MESG
MESTRADO EM ENGENHARIA DE SERVIÇOS E GESTÃO

Development of a model for Business Process Reengineering: A practical application in a Corporate Center of a Logistics Company

Ricardo Manuel Monteiro Moço

Master Thesis

Supervisor at FEUP: Prof. Alcibiades Soares Guedes

Supervisor at Rangel: Dr. Luís Marques

U.PORTO
FEUP FACULDADE DE ENGENHARIA
UNIVERSIDADE DO PORTO

2018-06-29

"The most dangerous phrase in our language is 'We've always done it this way.'" – Grace Hopper

Abstract

The digital age and the pillars behind the Industry 4.0 are putting growing pressure on companies' Corporate Centers, thus forcing to reshape its business processes in order to increase its efficiency, reduce costs and collaborate more closely with operations. This change is being highly influenced by technology, allowing them to move from transactional and manual-based tasks to focus on higher–value-added tasks.

This factors lead the company's Corporate Center under study to start implementing a continuous improvement culture, streamlining its processes and adopting a Business Process Management (BPM) approach.

Hence, this works aims to develop and apply a model to reengineer business processes with an end-to-end perspective and with a high focus on efficiency improvement through digitalization. As such, the model being presented is specifically addressed for radical changes in business processes instead of trying to improve the process AS-IS.

The result is the application of a model to an end-to-end process in the Rangel's Corporate Center, that is the starting point to other Business Process Reengineer (BPR) projects within the company, that will allow to acknowledge what are the next steps to improve its efficiency and shifting its mindset to a "*Global* Corporate Vision", through a strategy that adds more value to the portfolio of businesses so that the whole is worth more than the sum of its parts.

Acknowledgments

I would like to thank to my supervisor at Rangel, Luis Marques, for always being available to share his knowledge with me and supporting me everytime, surpassing sometimes his agenda contraints and fulfulling always our weekly meeting. His natural ability as a leader was also an inspiration during this process.

I would also like to express my gratitude towards my other supervisor within the project being developed, José Miguel Oliveira, for his technical inputs, leadership qualities and the general atmosphere of team work he is always able to provide.

To my academic supervisor, Professor Alcibiades Guedes, I would like to share a word of gratitude for the technical inputs and overall support during the project. His leardship abilities and clarity are certainly an inspiration to those who work with him.

Develop a Master Thesis project at Rangel was an experience for which I am grateful. During these months, I received the collaboration of several colleagues, from different departments. Among those, I specially want to thank Liliana Rodrigues, Miguel Cordeiro, Ana Matos (Kaizen Insitute) and Rita Castro for the support they gave me during the process. This experience was shared with other coleagues that started the program with me. I would like to express my gratitude to them, hoping we continue to take this path together.

To my family, without whom I would not have had such a pleasant and constructive experience, my deepest acknowledgments for the love and support they are always capable of provide.

The last but not the least to my friends for all the support and collaboration, specially Joana and Diogo, with whom I shared this journey.

Table of Contents

List of Tables

Development of a model for Business Process Reengineering: A practical application in a Corporate Center of a Logistics Company

Development of a model for Business Process Reengineering: A practical application in a Corporate Center of a Logistics Company

List of Figures

List of abbreviations

AP – Accounts Payable

BPA – Business Process Automation

BPM – Business Process Management

BPR – Business Process Reengineering

BPO – Business Process Outsourcer

BU – Business Unit(s)

CAPEX – Capital Expenditure

CEO – Chief Executive Officer

CMR - *Convention relative au contrat de transport international de marchandises par route* or Contract of International Carriage of Goods by Road

CRM – Customer Relationship Management

ERP – Enterprise Resource Planning

FTE – Full Time Equivalent

IT – Information Technology

KPI – Key Performance Indicator(s)

LT – Lead Time

OCR – Optical Character Recognition

OPEX – Operational Expenditure or Operational Excellence

PO – Purchase Order(s)

POD – Proof of Delivery

RDL – *Rangel Distribuição e Logística, S.A.*

REX – *Rangel Expresso, S.A.*

REX II - *Rangel Expresso II, S.A.*

RIAM – *Rangel Internacional Aérea e Marítima, S.A.*

RPA – Robotic Process Automation

RT – *Rangel Transitários, S.A.*

SCM – Supply Chain Management

SEPA - Single Euro Payments Area

SQL - Structured Query Language

SRS – Systems Requirement Specification

TMS – Transport Management System

TPS – Toyota Production System

WMS – Warehouse Management System

Development of a model for Business Process Reengineering: A practical application in a Corporate Center of a Logistics Company

1 Introduction

The digital age and the pillars behind the Industry 4.0 are putting growing pressure on companies' Corporate Centers, thus forcing to reshape its business processes in order to increase its efficiency, reduce costs and collaborate more closely with operations. This change is being highly influenced by technology, allowing them to move from transactional and manual-based tasks to focus on higher–value-added tasks. Companies unware of these shifts will probably loose competitive advantage by increasing the gap between its business operations and the Corporate Center.

Being part of Rangel Logistic Solutions' value proposition to offer a One Stop Shop service solution to its clients, the need for a Corporate Center more aligned with operations is even higher. As such, the company is implementing a global continuous improvement mindset and aims to take the digitalization step.

The present dissertation developed at the Rangel Logistic Solutions' Corporate Center, has the main goal of defining and applying an operative model to reengineer and digitalize its processes on an end-to-end basis and measure the benefits and the required investment. The result is the application of such model to an end-to-end process in Rangel's corporate center that is the starting point to other Business Process Reengineer projects within Rangel, that will allow the company to acknowledge what are the next steps to start the digitalization process.

1.1 Project background – Rangel Logistics Solutions

Rangel Logistic Solutions is a global logistics service provider offering a One Stop Shop solution to its customers, with a portfolio ranging from logistic activities to transportation, warehousing, physical distribution, express courier, customs formalities, trade fairs and exhibitions and information systems. The concept behind the company is to be a Global Logistics Partner, allowing its clients to narrow their focus on the core of their business. Today the group is a complete organization of companies, divided by sub-holding companies, each one corresponding a different business unit within a business-related portfolio:

Express and Parcels – provides domestic express services within Portugal with a variety of delivery options;

International Express – provides international express services through a strategic alliance with *FedEx*, and relying on a structure supported by a fleet of 669 airplanes, 43,000 vehicles and 143,000 employees, allowing the company to deliver urgent international packages to over 220 countries and to deliver 3.3 million packages every day;

Contract Logistics - provides a package of services integrating warehousing and stock management services with order preparation, assembly, labelling, pick and pack and national distribution;

Air and Sea Freight – provides freight forward services through air and sea transports, relying on special agreements with the well-known aviation and shipping companies;

Road Freight - provides freight forwards services across Europe through total coverage in all transport operations by road (groupage, full and part loads, inter-modal transport and local distribution), offering a large variety of regular and direct import and export routes. The service provided rely in an extensive and exclusive network of European Partners that have the capacity

to make the transport process suitable and complete, allowing this Business Unit (BU) to provide fixed transit times and control over the whole route of the merchandise until the final destination;

Customs Critical – provides logistics and transportation services tailored to specific client needs, normally in critical circumstances in terms of time urgency, dimension, weight, value, danger or special materials that require special resources, processes and a specific team, available 24/7;

Customs Broker – this Business Unit was the starting point for the creation of Rangel in 1980. It provides customs and world trade services on behalf of national or foreign companies, directly (a form which can only legally be done by customs brokers) or indirectly, alongside Portuguese customs and/or other official entities related to customs activity. Also provides services related to the representation of companies or individuals, by acting in the name of or on behalf of those when executing customs formalities and procedures which are inherent to importing and exporting goods, in the terms of and in conformity with both national and European Community legislations;

Feirexpo – this Business Unit was created in 1998 as a result of an experience as Official Logistics Operator of Expo 98. Since there, the service has evolved to a tailored business focused on handling and specialized transportation of works of art, including special packaging made in specific workshops, storage in an acclimatized and secured warehouse, transport in specially equipped trucks, coordination with international agents, courier assistance, insurance, customs formalities and global supervision.

The competitive advantage offered by Rangel Logistic Solutions is to manage all solutions as a unique portfolio, not only allowing customers to access all the services they need in one place but also to create management synergies between all the business units within the company. Due to this, the company has been tailoring its offer according to customers' needs as much as possible, offering out of the box solutions, sometimes apart from logistics. The capstone was the commercialization of the iQOS brand, from Philip Morris International, in Portugal.

In the words of Nuno Rangel, the company's CEO, "We want to be as close as possible to the needs of our customers". As such, Rangel has been betting on niche markets, and creating specific business units to address these needs. An example is the creation of Rangel Pharma, a specific unit of the company that handle the logistics of pharmaceutical material under required specific conditions. Since 2016, Rangel has been also investing in an e-commerce unit, *Rangel Ecommerce Full Service*. The concept is to offer an integrated service that ranges from the the creation of the Platform, to logistics, marketing and customer support.

Due to this, Rangel has been able to offer a distinct business model in comparison to its competitors with high impact in the way the operations are performed. Such model requires a huge integration effort between all business units. Hence, the Corporate Center must play a key role in the process, through a strategy that adds value to the portfolio of businesses so that the whole is worth more than the sum of its parts.

The company has its headquarters in Portugal (Porto and Lisbon) and sites in 4 more countries: Brazil, Cape Verde, Angola and Mozambique. The firm employs more than 1,500 staff. The project under study was developed in the headquarters of the company in Porto, more specifically in the Corporate Center.

1.1.1 Project background – Rangel Corporate Center

The Corporate Center of Rangel is represented by the mother company of the Group – *Rangel Invest* S.A.- and is responsible for advocating the organization's values, deciding the corporate strategy, managing the portfolio of businesses and their performance through continuous communication with the business units. Besides this, it is responsible to provide backbone processes and functions to the business units – the internal customers – such as Human Resources and Financial Management. Today, the Corporate Center is organized in a set of corporate entities represented in the organisational chart of the figure below.
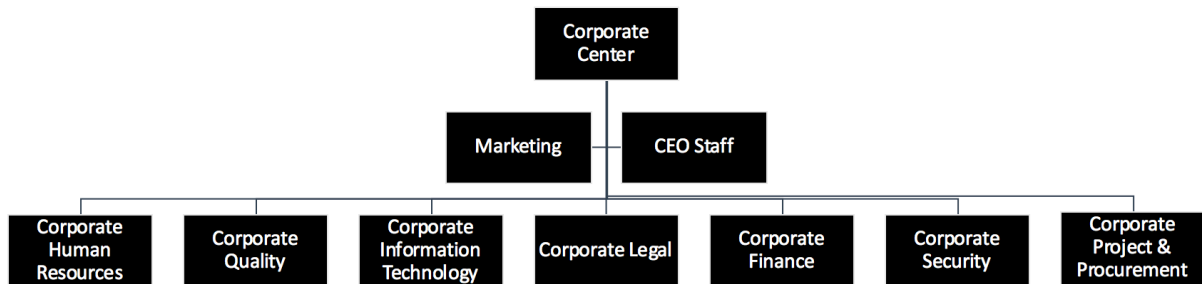
Figure 1 - Organisational Chart of Rangel's Corporate Center

The present project is intended to be cross-sectional to all areas within the Corporate Center and improve their efficiency through digitalization and automation of processes. However, given the aim of the present dissertation, the department that was found to be more suitable to this project was the Financial and Administrative. Today this department rely in many manual, paper-based and transactional processes in their daily-basis.

