWO). The DSO is from the creation of the invoice until payment is credited and the DWO is from the moment costs are registered in Seven until the stamped invoice is registered in Seven.

From the DSO/DWO an average of 13 months has been compared to simulation output of the current situation of which the results can be seen in the table below.

	Data Stork current	Simulation current OTC model output	% Deviation
DSO	21.15 days	20.07 days	5.11%
DWO	27.43 days	25.54 days	6.89%

As one can see, the differences between actual data and output from the current OTC models are minimal, which supports that the current OTC models produce accurate data. The differences can be explained/justified by a few *model limitations* as seen in the section below.

5.4 Limitations

In the simulations of the current and to-be models of the OTC process, limitations have occurred in both the models and in the Bizagi software itself. For both types, the limitations will be discussed and, if relevant, there will be explained how there has been worked around limitations.

Model limitations

In the OTC models the following limitations have been recognized:

1. The simulation models are a simplified version of reality and do not take external factors into account that could influence the OTC process.
2. Over-/under hours, inefficiency and extended lunch breaks are not taken into account.
3. Process- and waiting times per task are estimated averages from the departments involved and therefore will hold a small error compared to the actual averages and accumulated, the total maximum error could be significant. However, in reality there will be over- and under estimations which will balance each other out (as seen for the DWO/DSO).

Bizagi modeler simulation view limitations

In the Bizagi modeler simulation view limitations have also appeared in the software itself, which were the following:

1. Bizagi modeler simulation view allows maximum scenario durations of 999 days. If processes are very long, such as the manage sales contracts sub-process, there can only be a short amount of tokens ran per simulation.
2. If the total amount of time that it takes to run an X amount of tokens takes less time than the scenario duration, resource utilization will be distorted because Bizagi will assume that in this remaining time the resources do not work.
3. If there is a waiting time for a certain task to be performed by a certain resource, Bizagi assumes this resource cannot work during this wait time. This is also the case when there are parallel tasks for the same resource without waiting time. There has been worked around this by removing waiting times of tasks and manually adding them to the simulation results afterwards.
4. Bizagi modeler sometimes does not take waiting times from certain tasks into account. For some tasks it does and for some it does not, which is believed to be a bug in the software. However, there has been worked around this by checking the results very precisely and manually adding the waiting times that were not included. It has been verified that manually adding the waiting times afterwards to the results holds exactly the same outcome as the software including the waiting times in the first place.
5. Although in calendars working days have been defined as 9 hours. The process times shown the simulation results are based on 24h days. Therefore, these times had to be changed manually to 9-hour days. In section 5.5 “simulation results” all results have been manually changed to 9-hour working days.
6. The processing time KPIs which Bizagi produces as simulation output are made up from both processing time of tasks and sometimes (as explained in point 4) waiting times of tasks. There has not been made use of this KPI as it first of all only sometimes takes waiting times into account and therefore gives a distorted imagine of actual processing times. Furthermore, even if the waiting times are removed from the models and added manually afterwards, the KPIs only says something about total working/waiting times and nothing about the process time from the start until the end. The reason for this, is that the KPI from Bizagi also takes processing- and waiting times from side branches that are performed simultaneously by different actors into account.

Because of these limitations within the Bizagi simulation software, a lot of calculations had to be made in Excel to have data that makes sense. Moreover, some extra calculations have been made manually to create some additional interesting data such as critical path duration.

I would recommend Stork to do the simulations again in a simulation tool that is more supportive of the OTC process.

5.5 Simulation results

In this section for each of the sub-process models simulation results from the current and to-be situation have been compared. Because Stork Branch has on average 6 contracts per year, 6 tokens (contracts) have been run with an inter arrival time of 1/6th of a year. Below a short description is provided with the meaning of each of the types of (simulation) results. All performance indicators that are expressed in days are 9-hour working days.

Critical path
The critical path value has been calculated manually. Two types have been calculated: the maximum and average. The maximum critical path value is the longest process duration that can happen disregarding the chance of it happening (BiZZdesign, 2008). The average critical path does take chances into account and represents the average throughput time of a process (BiZZdesign, 2008).

Process cost
The value of this simulation result is built up of solely resource hourly costs because activity- and fixed resource costs, as mentioned before, are not applicable to the OTC process. This value therefore represents the average cost to execute a OTC sub-process. Bizagi calculates this value by adding for all departments the amount of hours worked times their hourly cost. It has manually been divided by 6 to get the average.

Average total waiting time execution tasks
This performance indicator represents the average total amount of days there has to be wait in order to execute certain tasks. These waiting days can arise from both the customer's and Stork's side.

Resource utilization
The resource utilization is the % of the scenario duration that a resource is working. The resource utilization is low in all sub-processes. The reason for this is that the simulation scenario duration is a year in which the process is only ran 6 times. Also, the model assumes that the resources do not work on other processes besides the OTC process which in reality is not the case.

Rework time
This KPI shows the average amount of extra processing time of tasks because of an internal disapproval. It has been calculated manually by multiplying the amount of times a token has looped back times the extra time as a result of it and then divided by the amount of tokens ran to get the average.

Manage sales contracts

First, the time performance indicators as seen in Figure 29 will be discussed:

1) *Critical path.* The average- and maximum critical path time decrease. The reason for this is that steps that in the current situation are performed manually, are estimated to be processed faster with the use of SAP ByDesign in the to-be situation. The average- and maximum critical path duration are the same for this process as all tasks have to be performed.
2) *Average total waiting time for execution of tasks*. The average total waiting time for execution of tasks is 75 days. This waiting time consists of the customer taking 60 days to review the contract before signing it, there is a week waiting time in the preparation of the budget, there is a week waiting time in appointing the resources to the project and it takes a day before the revised budget is send to the project administrator.
3) *Total average rework delay*. The total rework delay decreases significantly in the to-be situation. The reason for this, is that in the current situation the revised budget gets rejected a lot. If this happens, there will be looped back to the start of the creation of the revised budget after which the project administrator has to appoint resources to the project again before sending it to the line operational manager for approval after which project controlling records it. In the to-be situation, the budget is created after the appointing of labor resources and if it gets rejected, only the activity of creating the budget has to be performed again.

Manage sales contracts	Average critical path (days)	Maximum critical path (days)	Average total waiting time execution tasks (days)	Total rework delay (9h days)
Current	93.77	93.77	75	10.22
To-be	92.37	92.37	75	0.03

Figure 29: Time performance indicators manage sales contracts

Next, in Figure 30, for resources the utilization and associated process costs can be seen.

Resource	Utilization current	Total cost current	Utilization to-be	Total cost to-be
Accounting department	0.07%	0.2	0.00%	0.0
Offers&tenders department	8.81%	48	8.42%	45.6
Legal&compliance manager	0.00%	0	0.00%	0.0
Line operational manager	2.57%	25	1.30%	12.4
Project administrator	1.10%	2	0.66%	1.2
Project controlling	1.11%	4	0.44%	1.5
Risk manager	1.37%	8	1.37%	8
Commercial department			0.05%	0.2
	Total cost (mln COP)	**87**	**Total cost (mln COP)**	**69**
	Average cost (mln COP)	**14**	**Average cost (mln COP)**	**12**

Figure 30: Resource utilization and cost manage sales contracts

From this comparison a few things stand out:

1) The accounting department has a utilization of 0.0% in the to-be situation. The reason for this is that in the current situation, the accounting department creates the cost-/profit centers which in the to-be situation will be done by project controlling.
2) The legal&compliance manager has a utilization of 0.0% in both the current and to-be situation. The reason for this is that from the six tokens, in both the current and to-be situation, all are old clients and therefore no legal checks have to be performed.

3) The overall resource utilization decreases in the to-be situation. The reason for this is that the total amount of processing time decreases as a result of tasks being performed faster in SAP ByDesign. Therefore, as a logical consequence, the resource utilization decreases as well (which is the % of the time a resource performs actual work). Because the process costs are made up solely from resource hourly cost times the amount of hours actual work is performed, this KPI decreases as well.