1.1.2 Project background – Implementation of the Kaizen methodology

Attempting to improve the operational inefficiencies in the Corporate Center and to start creating a continuous improvement mindset, the Company initiated the implementation of the Kaizen methodology in June 2017, through a partnership with *Kaizen Institute*. As referred in the next chapter, the implementation of the Kaizen methodology aims to eliminate MUDA[1] activities and start creating more value through a shift in the company mindset. As such, more than a framework to improve the efficiency of the operational teams, Kaizen is a cultural change that promotes a continuous improvement mindset in the company and its individuals.

Currently, the work performed by *Kaizen Institute* at Rangel can be categorized into the following lines of action:

- Implementation of the *Daily Kaizen – Daily Kaizen* involves everyone in the continuous change being implemented, by engaging the creativity of people at all levels of the organization. The goal is to give the team the ability to improve their daily work, i.e. the maintenance and improvement of workplace standards is a daily activity that must be done by the *natural teams* who are closest to the work being performed everyday;
- Implementation of the *Breakthrough Kaizen – Breakthrough Kaizen* aims to teach the company and team leaders how to manage continuous improvement projects, providing tools, such as the *A3 Kaizen* or *Workshops Kaizen,* to support the implementation of

---

[1] MUDA - Japanese word for waste, or everything that does not add value

those projects. The first step of the implementation of the *Breakthrough Kaizen* was the diagnosis of the processes, in each team of the Corporate Center, that were not creating value, not only by listening to the people in *gemba*[2], but also using a technique called *shadowing*. Then, the identified MUDA processes were classified and organized into subprojects. For those subprojects, a chronological plan was created and the subprojects started to be implemented. It is important to highlight that some of the details of the *Breakthrough Kaizen* overlap with the project being developed in the present dissertation. As such, the model developed in the present project takes into account those details;

- Implementation of *Leaders Kaizen – Leaders Kaizen* aims to develop, in the medium and top managers, continuous improvement management behaviours, more related with the strategic objectives, teams' motivation and change consolidation.

With the dissemination of the Kaizen methodology in the Corporate Center, one issue arises with the implementation of this project, i.e. what is the value-added by the implementation of this project?

The main difference is that the work developed by the *Kaizen Institute* aims to promotes change not only by teaching the natural teams how to implement it but also by providing the tools to support it, while the work developed in this dissertation aims to use those tools and others to implement change.

Other major difference is the boundaries and size defined for the implementation of the projects of the *Breakthrough Kaizen*. While this projects are almost exclusively applied in the Corporate Center, this dissertation not only has an end-to-end focus, ranging from the Corporate Center to the Business Units, and outside the company's boundaries if possible, but also is more targeted for radical changes, instead of process improvements.

To sum up, this two approaches are not contrary, but complementary. As such, the model developed in this project considers the lessons learned in the Kaizen training sessions, and some techniques such as the *shadowing* technique for identifying the processes that require most priority change. Also the workshops taken in this projects were based on the Kaizen Workshops sessions learned, as well as the facilitation techniques with post-its. The *A3 Kaizen* template, was used by the author to build a Business Case for the project.

1.2   Problem Description

Rangel is going through a period of business growth. The sales volume is increasing every year, closing 2017 with 170M € in revenues. The company has also been increasing its portfolio of services with the launches of Rangel Custom Critical and Rangel Wine and Gourmet in 2016, as well as its global presence. In addition, external forces, including the industry rivalry, are putting growing pressure on the Corporate Center, demanding to change the way it operates, and the way it is configured. On the other hand, Transport & Logistics Industry has been marked has a low margin and profitable business. As such, the pressure to increase operational efficiency has been increasing.

---

[2] *gemba* - A Japanese word that literally means "the real place", normally used in business process improvement contexts to refer to the place where values is added, such as a manufacturing area or workshop

With the aim of increasing the company's efficiency and drop down the operating costs, there is an on going pursuit to optimize the companies' processes, while increasing its operational efficiency. With this in mind, the company has been starting to implement a continuous improvement culture, starting to implement the Kaizen method in the Corporate Center, with the aim of not only improving the operational efficiency of the departments, but attempting to shorten the connection between the Corporate Center and the Business Units and moving the company's vision to a "Global Corporate Vision".

1.3   Project Objectives

In a nutshell, the intention of this project is to implement an operating model to reengineer an end-to-end process, in order to scale the model to be used to redesign other processes and to measure the benefits along with the required investment. The model being developed must be compliant with the digitalization project being held by Rangel. As such, the framework being developed must heavily identify the IT levers that can support and automate the process being redesigned by the model. The final result of the model should allow the company to understand two major conclusions: (1) the return on investment; (2) an action plan to automate the process. All of this should be in line with the Kaizen method, that is the method being implemented in Rangel Logistic Solutions.

As mentioned above, the general idea of this project is to define a model that not only can be suitable to reengineer more processes, but also that accomplishes the strategic vision defined by the company with the present project. Thus, the process chosen to be the subject of this dissertation must have the following characteristics, in order to be more affected by the benefits of the digitalization:

(1) End-to-end process – the improvement of an end-to-end process not only allows the company to take more profits from the process improvement, but also strengths the connection between the departments and the business units
(2) Manual workflows – a process that requires too many manual workflows probably will have more benefits through digitalization
(3) Not streamlined - a process that has many ways of doing things is normally less efficient and suffer major benefits through process reengineering. In this kind of initiatives, one's major challenge is to find a way to streamline processes. Once streamlined is more suitable to be improved and scalable.
(4) Transactional and paper-based – according to a McKinsey on Finance report (2018), transactional and paper-based processes have more opportunities to be automatable through information technologies, for example through Robot Process Automation. Though, the full benefits of automation require a portfolio of technologies that varies across sub-functions.

Consequently, the process chosen for the aim of dissertation was the Accounts Payable Process, since it fulfils all the requirements highlighted above.

1.4   Report outline

The present report is structured as follows. Chapter 2 covers the literature review of the main themes of this project, with high focus on Business Process Reengineering and Business Process Automation. Also, the main principles of Kaizen and Lean thinking are covered, taking into account that this project fits with the implementation of the Kaizen method in the company's

Corporate Center. The structure of a Corporate Center of the Future is briefly presented in order to understand some changes that might happen regarding the implementation of this kind of projects.

Then, Chapter 3 presents the methodology used in each step of the model developed. As such, along with the methodology, the model is presented with the description of each step. Although, the model is structured by sequential steps, its application is completely iterative.

Chapter 4 presents the case study with the application of the model to a process owned mainly by Rangel's Corporate Center, following and applying the first three step of the model developed. After contextualizing the process chosen to be subject of the present project, the chapter describes briefly the Process AS-IS, as well as some data that characterize the current state of the process.

After describing the process AS-IS, chapter 5 presents some constraints and opportunities regarding the current state of the process, applying the step four of the developed model. This chapter represents the main foundation for defining the solution being presented in the following chapter.

Following the next steps of the model, chapter 6 applies the next step of the methodology, with the exception of the last step, that is out of the range of application of the present dissertation. In resume, firstly the defined solutions are presented and applied to the TO-BE process model, followed by the development of the Business Case and its application to one of solutions defined. Also, the KPI defined to measure the predicted benefits of the present project are presented in this chapter.

At the end of this dissertation, chapter 7 concludes this dissertation report by highlighting each proposed solution achievements and its impact to the project goal, as well as the main lessons learned during the development of this project. In this section, relevant topics for future development are also pointed out.

2 Literature Review

This chapter will focus on the key concepts related to this project, as well as relevant work produced in this field of expertise. Firstly, it will cover some relevant aspects related to digitalization of corporate center's processes, as well as the most important objectives behind such goal. In addiction, a brief introduction to Kaizen and Lean Thinking, since the project is being developed during the implementation of Kaizen methodology and during continuous improvement environment and Lean Thinking. This triggers the need to start analysing the actual procedures through Business Process Reengineering. Equally important, the exploration of the most important tools being used to automate Corporate Center's processes through Business Process Innovation, using Business Process Automation (BPA) tools, such as Robotic Process Automation (RPA) and Cognitive-Automation tools, since this project is highly focused on digitalization.

2.1 The Corporate Center of the Future

Effective corporate parenting strategy is a challenge that any organization with multiple businesses has to deal with. As described by Campbell and Goold (1998), the role of the Corporate Center is to add value to the portfolio of businesses so that the whole is worth more than the sum of its parts – value creation logic way of thinking. This value can be added in three very different types of activities: headquarters functions, centres of excellence, and shared services. Each creates value differently and should be managed differently.

As mentioned, technology and digitalization era are putting pressure on the way that today's Corporate Centers operate. These tech-driven changes not only are allowing the corporate center to become more agile and flexible at a lower cost, but also increasing the opportunities to add value by collaborating more closely with operations and develop deep business knowledge while opening up more opportunities for process innovation. According to Massenböck et. al. (2018), three tech trends are reshaping corporate centers:

- The automation of Transactional and Knowledge Management;
- Digitalization and the Adoption of Artificial Intelligence;
- The Growing Reliance on Virtual Collaboration Technology.

Davenport (1993) points out the importance of reengineer major and cross-functional processes, even cross the external boundaries. Cross-functional have more opportunities not only to reap the benefits from the process improvement, but also to align the Corporate Center with Business Unit's operations and better the center will be able to support the needs of the business. On the other hand, the level of change involved and the cross functional nature of process innovation greatly increase the risk of failure. Also, according to Catlin et. al. (2017) on a report of McKinsey&Company, it is important to obtain quick returns while improving the process in order to start collecting the benefits fast and to provide motivation to improve further.

Given the wide number of transactional, manual and paper-based activities, recent studies on digitalization points out Finance Function as one of the areas with more opportunities for automation. According to Plaschke et al. (2018), currently demonstrated technologies can fully automate 42 percent of finance activities. Basic task-automation technologies, such as Robotic Process Automation (RPA) and complementary technologies, like business-process management and optical character recognition tools, have been successfully applied across a number of activities in finance.

Hence, given that some of these technologies are replacing human intervention on repetitive and transactional tasks, employees can focus on higher-value-added tasks. Forthwith, the roles within the Corporate Center are expected to change as well. As a result, companies that embrace a digitalization project have been implementing new ways of working, such as agile teams and more fluid structures. Also, during the implementation of a digitalization project, it will reach a stage where it will require a fundamental organizational redesign, more grounded on collaboration where the ability to share data, expertise and talent are simplified. As a result, it may be required a shift from a traditional matrix structure to a network structure organized around sources of value. From the Corporate Center perspective, it will be required a global corporate view, creating synergies between all business units within the portfolio, abandoning a perspective where silos are drawn along functional lines (Catlin et. al. 2017).

2.2   Kaizen and Lean Thinking

Kaizen is a Japanese word for Change for the Better and translates the philosophy of continuous improvement. Broadly speaking, more than management and business process optimization methodology, Kaizen is a philosophy that can be applied to almost everything, even our personal life. If applied correctly it changes the management philosophy, the processes and the people from the shop-floor to the top management.

Attached to this philosophy is the concept of lean thinking. Lean thinking is related to the idea of delivering better value for customers by removing non-value-adding activities, MUDA activities – Japanese word for waste, or everything that does not add value (Coimbra 2016).

The lean philosophy has its roots in the 1950's, in the Japanese industrial context, based on the Toyota Production System (TPS) and had its origin with the Toyota leader at the time, Sakichi Toyoda. After a tour to Ford's car manufacturing plant, Toyota Motor Company had a clear target: overstep the levels of productivity of American auto industry companies. According to several studies, American companies were nine times more productive. In addition, Toyota leaders realized that the company was too small and did not have money to invest in the same amount of machine as Ford's production. As a result, it was mandatory to create a fast and flexible process of production as a result of which the clients would obtain desired, high-quality and reasonably-priced automobiles. This was the initial trigger to the Just-in-time production systems. The aim was to uplift the production capacity and reduce waste continuously (Dekier 2012).

The Toyota Production System has become the initial model for the application of the Lean and Kaizen's concept. However, the concept recognition only became popular in 1991 by James P. Womack, Daniel T. Jones and Daniel Roos in their book *The Machine That Changed the World*. Since its release, the Lean concept has gained more comprehensive meaning and have been confirming as the right methodology to achieve Operational Excellence (OPEX). Consequently, Lean Manufacturing is regarded as a successor of the TPS (Dekier 2012).

Most of lean methodologies refer to manufacturing industry, where a tangible product exists. As such, the lean philosophy started to expand to new fields, such as services, trade and public sectors (Leite and Vieira 2015). Within service environments, although there is engagement with the principles of lean, many of the techniques used in manufacturing context are not immediately applicable. Thus, lean concepts and methods must be reassessed before their application into service processes. Regarding this, Andrés-López et. al (2015) assessed the application of lean principles on the inherent characteristics of services, defining a practical

guideline for applying lean principles to the service sector, according to five steps: (1) Definition of Lean Service Principles; (2) Customer Role in Service; (3) Determination of Waste in Service; (4) Implementation: Assessment of Lean Service Methodologies; (5) Lean Service Model Validation: Results Monitoring & Continuous Improvement. Given the intangibility characteristic associated to services, the ability to recognize waste, through the analysis of the customer experience can be a major challenge for service organizations. Although, despite the lack of standards and methodology, its best practices, inherited from manufacturing, when applied to services can generate large economic and financial results, as well as proven improvements in the workers' behaviour.

2.3 Business Process Reengineering/Innovation

A simple definition of innovation is, of course, the introduction of something new. As such, the purpose of introducing something new into a process is to bring about major, radical change, i.e. the reengineering of the process. This requires stepping back from a process to inquire its overall business objective and then creating a creative and radical change to realize order-of-magnitude improvements in the way objective is achieved, such as reduction in process cost or time, or major improvement in quality, flexibility, service level, or other business objective (Davenport 1993). In practice, reengineering means to start over with a clean sheet of paper and rebuild the business better.

We all know the concept of process improvement. The difference from the concept of process innovation is the level of change it is intended to improve. While process improvement involves the same business process with slightly increased efficiency or effectiveness, process innovation requires performing the process in a radically new way. As expected, the paybacks derived from process innovation are higher, but often takes much longer time and with greater risk of failure. Both concepts require a cultural change, resulting on a deep focus on operational performance and empowerment of employees.

Reengineering evolves around business processes, rather on tasks, job descriptions, people or structures. As such, the first step to reengineer the corporation is to adopt a business process orientation. Adopting a process view of the business represents a revolutionary change in perspective: it amounts a strong emphasis on how work is done, instead of focusing only on what is done (Kiran 2017). Consequently, a Business Process Management (BPM) approach is needed. Over the last decade BPM has become a mature discipline, with a well-established set of principles, methods and tools that couple knowledge from information technology, management sciences and industrial engineering with the intent of improving business processes (van der Aalst et. al 2016).

Nevertheless, adopting a BPM does not add value if we cannot control the performance of the processes improvement initiatives. Performance measurement is a fundamental principle of management that is strongly attached to BPM. Measuring performance allows organizations to identify current procedures failures according to the company goals. By selecting key performance indicators, companies are able to understand what to do to increase performance dramatically. The first step in selecting the right KPI is to define the general and specific characteristics that KPI should satisfy (Parmenter 2015). In order to select the right key performance indicators, there are some characteristics that should be considered once they are being analysed (Todorović et. al 2013):

- Predictive – the KPI is able to predict the future of this trend;

- Measurable – the KPI can be expressed quantitatively;
- Actionable – the KPI triggers changes that may be necessary for corrective action;
- Relevant – the KPI is directly related to the success or failure of the project;
- Automated - reporting minimizes the chance of human error;
- Specific - only what is necessary;
- Time-based – is measurable in a specific time range.

Information Technology (IT) has been recognized has the main enabler for process reengineering, offering a wide range of opportunities to organizations for automating, informing, and transforming their business (Rahimi et. al 2016). Therefore, process driven IT management ensures alignment of IT decisions with business objectives. Because of these interdependencies, recent studies have been focusing on the missing gap between BPM and IT. For instance, Pinheiro (2004) develops the BP2IT – Business Process to Information Technology - methodology to fulfil the gap between the Technical and Management approaches, by applying Business Process Modelling tools in an accessible, simple and structured way in order to be specified to be used and managed by information systems.

Davenport (1993) defined nine categories for applying IT in Business Process Reengineering. These categories are represented in the Figure below, and reflect the specific means by which these business objectives are achieve. Considering the current technologies' trends and the scope of this project, the next chapter will focus on Automation.

Impact	Explanation
Automational	Eliminating human labour from a process
Informational	Capturing process information for purposes of understanding
Sequential	Changing process sequence, or enabling parallelism
Tracking	Closely monitoring process status and objects
Analytical	Improving analysis of information and decision making
Geographical	Coordinating processes across distances
Integrative	Coordination between tasks and processes
Intellectual	Capturing and distributing intellectual assets
Disintermediating	Capturing and distributing intellectual assets

Figure 2 - Categories for applying IT in BPR

2.3.1   Business Process Automation

As seen in the previous chapters, in the last decades, companies have put in a lot of effort into reengineering their business processes to lower cost and improve efficiency. Recently, with the democratization of information technology, complex business processes in areas such as financial services and other industries can now be automated. Tasks which were traditionally performed manually have now more opportunities to increase their efficiency through digitalization. Scheer et. al (2004) defines three main requirements that business processes have to comply in order to be more suitable for automation:

- Easily created, deployed and updated;
- Constructed in an interoperable way, so that different organizations, departments and information systems can integrate them together;
- Correctness and security.

Business Process Automation (BPA) can either be a standalone initiative or part of a Business Process Management strategy. The term of process automation is used to denote the transition from conducting business activities in a traditional manner to conducting them in a digital form, by applying IT as enabler for process automation (BarNir, et al. 2003). BPA links process design to application integration services in order to promote the automation of business process implementation and to allow for the execution of workflows that involve multiple heterogeneous applications (Melchert et. al 2004).

Traditional business process automation solutions, like Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) or Supply Chain Management (SCM) systems focus on the implementation of best practices. On the other hand, the next generation of process automation technologies enables the implementation at an economically acceptable cost level, through a flexible integration of business process definition and software application support. In order to achieve this, IT must be dynamically adaptable to the business processes definition so that it supports the execution of enterprise specific processes. As referred by Pal and Pantaleo (2005), the basis of BPA is the segmentation of the application software itself, the integration technologies, and the business process design.

Since most IT systems are intrinsically automation engines inner selves, a solid option is to extend their functionality to enable the automation of business processes, creating customized integrations between the disparate application systems where needed. In this case, the automation technology is tailored to the actual environment of the organization. On the other hand, some technology vendors are already developing automation tools only for the function of BPA. According to Plaschke et. al (2018), there is a growing trend towards the development of process automation tools that shortens the route to automation by taking advantage of the user interface layer instead of developing application coding or databases sitting behind them. Robotic Process Automation (RPA) is the apogee of these developments. Even that the term "robot" brings to a mental model of electromechanical machines, the term RPA must not be confused with physical robot, it is a software based solution that is configured to carry out repetitive operational tasks and procedures that are used to be done by humans. For business processes, the term RPA refers to configuring software to do the work previously done by humans, such as moving data from multiple input sources like email and spreadsheets to systems of record like ERP and CRM systems. Unlike traditional workflow technology, the information system remains unchanged, using an "outside-in approach", since the software robot operates on the user interface of other computer systems in the way a human would do and do not require programming skills for software interface configurations (van der Aalst et al 2018). As Lacity et. al (2015) refers in an application case study in Telefonica O2, early adopters of RPA are discovering that automation can entirely transform back offices, decreasing costs on low-added value and repetitive tasks while improving service quality, increasing compliance and accuracy and decreasing delivery time and human error. The same study concluded that one robot can perform structured tasks equivalent to two to five humans. Fung (2014) studies some characteristics of business process that may turn them suitable for RPA:

- Low cognitive requirements - Task that does not require subjective judgment, creativity or interpretation skills;

- High volume - Tasks that are performed frequently;
- Access to multiple systems - Process that requires access to multiples applications and systems to perform the job;
- Limited exception handling - Tasks that are highly standardized with limited or no exceptions to handle;
- Human error - Tasks that are prone to human error due to manual labour.

To achieve more widespread adoption and get the full potential of automation, there is a growing need to call on machines much smarter than those that fall under the RPA range of application. As such, RPA tools may need to be adapted and start handling non-standard cases, becoming machine that follow more closely to the actions performed by humans, such as supporting judgement based processes or making predictive decisions (Aguirre and Rodriguez 2017).

To address this issue, Cognitive Automation is used to automate tasks and decisions that involve algorithms to interpret unstructured data resulting in a set of likely answers, as opposed to RPA that uses rules to process structured data and instructions. The use of cognitive-automation technologies, such as artificial intelligence or machine learning tools, applied to the creation, aggregation and analysis of huge quantities of structured and especially unstructured information, thereby transforming unstructured information into useful data for the next steps of a process, may be able to provide complementary benefits, that together catch the full potential of BPA. As a result, more complex and less defined tasks can be supported through automation, such as judgement based processes, natural language processing and generation, cognitive analytics or machine learning capabilities.

These advances boost organizational efficiency and effectiveness, requiring fewer personnel to sit at desks performing transactional and manual-based tasks. For instance, employees who process invoices and payments, may become unnecessary, as Robotic and Cognitive Automation tools replicates human actions and judgement at tremendous speed, scale and quality, and at a lower cost.