Manage prices&rates

What stands out from the time performance indicators is that critical path times decrease significantly. This is caused at the beginning of the sub-process in which the recording of the labor/materials/equipment of a project takes place and within tasks of the project controlling department. In the current situation, the creation of the progress report by operations and reviewing the report and creating a forecast by the project administrator takes in total 46 hours. In the to-be situation, these tasks are replaced by creating cost assignment rules, recording labor/equipment/materials in SAP and creating the forecast in SAP which are in total estimated to take 16.17 hours. Moreover, in the current situation, project controlling has to perform a lot of tasks to calculate the WIP and cost backlog manually. In the to-be situation, SAP ByDesign will do this automatically combining the newly added tasks of creating cost assignment rules and running the revenue recognition.

Next, the average total waiting time for execution of tasks decreases with 5.75 hours (which happened with 50% chance in the current situation). This waiting time occurred in the current situation when the changed WIP and cost backlog were send back and forth between the project controller and project manager.

Manage prices&rates	Average critical path (days)	Maximum critical path (days)	Average total waiting time execution tasks (days)
Current	18.49	21	10.53
To-be	13.89	15.97	10.21

Figure 31: Time performance indicators manage prices&rates

Next, from the comparison of resource utilization and associated process costs in Figure 32, the following things stand out:

Resource	Utilization current	Total cost current	Utilization to-be	Total cost to-be
Project controller	1.58%	5.5	1.03%	3.62
Project administrator	1.32%	2.4	1.47%	2.61
Operations	2.05%	6.4		
Project manager	0.65%	4.3	0.55%	3.59
Line operational	0.41%	3.9	0.41%	3.92
Project controller	0.03%	0.2		
	Total (mln COP)	**23**	**Total (COP)**	**14**
	Average (mln COP)	**4**	**Average (COP)**	**2**

Figure 32: Resource utilization and cost manage prices&rates.

1) Resource utilization of project controlling decreases. The reason for this is that all the tasks of calculating the WIP and cost backlog manually will be eliminated as SAP ByDesign can do it automatically using cost assignment rules in combination with running the revenue recognition.

2) Resource utilization of the project administrator increases. The reason for this is that in the to-be situation the administrator creates the cost assignment rules, records labor/materials/equipment and creates a forecast instead of reviewing a report with quantities executed, reviewing this report and creating a forecast. This new series of tasks takes more time which results in an increase of resource utilization.
3) Resource utilization of the project manager decreases. The reason for this is that, since the cost backlog and WIP are no longer calculated manually, he/she does not need to approve changes in it anymore and has less processing time in the to-be situation.
4) Operations and the project controller leader have no resource utilization in the to-be situation anymore as they are no longer involved.

Manage customer invoices

First, the time performance indicators as seen in Figure 33 will be discussed:

Manage customer invoices	Average critical path (days)	Maximum critical path (days)	Average total waiting time execution tasks (days)
Current	8.91	10.47	7.02
To-be	5.94	7.5	4.69

Figure 33: Time performance indicators manage customer invoices

1) *Critical path*. The average- and maximum critical path decrease significantly even though an extra approval step has been added. The reason for this is that SAP ByDesign eliminates a lot of (control) tasks in this process. An example of such an elimination are the tasks around the pre-numbered invoicing formats which in total take 3.61 days.
2) *Average total waiting time for execution of tasks*. As mentioned above, 3 days of waiting time caused by the pre-numbered invoicing formats is eliminated with SAP ByDesign. However, also an extra approval is added in the to-be situation. The net result however is still a reduction of average total waiting time.

From the comparison of resource utilization and associated process costs in Figure 34, the following things stand out:

1) The resource utilization of the accounting department decreases significantly. The reason for this is that at the end of the current manage customer invoicing process a lot of tasks are performed by the accounting department regarding the pre-numbered invoicing formats and controls for the manual invoicing. Because of SAP ByDesign, all of these tasks will be eliminated as the invoicing will be done automatically in SAP.
2) The utilization of the project administrator decreases. The reason for this is because he/she does not perform the tasks of requesting the pre-numbered invoicing formats anymore.
3) The utilization of the treasury department increases. The reason for this is that simply more tokens took another path in the to-be situation and has nothing to do with SAP ByDesign / business process reengineering changes.

Resource	Utilization current	Total process cost current	Utilization to-be	Total process cost to-be
Accounting department	0.38%	0.79	0.01%	0.02
Project administrator	0.55%	0.98	0.46%	0.81
Project manager	0.27%	1.80	0.27%	1.80
Treasury department	0.14%	0.29	0.18%	0.39
	Total (mln COP)	**3.9**	**Total (mln COP)**	**3.0**
	Average (mln COP)	**0.6**	**Average (mln COP)**	**0.5**

Figure 34:Resource utilization and cost manage customer invoices

Manage cash collection

In this sub-process, no changes have been made by the SAP ByDesign implementation and/or business process reengineering changes.

Figure 35 shows the time performance indicators. As expected, for both the current and to-be situation there are no changes. The average critical path is 16.19 days of which 16 days are waiting time. The manage cash collection sub-process is almost always about waiting on payment. The other branches are simply controls in case there is not paid in time. In the maximum critical path, the customer did not pay in time and had to be contacted after which he/she gave a new date of payment on which Stork had to wait.

Manage cash collection	Average critical path (days)	Maximum critical path (days)	Average total waiting time execution tasks (days)
Current	16.19	17.11	16
To-be	16.19	17.11	16

Figure 35: Time performance indicators manage cash collection

Next, Figure 36 shows the differences in resource utilization and associated process costs (COP). Again, as expected, these are negligible and caused by differences in paths taken by the tokens in the current and to-be models in the simulations.

Resource	Utilization current	Total process cost current	Utilization to-be	Total process cost to-be
Treasury department	0.01%	0.028	0.01%	0.012
Project coordinator	0.00%	0.000	0.00%	0.000
Professional planner	0.08%	0.266	0.10%	0.302
	Total (mln COP)	**0.294**	**Total (mln COP)**	**0.314**
	Average (mln COP)	**0.049**	**Average (mln COP)**	**0.052**

Figure 36: Resource utilization and cost manage cash collection

5.6 Extended balanced scorecard

As stated in the systematic literature review, the extended balanced scorecard has been used to measure improvement over the “as is” situation. Below a table can be seen in which KPI’s of the different OTC relevant segments of the extended BSC are compared for the current and to-be situation. The specific KPI’s per segment are chosen for their relevance to the OTC process and their potential to obtain data through the use of simulations. Only if for none of the KPI’s in a segment of the extended balanced scorecard data could be gathered with simulations, an educated guess has been used. For each of the KPI’s an explanation will be given of how the value has been obtained.

KPI per segment of extended BSC	Current situation	To-be situation
Financial performance:		
Market share	4.65%	4.65%
Customer performance		
Return rate	😐	☺
Society/environmental performance:		
Perceived society satisfaction	☺	☺
Time-related process performance:		
Process duration	137 days	128 days
Cost-related process performance:		
Process cost (COP)	18.9 mln COP	14,4 mln COP
Process-performance related to internal quality:		
Rework time	10.22 days	0.03 days
(Digital) innovation performance:		
Reduction processing time to computerization	-	45.69 hours
Employee performance:		
Resource utilization	See section 5.5	See section 5.5

Table 3: Comparison KPI score current and to-be situation of the OTC process

Market share

This is the % of total revenue of the market that Stork Branch captures. At the end of 2017 Stork Colombia is expected to capture a market share of 28.4% which equals 171 EURm. This revenue consists of both MASA and Stork Branch to which Stork Branch contributes 28 EURm. Thus, the calculation for Stork Branch its market share is the following: (28.4/171)*28=4.65%. The market share is not necessarily expected to grow because of the SAP ByDesign implementation and therefore is estimated to be the same as in the current situation.

Perceived society satisfaction

With this KPI is meant how society perceives Stork. This KPI “value” has been obtained by talking to employees and is not expected to change because of the SAP ByDesign implementation.

Return rate
For this KPI an educated guess has been made in consultation with employees involved in the OTC process. Currently, on average, 5 out of the 60 invoices Stork Branch sends out per year are rejected because they contain an error. This error is most of the times a result of putting the wrong data in the invoice because customers can already require to sign supporting documentation of executed work before the invoice is send out (with unit rate- and reimbursable contracts). The return rate is expected to decrease because all data will be in the SAP ByDesign system, from which the invoice will automatically be generated and therefore no manual data errors will occur anymore (only if wrong data is in the system itself). Moreover, the accounting department will check the invoices in the to-be situation which is also expected to contribute to a decrease in return rate.