3   Methodology

As highlighted in this chapter, the present project aims to turn Corporate Center's processes more efficient, less costly and as streamlined as possible, through process reengineering. The main intention is to define a model to redesign processes in the Corporate Center and apply it to a case study. Also, the model being developed in the present dissertation focus in the application of IT as a change enabler, fulfilling the company strategic objective of digitalizing the Corporate Center.

Although this model was specifically tailored for the problem described in the present dissertation, it was also designed to be flexible and scalable enough, in order to be applied to other processes. It is important to outline that the methodology developed to support this model is designed for process reengineer instead of process improvement. The difference between these two concepts is clarified in the chapter above. As such, this methodology gathers the best practices of some frameworks already developed in the subject:

1. By observing successful cases of Business Process Redesign in companies such as IBM, Davenport (1993), developed a 5 step methodology for redesigning business processes with IT. This methodology highlights the difference between process innovation and process improvement and it was the main inspiration for the methodology developed for this project;

2. Business Process to Information Technology (BP2IT) methodology (Pinheiro 2004) aims to build a bridge between Business Process Modelling and Information Systems Development, fulfilling the gap between the Technical and the Management approaches. It links a simple and structured way to represent processes to Use Case models of the same process, producing the required specifications to develop the information systems;

3. The present dissertation was developed during the implementation of Kaizen Lean methodology in Rangel's Corporation Center. As such, the present methodology was also developed taking into account some principles presented in Coimbra (2016) and through knowledge gathered during Kaizen training sessions.

After the literature review, the methodology to support the model was developed and categorized into the steps represented in the Figure 3. The contents of each step are briefly analysed in the sub-chapters below. According to the steps defined, the next chapters will describe the practical application of the methodology to a process owned mainly by the Corporate Center, but with its extension to the BU and even outside the company's boundaries. Although the methodology is formulated by steps, the application is iterative, especially in the steps that will result in the final solution of the process. For instance, it is possible to reach a pre-solution that does not represent the pretended benefits for the company, and it may viable to study other opportunities that imply to rely less on IT solutions and require a different redesign of the process flow, in order to be economically feasible for the company.
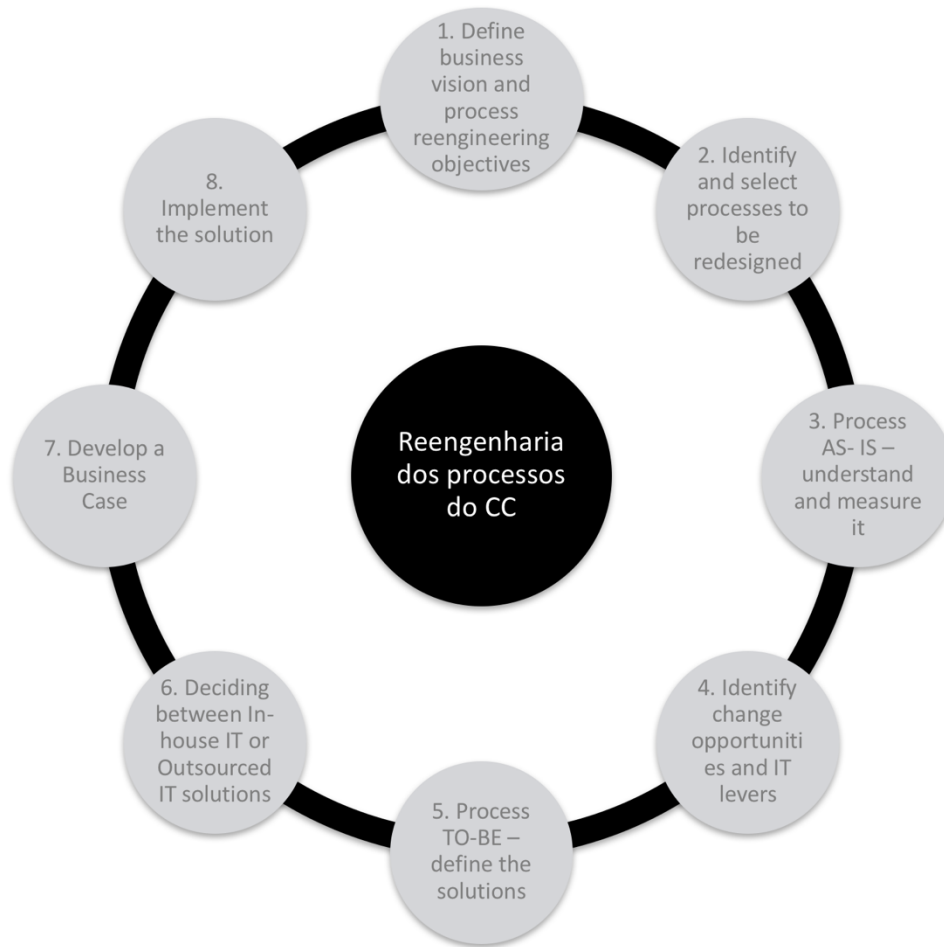
Figure 3 - Methodology that supports the developed model

3.1 Define business vision and process reengineering objectives

Before deciding which processes to be redesigned, it is important to define a broad strategic vision and context into which the process redesign fit, normally by the company's senior management.

Within the most common objectives are cost reduction, time reduction, output quality, customer satisfaction or quality of work life/learning/empowerment. Process vision and objectives can also derive from multiple sources - among them, analyses of corporate strategy and vision, high-level overviews of the roles of IT and people, customer and employee interviews, benchmarking of the best practices in other companies or a firm's performance objectives.

3.2 Identify and select processes to be redesigned

This step encompasses the overall listing of processes and the focus on those requiring immediate innovation initiatives, enabling the firm to focus on those most need of radical change, according to the vision and objectives defined in the step one. According to the objectives defined in the digitalization project being held by Rangel, the characteristics of the processes requiring immediate attention are presented in the introductory chapter. Also, during the implementation of the Kaizen project in the Corporate Center, the *shadowing* technique

(Coimbra 2016) was used to define the processes that represented more added-value and that required a deeper attention.

Also, the design of the company's process map, identifying the company's critical processes and their main interactions, provides a global view of the processes that require immediate attention (Pinheiro 2004). A process map is a high-level model representing the architecture of an organization, i.e., the essential aspects of an organization. Belonging to the same family as organizational charts, process maps provide a vision more oriented towards to the creation of value.

During this phase, project groups and stakeholders responsible for reengineering the chosen processes should be defined. Also, for each process, should be defined the following roles:

- A project manager, with the main responsibilities of managing the process reengineering project from the beginning till the end, promoting workshops and brainstorming sessions, choosing the right stakeholders for each phase of the reengineering project and documenting the main phases, including the process model AS-IS and TO-BE;
- A process owner performing the day-to-day overall management of the process, mainly after the implementation. This role ensures that all process activities are being performed and that they are staffed adequately. It may happen that these two roles overlap;
- The main stakeholders of the project and those that will be present along the workshops being held.

During this phase, the chronological plan may start to be developed, representing an overall view of the BPR project. Then, during the remaining phases, it should be reshaped with more detail, as the solutions and corresponding sub-project are being defined.

During the present dissertation this phase was already developed by Kaizen Institute, through the shadowing technique, and the processes requiring immediate attention were already identified in the start of the present project.

3.3   Process AS- IS – understand and measure it

Once identified the processes to be improved it is important to understand the current procedures of doing things before designing a new process, by modelling, documenting and measure it.

There are two main reasons for understanding and measure an existing process. First, problems must be understood so that they are not repeated. Second, accurate measurement can serve as a baseline for future improvements.

During this step, Business Process Modelling tools help with introspection. The company gets a deeper understanding of how the processes work and provides a visual representation for communication and analysis. Graphic representation of the process can be extremely helpful in understanding process flows.

Also, analysing and understanding an existing process provides an opportunity to document problems that may have been known about for years, and, at the same time, because most companies do not study processes on a regular basis, examining a process as a whole often highlights long standing problems, such as bottlenecks, redundancies, and unnecessary steps, that have gone unrecognized.

The project manager responsible for the process reengineering project must not only promote workshops and brainstorming sessions with the people responsible for executing the process in the shop-floor but also perform and document contextual observational studies of the process during its execution.

3.4 Identify change opportunities and IT levers

Since the methodology being developed aims to define a model for Business Process Reengineering, traditional improvement approaches, such as Process Value Analysis or Activity-Based Costing, may not be able to achieve the radical changes required for BPR. As such, since the aim is to transform and implement a new business process, this step does not require any specific methodology for process improvement. Instead, this step includes having a group of people reviewing the information collected in earlier phases and incorporate it into the next step. The choice of participants for this step must include team members who not only can deliver creative and innovative ideas, but also who can ensure that they are implemented. It is also important that key stakeholders that participated in the previous steps will participate in this phase.

This phase may also include a benchmarking of the best practices in other companies or Business Process Outsourcers (BPO), talking to suppliers of important change resources (mainly IT suppliers) and customers. Also some tests to IT solutions may also be required during this phase.

In process reengineer the change must be considered in three different dimensions: (1) the new process flow; (2) the new IT systems that support the new process; and (3) the new Key Performance Indicators (KPI) that will control the new process.

The result of the present step is to define the guidelines for the TO-BE process modelling.

3.5 Process TO-BE – define the solutions

According to the guidelines and change opportunities defined in the previous step, the process solution is developed in a series of workshops, brainstorming sessions and other facilitation techniques that encourages participation from all group members, regardless of their roles and relationships within the organization. The intention is to develop creative, but pragmatic new process designs, taking as input the process vision, the change opportunities, and benchmarking knowledge developed in the previous phases. Once more, the new process must consider the three dimensions of change highlighted in the previous step.

Depending on the size of the process being redesigned and how deep this change reaches, many solutions may be addressed to this change. Since a full implementation may be difficult or impossible, this methodology suggests to carefully manage these solutions in different projects.

Also the visual representation of the solutions, using for instance large whiteboards and coloured paper affixed to walls, is essential to assist on the communication, recording and validation.

For the same reason presented in the third step, the redesigned business process must be documented and modelled. Considering the type of processes addressed by the present project, it is recommended to use a multi-level modelling approach, with no more than three levels of detail. The IT levers, digitalization and change opportunities identified in the previous phase must be highlighted in the new process modelled.

When applicable, it should be developed Use Case models of the process, that will produce the specifications needed to the information system. Use Cases models consist on the enumeration and description of the basic functionalities of the system based on an increasing detail decomposition of the operations of the user with the system and represent a proven approach that links process modelling with information system specification (Pinheiro 2004). Also some mock-ups representing the user interface with information system can be developed during this stage.

It is important to highlight that this stage consists on an iterative process by assessing the feasibility, risks and benefits of each proposed alternative solution, until it reaches the optimum design solution.

3.6 Deciding between In-house IT or Outsourced IT solutions

After defining the optimum solution, some analysis must be performed regarding the new IT systems involved. The result of this analysis is the definition of which technologies would benefit more from an internal development or through outsourcing. This analysis depends mainly on the following factors:

- Internal development capacity of the company regarding the technology involved;
- The internal knowledge and expertise to create sophisticated software capable of handling all the tasks required;
- Maturity of the technology offered by suppliers;
- The level of customization pretended for the IT solution;
- The cost of outsourcing VS internal development.

During this step it should be defined the guidelines for the implementation of outsourced and in-house IT solutions. The proposal suggested by the present methodology is the following:

- In-house IT – definition of Use Cases models containing the specifications needed to the information system and if applicable a Software Requirement Specification (SRS) supporting an *Agile* approach to software development;
- Outsourcing – definition of a Request for Proposal (RFP) with the right level of detail to ask for a proposal and if applicable a Software Requirements Specification (SRS).

The result of this step is to gather the costs of the implementation of the defined solutions, in order to develop the Business Case.

3.7 Develop a Business Case for each solution – Measure the predicted benefits and develop an implementation plan

Regarding the solutions defined in the step 5 of the present methodology, this step aims to develop a Business Case to support the decision making.

The contents defined for the Business Case being developed are presented in the chapter six of the present dissertation. However, a Business Case that support the decision for the implementation of a project, should include at least the objectives of the project, a comparison between the current state and the predicted benefits, the project schedule, a plan of actions and a financial analysis.

After defining the new process, no more than 5 Key Performance Indicators (KPI) should be defined on a high-level vision of the process, and be aware of the opportunities and constraints by the change enablers of the process, i.e. KPI that reflect the business vision and the objectives

defined in the previous stages and allow to make a comparison between the current state and the predicted benefits after the implementation of the solutions. Also, this kind of KPI may be an important mean of communicating how the organization of the future will differ from the organization of today.

During this phase, the chronological plan should be reshaped according to the details regarding the subprojects that each one of the Business Cases addresses.

3.8   Implement the solution

Although this phase is out of the range of the project developed in this dissertation, due to time constraints and the dimension of the project, it is considered an essential part of the model being presented in this chapter, mainly because a BPR project normally involves a radical change in the company's old procedures, systems and people. As such, a well planed implantation has extra probabilities of success.

Thus, after deciding to go on with the solution, this step is about controlling and follow-up the implementation in terms of the process itself, IT systems and the new people's roles.

In case of the new process include an outsourced IT solution, a development of a Systems Requirements Specification (SRS) document may be considered. This document may serve as a foundation to develop the contract documents with the supplier. In case of a tender, a tender dossier should be prepared, according to the SRS. The contents suggested for the SRS is in accordance with the IEEE – 830 -1998. This recommended practice is aimed at specifying requirements of software to be developed but also can be applied to assist in the selection of in-house and commercial software products.

During this phase, KPI's, with an effective drill-down, for controlling operational performance of the process should be defined, with the purpose of performing an effective Business Intelligence on real time and follow the implementation of the project.

However, as seen, a full transition may be hard or impossible. As such the solutions may be categorized and organized into different projects. Depending on the size of the project and the depth of the change in the process, creating a pilot test or testing the implementation in a small business unit of the organization may be suitable. Also, a phased approach may be economically feasible, and the company can derive some financial quick wins from the process change earlier.

The implementation of a new process solution, especially in an end-to-end basis, requires the management of organizational change, since people's role may change. The reasons for this are simple – BPR requires either abandoning comfortable old ways of doing thing or relocate people from their role. In the end, in a BPR project with a digitalization purpose, the establishment of a company-wide agile operating model is expected.

A successful implementation of BPR initiative depends partially on consciously manage behavioural as well structural change, with both a sensitivity to employee attitudes and perceptions and tough-minded concern for results. That is bound to be disruptive, and there is no point in pretending these realities will not exist or trying to hide a BPR program behind closed doors.

4   Case Study

Rangel's Corporate Center is a crucial part of the company. Beyond advocating the organization's values, deciding the corporate strategy, it is also responsible to provide shared-services to the business units, such as Financial and Human Resources Management.

Through the implementation of the Kaizen method in the Corporate Center, the company aims to increase its operational efficiency and start creating a continuous improvement mindset. Along with this implementation, the company's intention is to implement a digitalization roadmap, not only adding even more efficiency and lowering costs, but also shortening the connection the connection between the Corporate Center and the Business Units and creating a "Global Corporate Vision".

As such, the present dissertation aims to develop a model for applying BPR to Corporate Center's processes, as presented in the previous chapter. As mentioned in the first chapter, the methodology presented in this dissertation has the intention of being scalable enough to be applied to more processes within the company.

The present chapter will focus on the application of this framework to a core process in the Corporate Center, and it will cover the first three steps of the methodology highlighted in the previous chapter.

As mentioned in the first chapter, the process selected for application of the framework being developed in the present dissertation has to fulfill the following requirements, according to the vision defined for the digitalization project within Rangel: (1) end-to-end process, ranging from the Corporate Center to the Business Units, and outside the company's boundaries if possible; (2) manual workflows; (3) not streamlined; (4) transactional and paper-based. Under these circumstances, the Accounts Payable Process has been found suitable for application of the framework being developed.

4.1   Accounts Payable Process – Process AS- IS

The Accounts Payable (AP) process is extremely important since it involves nearly all of a company's payments outside of payroll. The mission of accounts payable is to pay only the company's bills and invoices that not only are in accordance with the product or service acquired but also has all the information required to process it.

The AP process must also be efficient and accurate in order for the company's financial statements be accurate and complete. For instance, because of double-entry accounting an omission of a vendor invoice will actually cause two accounts to report incorrect amounts.

Hence, the company aims to improve this process, bearing in mind the following objectives:

- Increasing the operational efficiency and reducing costs by:
    - Eliminating the use of paper in the tasks of registering and validating invoices;
    - Optimizing the invoice registering process through automation;
    - Eliminating *MUDA* activities;
    - Improving the integration between the operational systems in the Business Units and the ERP (SAP);
    - Defining correct boundaries in each phase of the process.
- Streamlining the process in an end-to-end basis:
    - Shortening the connection between the Corporate Center and the Business Units;

- Increasing the effectiveness of the information for cost control and for the income statement.

Also, because accounts payable is a back-office function, it does not always take central stage as businesses look to grow or build competitive advantage. In fact, often accounts payable takes a back-seat to management's competing priorities. When it comes to working capital optimization, however, increasing payables should be a core strategy. Indeed, many businesses work this strategy by extending payables as long as possible to maximize free cash flow. However, this approach rarely is the right choice, since delaying payment might deteriorate supplier goodwill, resulting in slower delivery times, more arduous payment conditions, slower response to queries, lost discounts granted and bargain power. On the other hand, paying early can increase opportunities where the supplier discounts or rebates for early payment. As such, fostering a working capital culture can grant sizeable benefits.

4.1.1 Methodology

It is important to understand an existing process before designing a new one. In order to understand the existing process, the following methods were performed:

- Continuous communication with the process actors and participants, through **workshops**, **contextual interviews** and **observational study** in *gemba*;
- **Process modelling and documentation** to develop a common understanding of the existing state of the process;
- Gather data about the current state of the process, regarding the objectives defined for BPR project;
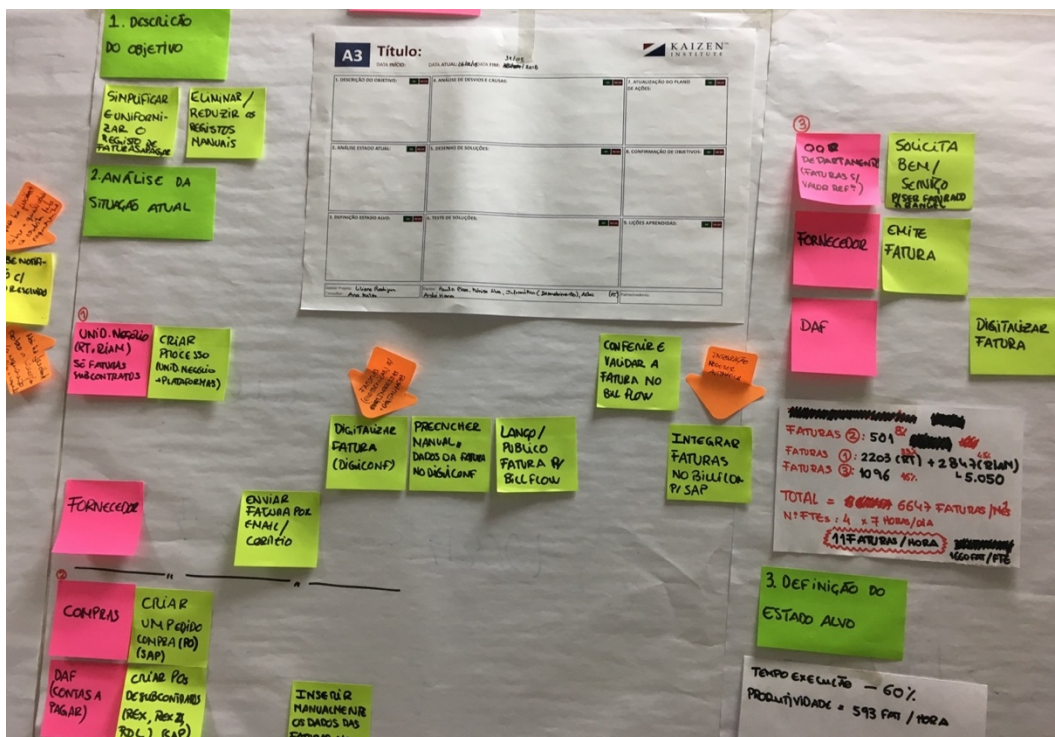- Development of a chronological plan for the BPR project.

Figure 4 - Image of a process modelling session during the workshops developed

The business vision and the objectives defined for the process reengineering were already presented in the first chapter, and represent a general vision of the digitalization and continuous improvement being developed by the Corporate Center of the company:

- Increase operational efficiency in the departments and reduce costs;
- Streamline processes, shortening the connection between the Corporate Center and Business Units;
- Focus on value-added tasks;
- Increase the effectiveness of the information;
- Dematerialize processes and increase the automation level.

The process modelling methodology used in the present dissertation is a multi-level modelling approach with no longer than three distinct levels of detail:

- 1st level – macro-view of the process describing the main phases of the process in a responsibility matrix, highlighting also the main actors of each phase;
- 2nd level – process modelling of each one of the main phases represented in the 1st level, either using a swimlane notation or a flow-chart notation;
- 3rd level – representing an activity of the 2nd level with more detail, either using a swimlane notation or a flow-chart notation.

At Rangel the main actor of this process is the Accounts Payable team within the Financial Department in Rangel's Corporate Center. Although this may be true, the process starts long before the AP team involvement. In an overview of the process, it is possible to highlight three main phases: (1) Purchasing; (2) Launching invoice; (3) Paying the invoice to the supplier. Each of this phases will be resumed in present chapter.