Process duration
This KPI value represents the average throughput time (average critical path) of sub-processes.

Sub-process	Sub-process duration current	Sub-process duration to-be
Manage sales contracts	93.77 days	92.37 days
Manage prices&rates	18.49 days	13.89 days
Manage customer invoices	8.91 days	5.94 days
Manage cash collection	16.19 days	16.19 days
Total	**137.36 days**	**128.39 days**

Process cost
This KPI value shows the average (resource) cost of executing a sub-process and has been obtained by running simulations in Bizagi modeler view. The costs are shown in Colombian pesos (COP).

Sub-process	Process cost (mln COP) current	Process cost (mln COP) to-be
Manage sales contracts	14.4 mln COP	11.6 mln COP
Manage prices&rates	3.77 mln COP	2.29 mln COP
Manage customer invoices	0.642 mln COP	0.503 mln COP
Manage cash collection	0.049 mln COP	0.052 mln COP
Total	**18,9 mln COP**	**14,4 mln COP**

Rework time
This value has been obtained by manually adding the extra process time that resulted from tokens looping back because of an internal disapproval. As seen in the table below, rework time only appeared in the simulations results in the manage sales contracts process. The reason for this, is that the probabilities for disapprovals throughout the OTC process are very low besides for one approval step in the manage sales contracts sub-process. Although the simulation results do not show much improvement on this KPI in the other sub-processes, the amount of errors and rework time as a result is expected to decrease throughout the entire OTC process. This because data will now be stored and retrieved from SAP ByDesign and as a result, less manual errors will be made.

Sub-process	Rework time current (days)	Rework time to-be (days)
Manage sales contracts	10.22 days	0.03 days
Manage prices&rates	-	-
Manage customer invoices	-	-
Manage cash collection	-	-
Total	10.22 days	0.03 days

Reduction processing time to computerization
This KPI value represents the reduction of process time of tasks that in the current situation are carried out manually and in the to-be situation will be performed in SAP ByDesign. This reduction in processing time disregards the paths taking by tokens in the simulation. For this KPI, only a value for the to-be situation has been provided because its value is relative to the current situation. The value has been calculated manually by adding all reductions in processing time throughout the sub-process as a result of steps from the current situation now being performed in SAP ByDesign.

Sub-process	Reduction of processing time to computerization (hour)
Manage sales contracts	20.84 h*
Manage prices&rates	21.85 h
Manage customer invoices	- 0.08 h
Manage cash collection	3.08 h*
Total	**45.69 h**

* Note: it is possible that the reduction of processing time to computerization is bigger than the reduction of the average-/maximum critical path as not all reductions are in the critical path. Moreover, it is possible that new tasks are introduced in the to-be situation which influences critical path times.

The reduction of processing time to computerization for the invoicing process is negative because the total processing time of tasks that are now performed in SAP ByDesign is larger than in the current situation in which these tasks are performed manually.

Resource utilization
This KPI value has been obtained by running simulations. The resource utilization per role per sub-process can be found in the simulation results in the respective sub-process results of section 5.5.

6 Business case

6.1 Business case framework

In this chapter, a business case for the SAP ByDesign implementation and business process reengineering changes has been written. The business case has been built according to the framework provided by John Ward, Elizabeth Daniel and Joe Peppard (Ward, Daniel, & Peppard, 2007). The reason for this is that general business case frameworks only focus on obtaining financial funding which has many dangers amongst for example “creative” calculations based on inadequate evidence. Although senior management is often more interested in only the financial benefits, staff within the organization, whom are critical to a successful implementation, are often more interested in other more subjective benefits. During the trips to the field it stood out that a lot of employees have no idea what the consequences of the SAP implementation/business process reengineering changes would be. It is crucial in order for the SAP implementation to be successful that the staff cooperates. Because this business case framework shows, amongst other things, the benefits/changes per benefit owner, it can be used to show the employees what will actually change for them and help increase acceptance.
This framework allows besides getting approval for financial funding also the following:

- To enable Stork to set priorities among different investments for funds and resources.
- To identify how the combination of the SAP ByDesign implementation- and business process reengineering changes will deliver each of the benefits that have been identified.
- To ensure commitment from the business managers to achieve the intended investment benefits.
- To create a basis for review of the realization of the proposed business benefits when the investment is complete.

In this business case, at first the business drivers will be discussed. Next, investment objectives will be discussed after which a table with benefits focused on the OTC process will be provided. Moreover, costs and an estimation of savings and a risk analysis for the entire SAP ByDesign implementation will be discussed.

6.2 Business drivers

At Stork there are in essence two types of projects:

1. License to operate (LTO) projects – Projects that simply have to be done for compliance reasons, regardless their financial return.
2. Regular projects – Projects that will be justified and ranked on the basis of their financial return or other key business needs, e.g. growth enabling.

The SAP ByDesign implementation at Stork Colombia can be classified as a LTO project although it also clearly brings some financial and other business benefits.

6.3 Investment objectives

The objectives of the SAP ByDesign implementation and business process reengineering can be found in Figure 37 per strategy pillar. For each of the investment objectives will shortly be discussed what is meant with the objective and how the objective is achieved. In Table 4 benefits that will be realized by achieving these investment objectives will be given for the OTC process.

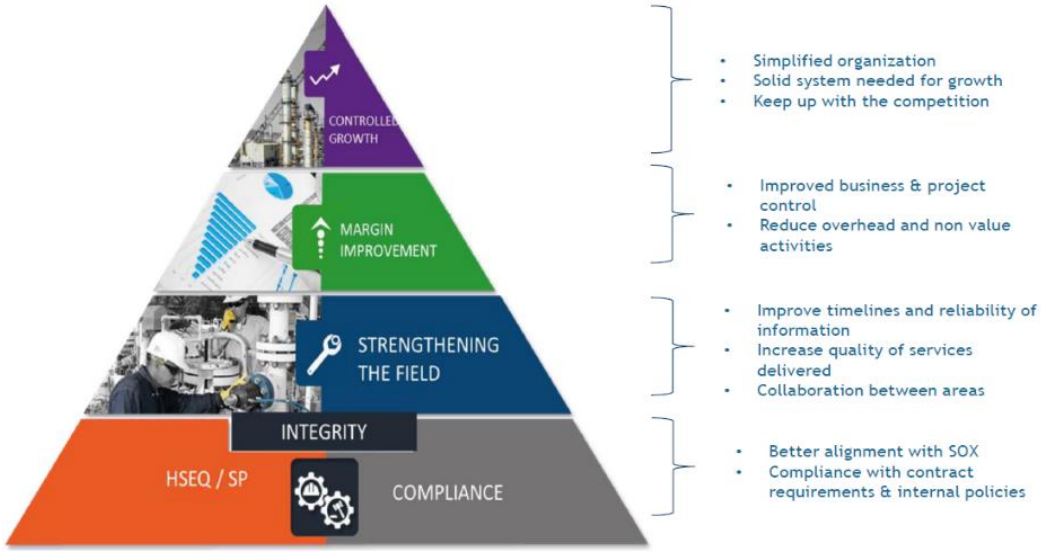


Figure 37: Investment objectives SAP ByDesign and business process reengineering

Simplified organization
This means a less complicated organizational structure. This is for example in the OTC process achieved by diminishing the amount of departments involved. In reality it also means less employees involved in the OTC process and on payroll.

Solid system needed for growth
This means having an integral system that captures all information and allows a more efficient way of working which in turn decreases utilization of current resources which can be used to capture growth. SAP ByDesign itself is such a system.

Keep up with the competition
Keeping up with the competition in terms of market share/profitability. Market share increase can be achieved with the improvement of quality of services delivered and profitability can be increased as overall processes become more efficient.

Improved business & project control
Improved business in this context means tackling bottlenecks/problems in the current way of working. With improved project control is meant that projects can be monitored and controlled better. Amongst other things this includes employees following the processes as they are defined by Stork which can be achieved by creating certain process steps in SAP ByDesign which won't allow the process to continue unless they are performed. Improved business is achieved by reengineering bottle-necks/problems in the current situation.