The modelling of the AP process AS-IS, according to the methodology presented above, can be found in the Appendix A.

4.1.2   Process Modelling

4.1.2.1   Purchasing

It is not the intention of the present chapter to detail all the purchasing and operational processes of each Business Unit, but to understand how different types of invoices are generated by different business units, depending on the products or services being purchased/subcontracted. As such, for the purpose of the Accounts Payable process, the purchasing phase is triggered by a request to the supplier and ends with an invoice being sent to Rangel's Corporate Center.

As stated in the introductory chapter of the present dissertation, Rangel has different business units with distinct characteristics, resulting on different purchasing processes and different types of vendor invoices. Considering the operational synergies between Rangel's business units, it was possible to categorize the purchasing phase in four different flows. These are:

- Road Freight (RT) and Air&Sea Freight (RIAM) subcontracts;
- Express and Parcels (REX II), International Express (REX) and Contract Logistics (RDL) subcontracts;
- Purchasing of consumables/supplies;
- Other purchases (such as contracts, rentals travel invoices, etc).

Road Freight (RT) and Air&Sea Freight (RIAM) subcontracts

The purchasing operations in the freight forwarders Business Units of Rangel - Road Freight (RT) and Air&Sea Freight (RIAM) – are connected to an operational reference number. This reference number is created in the Transport Management System (TMS) of this BU, when a client requests a service. This operational reference number is called "Process Number" and reflects the service requested by client to Rangel and all the services that Rangel requests to the suppliers and the corresponding monetary amounts, allowing the operational to control the profit margins of each process. Initially the service requested to the supplier is represented through a cost provision created manually by the Operational Team (in RIAM) - through a costs reference table, depending on the supplier –, or automatically by the TMS (in RT). For the purpose of the Accounts Payable, this operation generates invoices with the Process Number embedded in the lines of the invoice, as shown in the Figure 5.
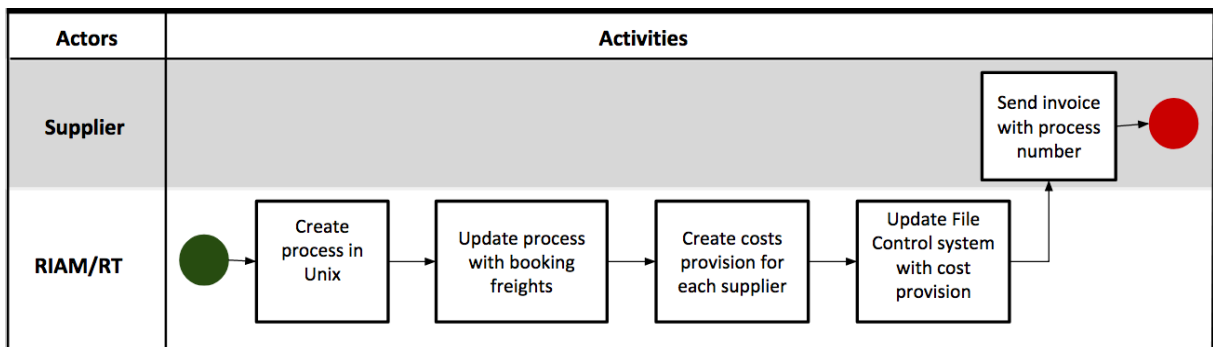
Figure 5 - Process Model AS-IS (2nd level modelling) - Purchasing RT/RIAM subcontracts

Express and Parcels (REX II), International Express (REX) and Contract Logistics (RDL) subcontracts

The purchasing operations in this case are connected to a Purchase Order (PO) created manually in SAP. Once a month the operational of the corresponding BU sends to the Accounts Payable team a list of Purchase Orders for creation, that represents all the services performed by the supplier. After the creation of the PO, the AP operational sends to the supplier an email with a template extracted from SAP with the PO attached. The concept of Purchase Order (PO) requires that the purchaser sends a document to the vendor not only authorising the purchase, but also to produce the invoice with the PO number, in order to track the original order and launch the invoice for payment more quickly.
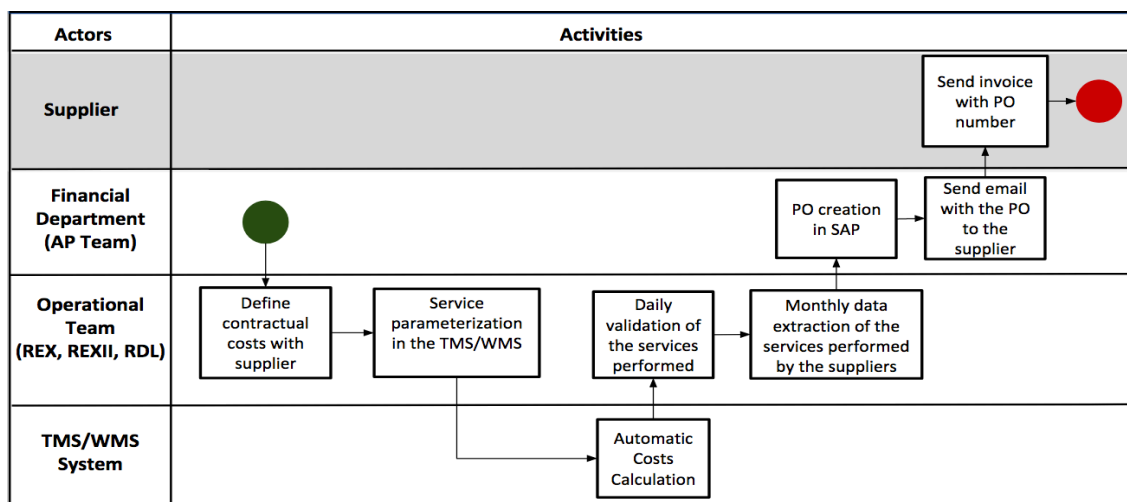

Figure 6 - Process Model AS-IS (2nd level modelling) - Purchasing REX/REX II/RDL subcontracts

Purchasing of consumables/supplies

The purchase of consumables/supplies is also connected to the creation of a Purchase Order manually in SAP. This process is predominantly handled by the Procurement Department that belongs to Rangel's Corporate Center. The Procurement department deals with the procurement and purchasing of all goods within Rangel, except the subcontracts processed by the BUs.

The process is triggered by an employee that requests the purchase of a product or service. After the request validation, the Procurement Operational creates the PO in SAP and sends it to the supplier.
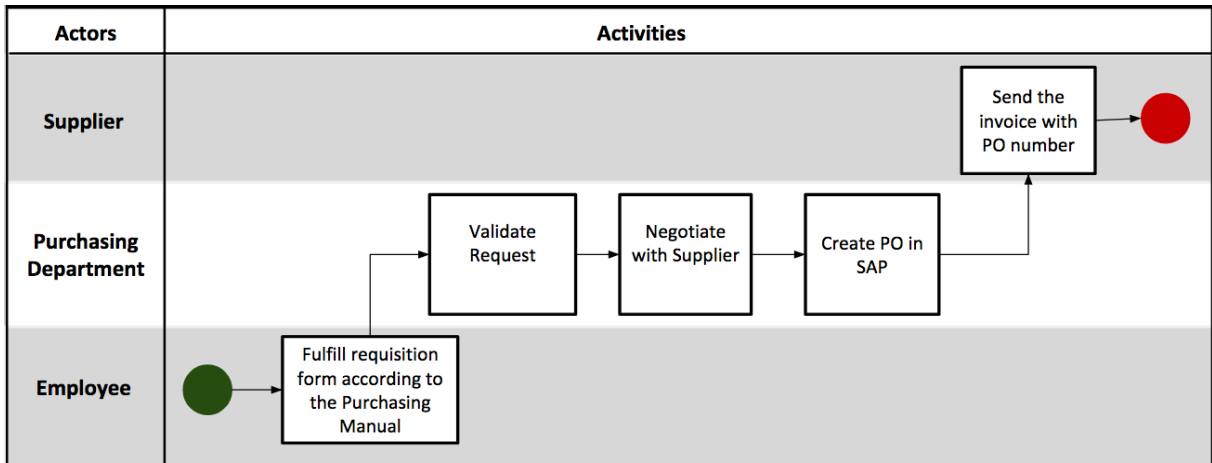
Figure 7 - Process Model AS-IS (2nd level modelling) - Purchasing of consumables/supplies

Other purchases (such as contracts, rentals, travel invoices, etc)

This purchasing operations do not have a pre-defined procedure and correspond to ad-hoc requests from different departments or services charged by suppliers, normally with the same amount periodically such as rental or energy contracts. This kind of purchases are associated to invoices with no internal reference.

4.1.2.2   Launching invoice for payment

According to the different procedures stated above, different types of invoices are generated and consequently registered distinctly. The types of invoices generated are:

- Invoices with Road Freight (RT) and Air&Sea Freight (RIAM) process reference;
- Invoices with Purchase Order;
- Invoices with no reference.

After receiving the invoices, the Accounts Payable team sorts and registers them according to the corresponding BU and respective type. As expected, different types of invoices have completely different launching procedures and different systems are used to perform the corresponding operation:

- RT/RIAM invoices – this type of invoices include an operating reference created during the purchasing phase, that is the "Process Number" mentioned in the chapter above. As seen above, this reference allows the Operations Team to root the invoice to the original process for approval. One invoice from a supplier can include services from several processes, making the approval task a bottleneck in the process;

- Invoices with Purchase Order – since the PO represents an agreement with the supplier, this type of invoices are already pre-approved, making the launching process a simple task. In this kind of invoices, the approval is only necessary to manage the exceptions, for instance the invoices with an amount that does not match with the amount of the PO created. In this case, due to a pre-agreement established with the supplier, the exceptions represent a small percentage in the overall number of PO invoices;
- Invoices with no reference – this kind of invoices have a flow completely manual. Firstly, they are scanned and sent by email for approval. In the case of bills generated from ad-hoc requests, many times is not obvious who is the approval agent, since there is not a pre-defined channel to request the service to the suppliers. Then, the invoice is registered manually in SAP.

4.1.2.3 Paying the invoice

Invoice payment is the last phase of the Accounts Payable process. The payment of invoices in the company are performed twice a month by the Treasury team in the Financial Department, according to the agreed terms defined with the suppliers. Once again, it is not the intention of the present chapter to perform a deep analysis to all the payment activities performed by the Treasury team, but consider this process as a part of an end-to-end analysis to the AP process.

The first phase of the payment process is the update of the payments plans with the invoices launched for payment by the AP team, as stated before. This task is performed manually on an excel file that defines which invoices to include in the payment cycles, according to the due dates of the invoices. The payment cycles are the moments when the payments are performed. Hence, a member of the Treasury team extracts from SAP, twice a month, the data with the invoices approved and launched for payment and imports this data into an excel file. This file automatically links the due dates of the invoices with the cycle of payments being performed, detailing which amounts are going to be paid to the suppliers in each payment cycle, according to the agreements plans for payment.

Then, the payments are performed during the payment cycles, i.e. 2 times in the month. The company includes three different types of payment in the process. These are:

- Online bank transfers (e-Banking) – normally used in international payments to suppliers through online banking accounts that the Treasury team has access to;
- Payment with checks – used in almost all national payments, where a letter is sent to the supplier with the corresponding check, to be deposited in the bank. This checks are processed in SAP, printed and signed to be delivered by letter to the supplier;
- Confirming – it is payment management service, through which Rangel transmits to the bank forward payment orders to its suppliers. From that moment, the bank manages the whole process, communicating to the suppliers the information regarding the payments of which they are beneficiaries. Suppliers may request, if they wish, an advance payment, up to the contracted credit limit, within the term and negotiated conditions. This method of payment is used only through an agreement with the supplier and normally for large amounts of money.

4.1.3 Current state

Some initial data was gathered about the current state of AP process, more specifically data about the volume of invoices processed and the percentage of invoices according to its type.

This data will help to prioritize the change opportunities and solutions identified in the next chapters. The data gathered about the types of invoices processed are presented in the Figure 8 in a graphical format. More data about productivity of the process AS-IS is presented in the Figure 9. It is also important to notice that the data was collected during the workshops developed, since there was no culture of performance measurement.
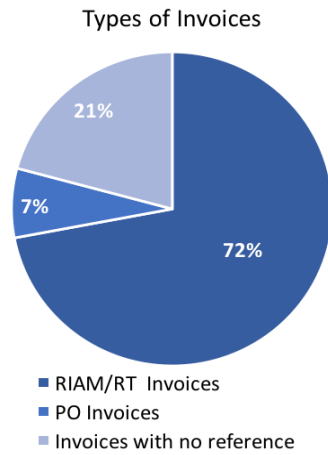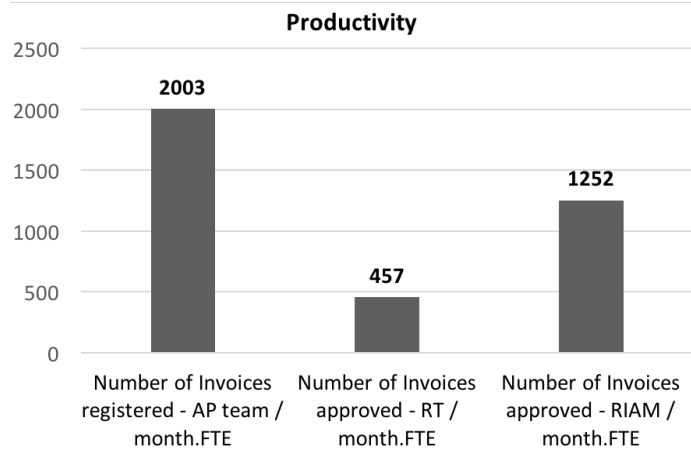

Figure 8 - Type of invoices processed by the AP team

Figure 9 - Current productivity data of the Process AS-IS

4.1.4 Chronological plan

As mentioned, during this phase, the chronological plan starts to be developed, giving an overall view of the implementation of the BPR project. As the project goes on to the next phases, the chronological plan is updated with details about the implementation of the solution, such as duration times and important deliverable dates.

The chronological plan proposed corresponds to an adaptation performed to an existing template used by the Continuous Improvement department of the Contract Logistics BU. This chronological plan is a Gantt Chart that, firstly presents the activities being performed in the overall BPR project, and then details more specifically the ones of the corresponding sub-project, in order to provide not only the implementation plan for the sub-project, but also to present an overall view of the implementation plan of the BPR project. The chronological plan developed can be found in the Appendix D.
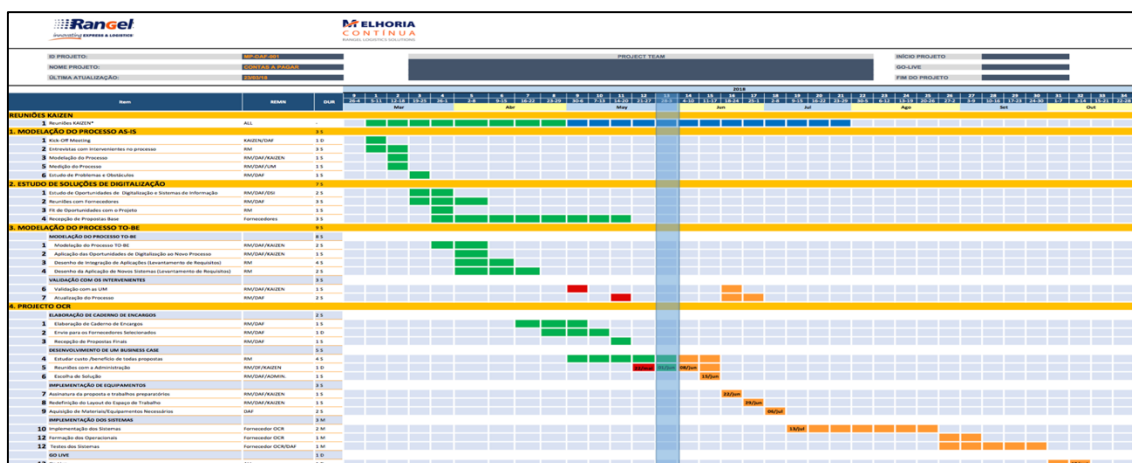
Figure 10 - Chronological Plan developed for the project

5   Constraints and Change Opportunities

Once the process is modelled and well-known, this chapter will cover and document the
constraints and opportunities identified during the phase of understanding the AP process AS-
IS. The problems and the opportunities will provide inputs to reach the solution for the TO-BE
process.

The BPR approach being studied in the present dissertation aims to analyze the problem in an
end-to-end perspective, taking into account all the inputs and outputs of the process. As such,
the roots associated to the problems identified will be more natural during the phase of
analyzing the process AS-IS. For instance, since this analysis covered all the inputs received
from the Business Units during the purchasing phase, it became natural that there was a need
to streamline the process as much as possible.

As already mentioned, the model developed and applied during this project goes beyond the
traditional methodologies of process improvement methods to explore problems, such as the 5
Whys method or the cause-and-effect diagram derived from the lean principles. Process
improvements techniques may be helpful once the new process is implemented. Hence, the
approaches taken during this phase were the following:

- Organizing workshops and brainstorming sessions with people involved in every
  phases of the process;
- Benchmarking of the best practices in other companies and BPO.

Although the model being developed aims to analyze the process in an end-to-end perspective,
the need to change was triggered during the implementation of the Kaizen method in the
Corporate Center. During such implementation, one of the main inefficiencies identified in the
shared-services processes was the lack of connection between the Corporate Center and
Business Units, that caused much of the operational inefficiencies identified, such as
duplication and lost of information, resulting in added costs to the company. The main
advantage of the model being developed is that provides a support to analyze the processes in
a perspective that links this two parties, taking advantage of the potential synergies that the
Corporate Center can provide. With such a holistic approach the problems and opportunities
can be analyzed as whole and not as a sum of parts.

In addiction, some strategic problems were already identified by the company and presented in
the first chapter. Some of this problems were the roots for the implementation of the Kaizen
method and triggered the development of this project:

- Lack of connection between the Corporate Center and the Business Units;
- Operational inefficiencies in the Corporate Center;
- Lack of continuous improvement mindset.

After an initial analysis, it was clear that these problems started far beyond the Corporate
Center. Although there are some operational inefficiencies in the Corporate Center, the origin
is where the process stars, i.e. in the Business Units or even outside the company boundaries,
for instance in the lack of information that the supplier includes in the invoices.

As such, during the phase of understanding and modelling the process AS-IS, it was possible to state a set of constraints in each phase of the process. Those constraints were visual assigned with an arrow as stated in the Figure 11, not only to provide a visual impact but also to root it to the respective part of the process.
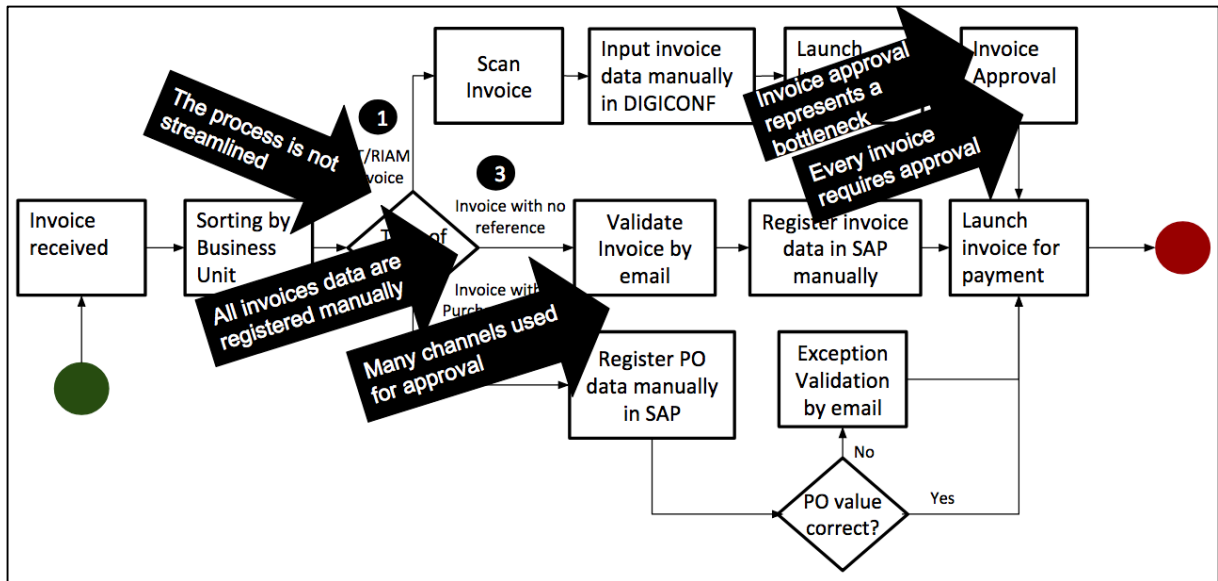

Figure 11 - Constraints identified in the Process Model AS-IS

Because there is not a single cause connected to this problems, studying all possibilities is mandatory. Thus, after analysing all problems in every phase of the process a more holistic approach is required. As such, the problems were categorized according three different dimensions: (1) the process flow; (2) IT systems; and (3) the KPI's for controlling the process.

- Process flow
  - Heterogeneous flows;
  - Lack of Communication Assertiveness and Missing Information;
  - Cases without a clear definition;
  - Process Boundaries;
  - Working habits;
  - Inefficient payment methods.
- IT systems
  - Information silos;
  - Inefficient use of SAP;
  - Inefficient approval system;
  - Manual workflows.
- Key Performance Indicators
  - Lack of Performance Measurement culture in processes.