Reduce overhead and non-value activities
This means reducing the number of employees working in the office and activities that hold no value for both Stork and the customer. The reduction of overhead is achieved by making all processes more efficient and therefore requiring less employees to do the same amount of work. An example of eliminating non-value added activities is the elimination of tasks regarding the pre-numbered invoicing formats in the OTC process.

Improve timelines and reliability of information
With the improvement of timelines is meant diminishing the time between the start and end of processes. Improving reliability of information means reducing the amount of incorrect data and errors that leads to disapprovals/returns. Timelines are improved as manual tasks are automated and lots of control/non-value added activities are eliminated. Reliability of information is increased because data can now be controlled as it is saved in SAP ByDesign which is accessible for everyone instead of in an Excel sheet.

Increase quality of services delivered
With an increased quality of services delivered for the customer is meant less errors and more detailed information. This is achieved with for example a better planning in SAP ByDesign and more detailed invoicing.

Collaboration between areas
Better collaboration between areas is achieved with centralized data in SAP ByDesign for everyone with the right authorization to access.

Better alignment with SOX
The Sarbanes-Oxley Act (SOX) requires public companies such as Stork to attest to the accuracy of their financial reporting and establish adequate internal controls over their financial reporting including the required segregation of duties. When this is not done, fines and in extreme cases even imprisonment of management can follow. Furthermore, it can seriously damage a company's reputation. Because SAP ByDesign can be used to enforce tasks to be performed as it won't allow the process to continue, this investment goal can be achieved by enforcing such internal control steps in SAP ByDesign.

Compliance with contract requirements & internal policies
This objective means that Stork wants to get better at meeting contract requirements and following its internal policies. This is achieved by adding controls/internal policies within the processes and using SAP ByDesign to enforce the tasks to be performed.

6.4 Benefits focused on the OTC process

Below in Table 4, benefits for the OTC process as a result of the SAP ByDesign implementation and business process reengineering changes have been given. To every benefit, a measure and benefit owner have been assigned. The measure can be used to measure the extend of the benefit. The benefit owner is the department/function that will take advantage of the benefit. Furthermore, each benefit is linked to one or more investment objectives as seen in Figure 37. In the benefit table, the benefits have been classified according to the main change that is required to realize the benefit: doing new things, doing things better and stop doing things. Furthermore, the benefits have also been classified according to their degree of explicitness, which is ability to assign value to the benefit from information that is already known or can be determined before the investment is made.

There are four categories of explicitness in ascending level of explicitness:

1) Observable, these are benefits that can only be measured by opinion or judgement.
2) Measurable, these are benefits for which a measure already exists or can easily be put in place.
3) Quantifiable, these are benefits for which a measure already exists or can easily be put in place and a reliable estimation of the size/magnitude of the benefit can be made before the investment is made.
4) Financial, these are benefits that can be expressed in financial terms and are the result of applying a financial value or formula to a quantifiable benefit.

	Doing new things	Doing things better	Stop doing things
Financial			
Quantifiable			➢ **Benefit:** Stop using pre-numbered invoicing formats (*Reduce non-value added activities*). **Measurement:** Reduction of process time (3.61 days). **Benefit owner:** Accounting department and project administrator. ➢ **Benefit:** Stop calculating the WIP and cost backlog manually (*Improve business/project control*). **Measurement:** Reduction of 33 hours of processing time for the project controlling department. **Benefit owner:** Project controlling. ➢ **Benefit:** Stop requesting accounting to create the cost centers (*Simplified organization).* **Measurement:** Process time (1-hour reduction). **Benefit owner:** Accounting department.
Measureable	➢ **Benefit:** Better analyses because costs per project can be seen before the actual costs are booked using standard cost rates (*Improved business and project control*). **Measurement:** Margin improvement. **Benefit owner:** Project administrator, project controller and project manager.	➢ **Benefit**: Less errors in invoices because they will now be generated and processed in SAP ByDesign instead of created manually (*Improved business/project control*). **Measurement**: Return rate due to errors. **Benefit owner**: Project administrator.	➢ **Benefit**: Reports don't have to be created manually anymore as SAP creates them automatically (*Reduce overhead and non-value added activities*). **Measurement**: Process time and errors. **Benefit owner**: Every department that used to create manual reports. ➢ **Benefit**: Stop creating the list of units produced manually (*Collaboration between areas).* **Measurement:** Amount of errors. **Benefit owner**: Project administrator.

Measureable		➢ **Benefit:** Data between SAP and CRM aligned (*Increase quality of services delivered & improved business/project control*). **Measurement:** Amount of errors. **Benefit owner:** Commercial, operations and finance. ➢ **Benefit:** Creation of budget zero cannot be skipped anymore as it is assigned to one person (*Improved business/project control*). **Measurement:** Amount of errors. **Benefit owner:** Project administrator/controlling. ➢ **Benefit:** Better analyses as resources (to be) used in the project will be registered in SAP instead of Excel (*Improved business/project control*). **Measurement:** Margin improvement **Benefit owner:** Project administrator/management /professional planner/ project controlling. ➢ **Benefit:** See margins at a deeper level (*Improved business/project control*). **Measurement:** Margin improvement. **Benefit owner:** Project controlling.	➢ **Benefit:** No more data requesting as data will be available, updated and accessible for everyone with the right authorization real-time (*Improved business/project control & Collaboration between areas).* **Measurement:** Process time/errors/elimination of requesting data tasks. **Benefit owner:** Every department.
Observable			

Table 4: Benefits of the OTC process for Stork Branch

6.5 Costs (estimated by SAP project organization)

Below the total costs of the SAP ByDesign implementation project can be found. For each of the rows in Table 5, a short explanation will be given.

One off investment	**Driver**	**Amount EURm 2017**
Consultant costs implementation	6 Consultants	0.8
Other implementation costs	Travel costs	0.1
Personnel costs of people working in SAP team	12 employees	0.3
Total one off investment	**-**	***1.2***
Recurring costs		
SAP subscription fees user licenses	*100*621*	*0.06*
Total recurring costs	**-**	***0.06***

Table 5: SAP ByDesign implementation project costs

Consultant costs implementation.
The SAP ByDesign implementation was/is supported by 3 local- and 3 Dutch consultants. The 0.8 EURm cost seen here is the sum of salary costs from April- to December 2017 for all six consultants.

Other implementation costs.
The other implementation costs consist of training-, flight-, accommodation and handling-, vehicles-, communications plan- and restaurant costs. The 0.1 EURm is a summation of all of these costs made for the SAP project in Stork Branch from April- until December 2017.

Personnel costs of people working in SAP team.
The SAP team consists of 12 employees that are (partly) made free of their regular duties. The 0.3 EURm cost seen here consists of the salary costs of all these 12 employees for the months April-December 2017.

SAP subscription fees user licenses.
Within Stork Branch, 100 employees will be working with SAP ByDesign. The costs per user license is 621 euro per year and therefore the total user license fee is 100*621 = 0.0621 EURm per year.

6.6 Savings (estimated by SAP project organization)

Below an estimation of the total savings of the SAP ByDesign implementation project can be found. For each of the rows in Table 6, a short description of the calculation will be given. The percentages of saving per category have been estimated by both the project controlling- and the finance department.

Improve control over procurement/external spend.
Currently Stork Colombia spends 17 million per year on 3rd parties. Because of improved control this amount can be diminished by 1-1.5%.

Increase of invoiced costs & over hours.
Currently 25 million of Stork Colombia's revenue is from invoiced costs. However, in the current way of working sometimes work is executed without a service order. The customer can then say that the executed work was not agreed upon and refuse to pay. In SAP ByDesign, work can only be executed once the service-/project order have been released and therefore such incidents won't happen anymore. Because of this, the amount of invoiced cost is estimated to increase with 0.2-0.4%.

Working capital reduction – WIP & Debtors.
The working capital (WIP) is the amount of money necessary to operate which is currently 3 million. It is estimated to be reduced with 5% because debtor money will be received earlier. The reason for this is that all data is now registered in SAP ByDesign and as a result less disputes will arise in the future that cause delays of payment. The calculation is 3 million times 5% times the weighted average cost of capital (WACC). The reason it is multiplied by the WACC is because that is the percentage of interest Stork Colombia has to pay in order to borrow money.

Savings - YOY	**Driver**	**Calculation**	**Amount EURm 2018**
Improved control over procurement/external spend	% of spent	1-1.5% * 17m =	0.2-0.3
Increase of invoiced costs & over hours	% of Revenue	0.2-0.4% * 25m =	0.1
Working capital reduction – WIP & Debtors	% of WIP & debtors * WACC	3 *5%*13%=	0.02
Total potential savings	**-**	**-**	**0.32-0.42**

Table 6: SAP ByDesign implementation project savings

In conclusion it can be seen that the SAP ByDesign implementation will break-even after 1.26 / (0.26-0.36) = 3.5 - 4.85* years and generate a positive return afterwards. This because all of the savings are recurrent and almost all costs are a one-off investment.

Moreover, as stated in section 1.1, the SAP ByDesign implementation in Stork Branch serves as a pilot for MASA later on. Because of the experience Stork Branch gains with its implementation, the total costs for the SAP ByDesign implementation for MASA are expected to be lower than Stork Branch's even though MASA is significantly larger.

*The calculation is (the total one-off investment in 2017 + recurrent cost for 2017) / (total recurrent savings – total recurrent costs)

6.7 Risks and mitigations

Below, the most important risks that could occur after the SAP ByDesign implementation will be stated with a plan to mitigate them.

Type of risk	Risk	Mitigation
Technical	Complexity SAP system	This risk will be mitigated through the training of key users from different departments. These key users will later on train their departments in using SAP.
Technical	Internet connections in the field	Test the internet connection during the trips to the field (by working in the SAP system). If necessary, inform management that it needs to be improved.
Technical	Delays because of errors in master data	First, the key users will fill in the master data (according to a set of rules agreed upon with all key users) in a template. Next, this template is checked for consistency after which it gets uploaded in the system. Moreover, even if erroneous master data gets uploaded in the system, it should be discovered and fixed during either the integral testing and/or the user acceptance testing.
Organizational	Employee acceptance of change	This risk can be mitigated by showing employees what benefits the implementation of SAP/business process reengineering changes will hold for them individually. A recommendation is therefore to distribute the table with benefits from this business case amongst the employees involved in the OTC process.
Organizational	Retention of SAP knowledge from key users after the project is finished	This risk can be mitigated by holding certain people (for example the key users) responsible for retaining the information. Also, incentives can be provided in order to make it more attractive to retain the SAP knowledge.

Table 7: Risks and mitigations SAP ByDesign implementation

7 Implementation plan

In this chapter, an implementation plan for SAP ByDesign has been written. First the implementation trajectory will be discussed and what still needs to be carried out before SAP ByDesign can go live. Second, (potential) delays regarding the implementation will be shortly discussed. Last, recommendations will be given for the implementation and acceptation of change.

Implementation trajectory

At the moment, there is group of middle-management employees within Stork that has been made (partly) free of duties to focus on the SAP implementation (in which I also took part). This group is called the key users and consists of employees from all from different departments. Currently the key users are being trained to work with SAP ByDesign and will train employees within their departments later on. A visualization of the SAP ByDesign implementation trajectory can be seen in Figure 38.

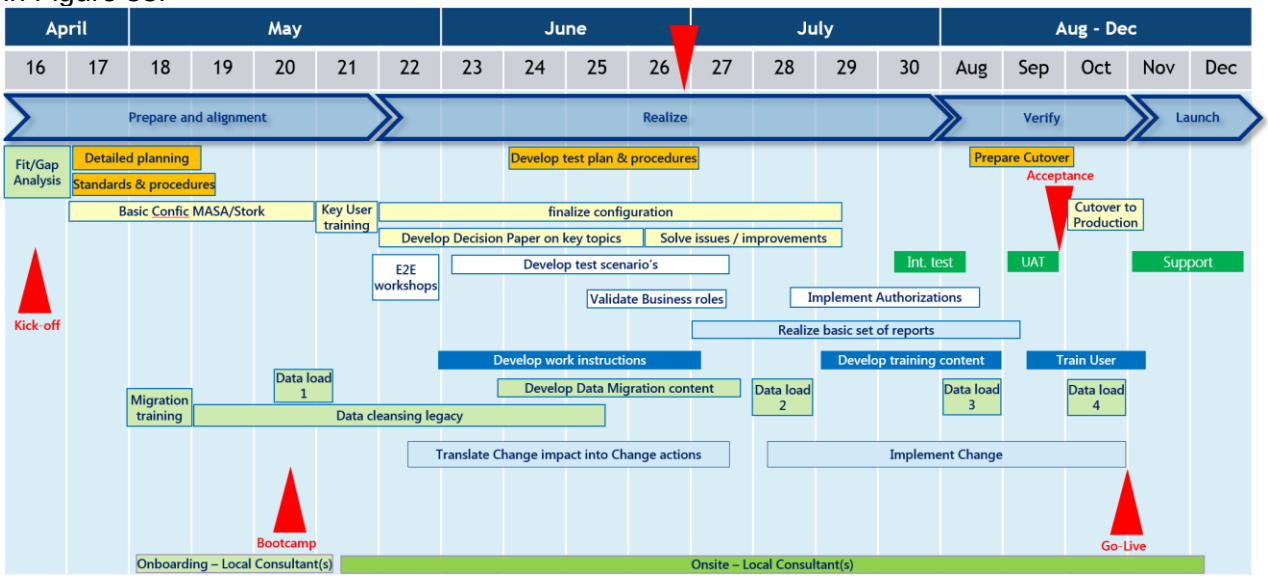


Figure 38: Implementation trajectory SAP ByDesign

So far current processes have been explained to SAP consultants in order to tailor SAP ByDesign to Stork Branch, decision papers have been written and approved by senior management/headquarters on key topics, processes have been changed for the SAP ByDesign implementation, work instructions have been developed, business process scenarios have been walked through in the system by the key users and eventual problems have been identified (of which some already have been tackled), data has been uploaded to the system (first two data loads), change impact has been translated to change actions and a basic set of reports has been realized.

Before the SAP ByDesign implementation can go live the following needs to be carried out:

1. First, the last remaining identified problems by the key users need to be fixed. This is currently taking longer than expected. The reason it is taking longer is that Colombia has an extensive financial law which causes Colombian financial processes to slightly differ from the financial processes in other countries in which Stork is located and uses SAP ByDesign. Initially explained to the SAP consultants these processes appeared to be the same as in other countries but when going through the processes with the key users, issues were found.

2. Second, the last two data loads need to be transferred into the system. The third data load as seen in Figure 38 consists of all materials after which all information should be in the system. However, after the UAT (user acceptance testing), it could be possible that data needs to be altered or additional data needs to be uploaded into the system for which there is an optional fourth data load.

3. Third, implementing authorizations. The authorizations are the access rights per user or user role and define what employees are allowed to do/see in the system.

4. Fourth, developing training content. Training content per department will be developed by the respective key user that will train the department. The training content will be based on notes made during the key user training and screenshots from within the system.

5. Fifth, integral testing. The integral testing will happen with the entire key user group. Different processes will be walked-through in which responsible departments will perform the tasks they will have to perform once SAP ByDesign goes live as well. This is done to see whether everything is functioning as it should in the system.

6. Sixth, UAT (user acceptance testing). This is exactly the same as the integral testing except that now all issues that were found during the integral testing should be solved. This is the last testing before going live.

7. Last, training of users. Key users will train their own department with the training content they developed themselves. Before training takes place, each key user must specify how many employees within their department they are going to train and how much time they require. The amount of time required for training can differ per department as some departments have to perform more steps in the system than others.

(Potential) implementation delays

Currently the implementation is delayed because the solving of the by the key users identified problems is taking longer than expected (as explained in the first bullet point above). Further, a potential delay which I believe is most likely to manifest itself is before the training of users. Recently in a human resources workshop in which the entire SAP team participated, it became clear that all key users are feeling very insecure about their SAP knowledge and do not feel comfortable enough yet to train employees within their departments. Therefore, I would propose to, although this will delay the implementation, to train the key users more until they feel comfortable enough to train their departments. This because if the training of key/regular users is not carried out properly there will be many mistakes/errors in the system of which the consequences both in terms of money and time will be much bigger than the implementation delay for extra training.

Recommendations

During my bachelor assignment visits have been made to both Yopal and Neiva (which are, together with Bogota, the three regions in which Stork branch is located) to talk to the people in the field. What stood out was that the people in the field had no idea about what changes SAP ByDesign holds and were somewhat frightened about the idea that they might lose their jobs because of the implementation. Because of this I would like to do two recommendations. First, I would recommend to, before the training of users is carried out, to explain the changes SAP ByDesign holds in general and that functions will not become unnecessary but only the definitions

of certain functions will shift. Second, to increase acceptation of the SAP ByDesign/business process reengineering changes within the to-be OTC process, I would recommend to distribute my business case as seen in chapter 6 amongst employees involved in the OTC process. Especially the benefit table as it shows individual benefits per benefit owner which can help motivate employees to embrace the implementation.

8 Conclusion and recommendations

8.1 Conclusion

With this research and answering my main research question, an improved standardized OTC process for Stork Branch has been designed that is supported in SAP ByDesign. The improved standardized OTC process can be seen throughout chapter 4. In order to be able to create the improved standardized OTC process, the following questions have been successfully answered:

1. *How does the current OTC process look like?*
2. *How can the current OTC process, with respect to the improvement goals of Stork, be analyzed?*
3. *How can the to-be situation of the OTC process be envisioned?*
4. *To what extend are the KPI's related to the extended balanced scorecard improved compared to the 'as is' situation?*
5. *To what extend do the SAP ByDesign implementation and business process reengineering changes contribute to Stork's improvement goals?*

1) The first question has been answered in Chapter 3 in which models of the current OTC process together which a description have been provided. The OTC process has been split into four sub-processes because of its size/complexity and have been modelled for both the current- and to-be situation using Bizagi modeler.

2) The second question has been answered in chapter 2, the literature review, in which business process modelling notations, business process reengineering best practices and business process performance models and KPIs have been discussed.

3) The third question has been answered in chapter 4. In here, the models of the to-be OTC process are shown for which the current models have been served as a basis with additional inputs as described at the beginning of chapter 4. The to-be models itself can be found throughout chapter 4 with a description/reason for each change.

4) After this, the extended balanced scorecard, as described in chapter 2, has been used to validate improvement of the to-be models. Data for the KPIs used in the extended balanced scorecard has been obtained through both simulations in Bizagi modeler and educated guesses when KPI data could not be generated with simulations. Within the Bizagi modeler simulation function some problems/limitations have occurred because of which some calculations had to be made manually with the simulation data output. In section 5.4 is described what limitations have occurred and how there has been worked around. In the table below, a comparison of KPI values of the segments of the extended balanced scorecard that are relevant to the OTC process is shown. As one can see, on most KPIs an improvement has been achieved.

KPI per segment of extended BSC	Current situation	To-be situation
Financial performance		
Market share	4.65%	4.65%
Customer performance		
Return rate	😐	☺
Society/environmental performance		
Perceived society satisfaction	☺	☺
Time-related process performance		
Process duration	137 days	128 days
Cost-related process performance		
Process cost (COP)	18.9 mln COP	14,4 mln COP
Process-performance related to internal quality		
Rework time	10.22 days	0.03 days
(Digital) innovation performance		
Reduction processing time to computerization	-	45.69 hours
Employee performance		
Resource utilization	See section 5.5	See section 5.5

5) The fifth question has been approached from a business case perspective from which in chapter 6 can be concluded the SAP ByDesign investment will break-even after 3.5-4.85 years. This is acceptable as the project has been justified as a license to operate (LTO) project, a requirement for compliance reasons regardless of its financial return. Last, from the implementation plan in chapter 7 can be seen that before SAP ByDesign can go live the following needs to be carried out: solving the last remaining by key user identified problems, the last data loads need to be transferred into the system, the integral testing needs to be carried out, authorizations need to be implemented, training content needs to be developed, the user acceptance testing needs to be carried out and users need to be trained.

8.2 Research limitations

Limitations in this research have occurred both within my research itself and within the Bizagi modeler simulation tool which has been used to validate improvement of the to-be OTC process. Both will be discussed separately below.

Limitations within research

The first limitation within my research I want to acknowledge is in the innovation phase of the BPE method which is about generating ideas to renew/improve the current process. The inputs I have used to reengineer the OTC process are the following: inputs from departments involved, literature on best business process reengineering practices, SAP ByDesign requirements, Stork Australia documentation, Stork's improvement goals and identified problems within Stork. With these inputs I have created an improved and standardized OTC process. However, the to-be OTC process created is possibly not the optimum to-be OTC process because there will always be more/new ideas to achieve improvement.

The second limitation in my research is within the execution of the simulations in Bizagi modeler. Because simulations can never encompass reality, I have acknowledged the following few limitations in my models. First, external factors that can influence the OTC process are not taken into account. Second, under-/over hours, extended lunch breaks and sick leave are not taken into account. Last, process-/waiting times of tasks and probabilities within my models are estimated averages by the departments who perform the respective tasks. Accumulated, the error could be significant but section 5.3 “model validation” supports that in reality there will be over-/under estimations that will middle each other out.

Bizagi modeler simulation functionality limitations

Within the Bizagi modeler simulation functionality, the following limitations have occurred for which I had to find work around’s:

1. Bizagi allows a maximum scenario duration, and if processes are long, for example such as for the manage sales contracts process, only a short amount of tokens can be ran per simulation.
2. If the total amount of time that it takes to run an X amount of tokens takes less time than the scenario duration, resource utilization will be distorted because Bizagi will assume that in this remaining time the resources do not work which of course in reality is not the case, resource will work on other tasks during waiting times.
3. If there is a waiting time for a certain task to be performed by a certain resource, Bizagi assumes this resource cannot work during this wait time which of course in reality is not the case as resources will work on other tasks. This is also the case when there are parallel tasks for the same resource without waiting time.
4. Bizagi modeler sometimes (randomly) does not take waiting times from certain tasks into account. For some tasks it does and for some it does not, which is believed to be a bug in the software.
5. Although in calendars working days have been clearly defined as 9 hours. The process times shown the simulation results are based on 24h days.
6. The processing time KPIs which Bizagi does produce as simulation output are made up from both processing time of tasks and sometimes (as explained in point 4) waiting times of tasks. There has not been made use of this KPI as it first of all only sometimes takes waiting times into account and therefore gives a distorted imagine of actual processing-/waiting times. Furthermore, even if the waiting times are removed from the models and added manually afterwards, the KPIs only says something about total amount of processing time and nothing about the process time from the start until the end. The reason for this, is that the KPI from Bizagi also takes processing- and waiting times from side branches that are performed simultaneously by different actors into account.

To work around these limitations, manual (Excel) calculations have been carried out with the simulation data to have it make sense. For example, the time indicators have been converted to 9-hour days instead of 24-hour days (point 3&4) and waiting times have been removed from the models and added manually afterwards (point 5). Moreover, some extra additional KPIs have been calculated such as average- and maximum critical path and average amount of days of waiting time before tasks can be processed. Results per sub-process can be seen in section 5.5.

8.3 Recommendations

Taking everything into consideration, i.e. both my research as well as the cultural aspects I encountered, I would like to make the following recommendations to Stork:

1. I recommend Stork to invest in an interface between SAP and their CRM tool. Although a financial return will yet need to be determined, the benefit of one customer database will strongly add to Stork its drive for improved compliance and less data handling

2. I would recommend Stork to re-do the simulations that have been carried out with Bizagi modeler, with a software package that is actually designed for dynamic simulations.

3. In contradiction to the Dutch culture, in the Colombian culture it is not so common for staff to raise their concerns about management decision/changes. I would therefore recommend Stork to distribute my business case as seen in chapter 6 amongst employees involved in the OTC process in order to show them the individual changes in order to encourage them to provide their feedback and increase their acceptance of the SAP ByDesign implementation.

4. I would recommend to provide more training in the system for the key users as they have expressed to be feeling too uncomfortable with their current SAP ByDesign knowledge to train employees within their respective department. Although this would delay the SAP ByDesign implementation, the consequences of not having properly trained employees work in the SAP ByDesign system outweighs the implementation delay before going live.

5. I recommend Stork to appoint one ‘Champion’ for each business process. I believe it would be very beneficial during the SAP implementation and transition to the to-be situation to have as a minimum one ‘expert’ for each business process.

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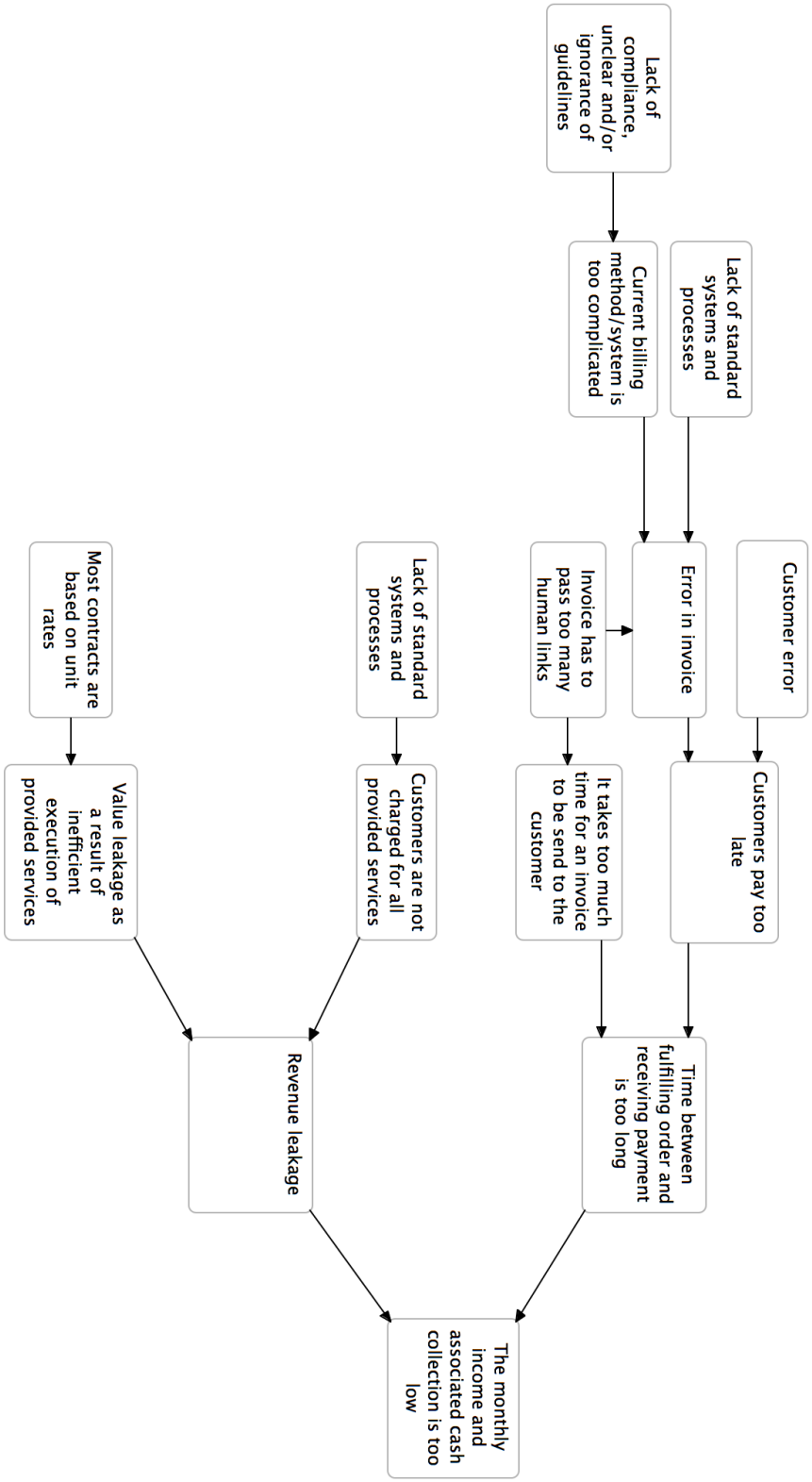
Appendix A: Problem cluster Stork Colombia



Appendix B: Indicators with operationalization per BSC perspective

Perspectives	Indicators/measures/metrics	Operationalization
1/Financial performance		
	Sales performance	[Achieved total sales]/[planned sales] * 100
	Inventory turnover	[Annual total sales]/[average inventory] * 100
	Market share	% of growth in the last years [Sales volumes of products and services]/[total market demands] * 100
	Earnings per share (EPS)	[After-tax net earnings − preferred share dividends]/[weighted average nr of shares outstanding]
	Average order value	[Aggregated monthly sales]/[monthly nr of orders]
	Order growth	[Number of orders in the current month]/[total nr of orders]
	Revenue growth	[Revenue from new sources]/[total revenue] * 100
	Operating revenue	Sales revenues
	Return on investment (ROI)	[After-tax profit or loss]/[total costs] [Revenue − cost]/[cost]
	Return on assets (ROA)	[After-tax profit or loss]/[average total assets]
	Circulation of assets	[Operating revenues]/[assets] * 100
	Current ratio	[Current assets]/[current liabilities] * 100
	Net profit margin	[After-tax profit or loss]/[total operating revenues] [Total operating revenues − operating expenses − non-operating expenses]/[total operating revenues]
	Profit per customer	[After-tax earnings]/[total nr of online, offline or all customers]
	Management efficiency	[Operating expenses]/[operating revenues] * 100
	Debt ratio, leverage level	[Debts]/[assets]
2/Customer performance		
2.1/Customer performance		
	Customer complaints, return rate	Nr of complaints, criticisms or notifications due to dissatisfaction about or non-compliance of orders, products and services Nr or % of orders returned, rework or services to be redone (e.g., incorrect deliveries, incorrect documentation)
	Perceived customer satisfaction	Qualitative scale on general satisfaction (e.g., Likert), possibly indexed as the weighted sum of judgements on satisfaction dimensions (e.g., satisfaction with products and services, perceived value, satisfying end-user needs, being the preferred suppliers for products or services, responsiveness, appearance, cleanliness, comfort, friendliness, communication, courtesy, competence, availability, security)
	Perceived customer easiness	Qualitative scale (e.g., Likert) on the degree of easiness to find information and regulations, to fill out applications, and to understand the presentation of bureaucratic language
	Customer retention	Nr of returning customers
	Customer growth	Nr of new customers
	Customer query time, resolution time, response time	Average time between issuing and addressing a customer problem or inquiry for information
	Customer waiting time	[Time for information about a product or service] + [time for following status updates] + [time for receiving the product or service] Max nr of customers in the queue or waiting room [Handled requests]/[total requests]
	Punctuality, delivery reliability	[Late deliveries or requests]/[total nr of deliveries or requests] % of On-time deliveries according to the planning or schedule
	Payment reliability	[Nr of collected orders paid within due date]/[total nr of orders] * 100

Perspectives	Indicators/measures/metrics	Operationalization
	Information access cost, information availability	Information provided/not provided Time spent in asking for information about a product or service (in days) Time required to get updated about the status of a product or service Cost of information (euro)
	Customer cost	Product cost or the cost of using a service (euro)
2.2/Supplier performance		
	External delays	Nr of delayed deliveries due to outage or delays of third-party suppliers
	External mistakes	% of Incorrect orders received
	Transfers, partnerships	% of Cases transferred to a partner
2.3/Society performance		
	Perceived society satisfaction	Qualitative scale on general satisfaction (e.g., Likert), possibly indexed as the weighted sum of judgements on satisfaction dimensions % of Society satisfied with the organization's outcomes
	Societal responsibility, sustainability, ecology, green	Number of realized ecology measures (e.g., waste, carbon dioxide, energy, water) Quantity of carbon dioxide emitted per man month
3/Business process performance		
3.1/General process performance		
	Process complexity	Number of elementary operations to complete the task
	General process information	Nr of orders received or shipped per time unit Nr of incoming calls per time unit Nr of process instances
	Order execution	[Nr of executed orders]/[total nr of orders] * 100
	Perceived sales performance	Qualitative scale (e.g., Likert) on the successful promotion of both efficiency and effectiveness of sales
	Perceived management performance	Qualitative scale (e.g., Likert) on the improvement of effectiveness, efficiency, and quality of each objective and routine tasks
	Surplus inventory	% of current assets Value of surplus inventory (e.g., pharmaceutical material) to total assets ratio
	Occupancy rate	Average % occupancy, e.g., of hospital beds
3.2/Time-related process performance		
	Throughput	Nr of processed requests/time unit
	Process duration, efficiency	[Σ(finish date − start date) of all finished business objects]/[number of all finished business objects]
	Process cycle time, order cycle time, process duration, average lifetime, completion time, process lead time	Time for handling a process instance end-to-end Aggregated time of all activities associated with a process (per instance) [Application submission time] − [application response time]
	Average sub-process turnaround time, task time, activity time	[Sub-process start time] − [Sub-process finish time]
	Processing time	Time that actual work is performed on a request
	Average order execution time, order fulfillment time, order lead time	[Σ(Dispatch time − creation time)]/[total number of orders] [order entry time] + [order planning time] + [order sourcing, assembly and follow-up time] + [finished goods delivery time]
	Average order collection time	[Σ(Collection time − creation time)]/[number of collected orders]
	Average order loading time	[Σ(Final distribution time − distribution creation time)]/[number of loaded orders]

Perspectives	Indicators/measures/metrics	Operationalization
	Process waiting time, set-up time	Average time lag between sub-processes, when a process instance is waiting for further processing Time between the arrival of a request and the start of work on it (=time spent on hold) Average waiting time for all products and services
	Manufacturing cycle efficiency	[setup time + (nr of parts * operation time)]/[manufacturing lead time]
	Manufacturing lead time	[setup time + (nr of parts * operation time) + queue time + wait time + movement time]
	Value added efficiency	[Operation time]/[manufacturing lead time]
3.3/Cost-related process performance		
	Activity cost	Cost of carrying out an activity
	Process cost, cost of quality, cost of producing, customer order fulfilment cost	Sum of all activity costs associated with a process (per instance)
	Unit cost	Nr of employees (headcount) per application, product or service
	Information sharing cost	[Time for system data entry] + [time for system delivery output]
3.4/Process performance related to internal quality		
	Quality of internal outputs, external versus internal quality, error prevention	% of instance documents processed free of error Number of mistakes [Nr of tasks with errors]/[Total nr of tasks per process] Nr of syntactic errors Nr of repeated problems Presence of non-technical anomaly management (yes/no)
	Deadline adherence, schedule compliance, due date performance effectiveness, responsiveness	% of Activity cycle times realized according to the planning or schedule [Number of finished business objects on time]/[number of all finished business objects] * 100
	Process yield	Multiply the yield per process steps, e.g., $(1 - \text{scrap parts/total parts})^{\text{step 1}} * (1 - \text{scrap parts/total parts})^{\text{step 2}}$
	Rework time, transaction efficiency	Time to redo work for an incident that was solved partially or totally incorrect the first time Average time spent on solving problems occurring during transactions
	Integration capability	Time to access and integrate information
3.5/Process performance related to flexibility		
	Special requests	Nr of special cases or requests
4/"Learning and growth"-performance		
4.1/(Digital) innovation performance		
	Degree of digitalization	% Reduction in processing time due to computerization [Nr of process steps replaced by computer systems]/[Total nr of steps in the entire process] Nr of digital products or services
	Degree of rationalization	% of Procedures and processes systemized by documentation, computer software, etc.
	Time for training on the procedure	Measured in hours
	Novelty in output	Nr of new product or service items
	Customer response	Nr of suggestions provided by customers about products and services
	Third-party collaboration	Nr of innovation projects conducted with external parties

Perspectives	Indicators/measures/metrics	Operationalization
	Innovation projects	Nr of innovations proposed per quarter year Nr of innovations implemented per quarter year
	IS development efficiency	Nr of change requests (+per type of change or per project) Time spent to repair bugs and finetune new applications Time required to develop a standard-sized new application % of Application programming with re-used code
	Relative IT/IS budget	[Total IT/IS budget]/[Total revenue of the organization] * 100
	Budget for buying IT/IS	[Budget of IT/IS bought]/[Total budget of the organization] * 100
	Budget for IS training	[IS training budget]/[overall IS budget] * 100
	Budget for IS research	[IS research budget]/[overall IS budget] * 100
	Perceived management competence	Qualitative scale (e.g., Likert) on the improvement in project management, organizational capability, and management by objectives (MBO)
	Perceived relationship between IT management and top management	Qualitative scale (e.g., Likert) on the perceived relationship, time spent in meetings between IT and top management, and satisfaction of top management with the reporting on how emerging technologies may be applicable to the organization
4.2/Employee performance		
	Perceived employee satisfaction	Qualitative scale on general satisfaction (e.g., Likert), possibly indexed as the weighted sum of judgements on satisfaction dimensions Qualitative scale (e.g., Likert) on satisfaction about hardware and software provided by the organization
	Average employee saturation, resource utilization for process work	[Time spent daily on working activities]/[total working time] * 100 [Work time]/[available time] % of operational time that a resource is busy
	Resource utilization for (digital innovation)	IS expenses per employee % of Resources devoted to IS development % of Resources devoted to strategic projects
	Process users	Nr of employees involved in a process
	Working time	Actual time a business process instance is being executed by a role
	Workload	Nr of products or services handled per employee
	Staff turnover	% of Employees discontinuing to work and replaced, compared to the previous year
	Employee retention, employee stability	% of Employees continuing to work in the organization, compared to the previous year
	Employee absenteeism	[Total days of absence]/[total working days for all staff] * 100
	Motivation of employees	Average number of overtime hours per employee
	Professional training, promotion and personal development	% of Employees trained % of Employees participated in a training program per year Nr of professional certifications or training programs per employee
	Professional conferences	% of Employees participating in conferences

Appendix C: Trigger tables current and to-be situation of sub- and control processes

Trigger table sub- and control processes current situation

Name process	Trigger	End-point
Manage sales contracts	RFP from customer	Record revised budget/creation cost- and profit center
Manage prices and rates	Revised budget recorded/creation cost- and profit center	Project closed in Seven
Manage prices and rates control process 1	After accounting is closed and WIP and cost backlog are booked in Seven	Create project control worksheet “EP earning profit”
Manage prices and rates control process 2	Before closure meeting	Prepare worksheet “formato para informe de control de costos operativos”
Manage prices and rates control process 3	During PRAM	Update risk and opportunity
Invoicing process	Business is executed	Close accounting in Seven
Invoicing control process 1	End of the month	Accounting department receives invoices not used by project administrator
Invoicing control process 2	End of the month	WIP and cost backlog are booked in Seven
Invoicing control process 3	End of the month	Review of revenue and margin of projects and service orders is documented
Cash collection	Accounting is closed in Seven	AR is closed in Seven
Cash collection control process 1	End of the year	Create accrual for outstanding amounts overdue more than 360 days and not intercompany accounts
Cash collection control process 2	After check bank statement	Professional planner signs final reconciliation between bank balances and bank statements and sign it
Cash collection control process 3	Before accounting closure	Professional planner approves reconciliation AR and GL
Cash collection control process 4	Before PRAM	Project controller leader approves closing file

Table 8: Trigger table current situation OTC process

Trigger table sub- and control processes to-be situation

Name process	Trigger	End-point
Manage sales contracts	RFP received from customer	Release of sales- and project order
Manage prices and rates	Release of sales- and project order	PRM meeting
Manage prices and rates control process 1	During PRAM	Update risk and opportunity for critical projects
Invoicing process	Business is executed	Final process is processed in SAP
Invoicing control process 1	End of the month	Make sure there are no inconsistencies in the WIP status of projects
Invoicing control process 2	End of the month	Review of revenue and margin of projects and service orders is documented
Cash collection	Final process is processed in SAP	AR is closed
Cash collection control process 1	End of the year	Create accrual for outstanding amounts overdue more than 360 days and not intercompany accounts
Cash collection control process 2	After check bank statement	Professional planner signs final reconciliation between bank balances and bank statements and sign it
Cash collection control process 3	Before accounting closure	Professional planner approves reconciliation AR and GL
Cash collection control process 4	Every month	Project controller leader approves closing file

Table 9: Trigger table to-be situation OTC process