One of the topics highlighted above were the reasons behind the choice of this process for redesign. Among them were the operational inefficiency and the need to reduce costs and streamline the procedure. The problems identified above not only reinforced these consequences but also highlighted much more, that led to need of redesigning the process in an end-to-end perspective. These are:

- Lost of leverage and power of negotiation with the supplier;
- Later payment of invoices;
- Increasing number of supplier complaints and the time wasted in supplier support;

- Difficult to track payables outstanding by vendor and by payment terms;
- Inaccurate and error prone data for accounting processing and management reporting;
- Inability to resolve unreconciled items on a timely basis.

5.1   Process flow

5.1.1   Heterogeneous flows

By analysing the process modelling in the previous chapter, it was possible to notice that there are many procedures for subcontracting services and purchasing products, depending on the Business Unit. For instance, while Express and Parcels makes use of Purchase Orders to establish an agreement with the supplier, resulting in the issue of pre-approved invoices, the Freight Forwards BU's approves invoices after receiving them, with no pre-agreement with the supplier about the cost of the service after its provision. Later, this results in different types of invoices to handle with and distinct ways of registering them by the AP team.

5.1.2   Lack of Communication Assertiveness and Missing Information

By analysing messages of communication between a supplier and an Operational of RIAM/RT, it was possible to realize that communication exchanged was careless and without a common line of approach by all team members. Requests and replies were not assertive regarding the information to be included in the invoice for approval, in this case the inclusion of the "Process Number" in the invoices that will allow to root it for approval. Also, it was noticed that alterations in the service provision that caused to change the cost provision were not inserted in the system, causing problems during the approval phase.

The analysis performed reflected that the company, in general, seem to have neglected this aspect of ongoing interaction with the supplier, and focus their attention on the initial stages of the transactional purchase process. Consequently, this run into problems in the ongoing phases of the process. A study by van der Valk and Rozemeijer (2009) into successful interaction between buyers and sellers of business services showed, for example, that active contract management is a key success factor for successful service purchasing.

Also, by analysing several invoices from the suppliers it was possible to notice that some mandatory information for the later steps was missing or included incorrect information, preventing the invoice to be approved or even registered in the system. In addiction, there is not a standard procedure for handling this kind of situations, sometimes with the improper acceptance of the invoice without communicating with the supplier. The Figure 12 represents an invoice that misses mandatory information that prevents it to be registered for approval.
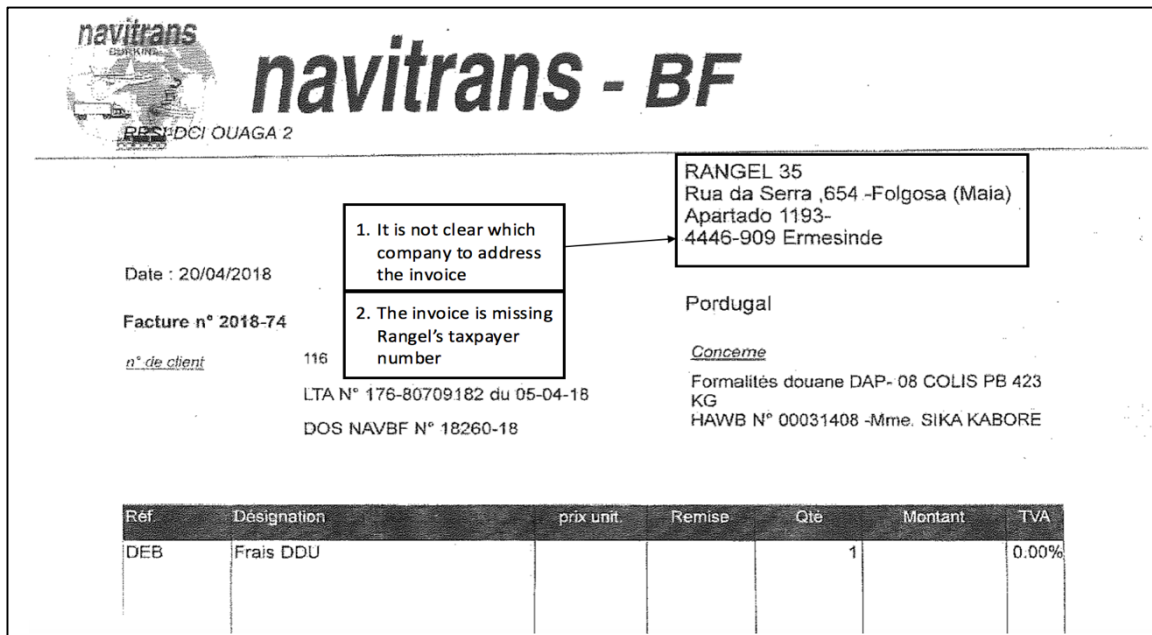
Figure 12 - Example of invoice with mandatory information missing

5.1.3 Cases without a clear definition

Another huge pain for the AP team is the handling of invoices with no reference. This invoices, in the most cases, are generated by ad-hoc requests by different departments and do not have a clear procedure during the purchasing phase, most of the times without notifying the AP team. As such, after receiving the invoice, it is not clear who is the department or team responsible for the approval, requiring a lot of time to trace back the invoice to the request. This turns the approval phase into a huge bottleneck.

Other problem that is not clearly defined is the invoices of contracts and rentals. This kind of invoices are manually registered in SAP, even they charge a fixed monetary amount every month (recurring invoices) and have a standard layout. As going to be detailed in the next chapter, this type of invoices represents an opportunity of automation through an efficient use of SAP.

5.1.4 Process Boundaries

During the workshops performed in the previous phase of the model – Process AS-IS – it is clear that the process has never been properly documented and analyzed. One of the advantages that a Process Management approach brings is the definition of efficient process boundaries, i.e. who does what in the process. This problem scales up even more with cross-sectional processes.

During the previous step, it was possible to notice that some tasks were not clearly defined and the information was often replicated in different phases of the process. For instance, registering the RT/RIAM invoices in the system for approval was done in different steps and by more than one actor. While the AP team registers the header of the invoice, the RT/RIAM operational has to register the data included in the lines of the invoice. Other case is the creation of Purchase Orders in SAP. There are cases that the PO is created by the Procurement Department and

others that is created by the AP team. Also, it is not clear why the requester did not create the PO, when it possesses all the information to perform the respective task.

One of the advantages of BPM, if well applied, it establishes clearly redefined process boundaries with proper coordination between the different parties.

5.1.5 Inefficient payment methods

One of the major problems identified during the payment phase, is the use of inefficient payment methods, that do not add value to the process. As analyzed in the previous chapter of this dissertation, three payment options are at the Treasury team disposal: (1) banking transfers; (2) check; (3) confirming.

Check payments have the advantage of not only providing more detail about the payment that the company is performing, since the check is sent along with a letter, but also to extend payable and maximizing free cash flow. However, this payment besides representing additional costs to the firm, since it requires printing all the checks and sending them to the suppliers, it is considered a bottleneck in the process, regarding the time required to perform it.

On the other hand, online banking transfers are a quick way for performing payments to suppliers. However, in Rangel, this process is still inefficient, comparing with its current potential, since it is performed manually, i.e. an individual transfer is performed for each supplier. The use of SEPA (Single Euro Payments Area) files extracted directly from SAP, might be a way to turn this process more efficient.

5.2 IT Systems

5.2.1 Information Silos

An information silo is an information management system that is unable to freely communicate with other information management systems. Thus, information is not properly shared but rather remains sequestered within each system or subsystem. Communication within an information silo is always vertical, making it difficult or impossible for the system to work with unrelated systems. System Silos are the opposite of an integrated view of the systems and contribute to decrease the level of automation of the company. This can result in a variety of problems, such as duplication of effort, lack of synergy and missed opportunities. Also, it is important to state that cultural information silos are often reinforced by technology and business processes that do not support collaboration. In a multi-portfolio company with several Business Units, this problem arises. As expected, a considerable part of the information silos identified happen between the Corporate Center and the BU's.

Taking the creation of a Purchase Order in Express and Parcels for example. As seen in the chapter above, although all the information for the creation and emission of a PO is processed in the TMS, the information is sent, in an excel file, by email for the AP team to create the PO's in SAP and send by email to the supplier. Through a proper Enterprise Application Integration, the PO could be created in the TMS without duplication of the effort. Other case is the creation of a supplier account in any Business Unit system. Although the supplier has been created in the TMS. The BU operational has to send an email to the AP team to create the supplier in SAP with the proper information.

These are clear examples, among others, of data that is not shared between systems, causing duplication of efforts that can lead to an increase in costs and lack of synergy. This can easily cause a number of missed opportunities for the business, employee frustration and result in missed payment deadlines, misplaced priorities or an outright failure to achieve business objectives. Also, when information is not readily available across the organization, it can result in faulty decision-making based on inaccurate or out-of-date data.

5.2.2 Inefficient use of SAP

The main goal of an ERP is to standardize, streamline and integrate business processes across functional areas in the organization and all the applications required by an organization as a whole, and connects the organization to other enterprises in a network form. Thus, ERP opens a window of opportunity for businesses to compete globally, respond to competitive pressures, and increase revenue. As such, the value of an ERP system entails examining the amount of duplicated effort that the ERP system eliminates and the increased efficiency that results from having an ERP solution in place. Savings can be derived from a reduction in staff numbers and productivity improvement.

The ERP system implemented at Rangel was SAP. SAP is used in Rangel mainly in the support processes, i.e. almost exclusively by the Corporate Center. Briefly, it used to support almost all Finance processes and to process payroll in Human Resources. As such, it is possible to say that it still not used as a true ERP system. However, it is not expected that the ERP support all business functions in a monolithically view of an integrated system, but at least find the right balance where it is possible to take the maximum profit out of it. Today, even in some processes is still not used as efficiently as it should, according to its capabilities.

Let's take the example of the payment of invoices by the Treasury team. In order to pay invoices, the Treasury Team updates the payments plans with the invoices launched for payment by the AP team, as stated before. This task is performed manually on an excel file that defines which invoices to include in the payment cycles, according to the due dates of the invoices. This an example of a process that can be entirely supported by SAP without updating the payment plan manually.

Other case is the registering of recurring invoices in SAP. Recurring invoices are popular in modern businesses for the ability to automatically charge customers for an agreed amount for goods and services. These invoices are normally submitted, or the charges normally applied, on a monthly basis. Examples of this kind of invoices are contracts with monthly fixed amounts. Today, this invoices represent nearly 7% of the invoices and are registered completely manually in SAP. This is another example of a process that can be entirely supported by SAP.

5.2.3 Inefficient approval system

Today, after the AP team registers invoices without PO (or even PO invoices with mismatching), the next step is the approval of those invoices. As can be seen above, this represent 95% of the cases.

The major problem regarding the approval is that there is no single channel for handling these workflows. While the freight forwards BU's use an in-house software, called *Billflow*, to approve this invoices, the other BU's approve invoices by email with no integration with SAP for payment. Also, *Billflow* has been reported by the company as an inefficient and non-flexible system to handle the approval of 72% of the company's invoices. In addiction, not only the

approval workflow parametrized in the system was considered a bottleneck in the process but also the user-interface was not intuitive and prone to errors. Thus, the need for a robust BPM system that could support all the workflows was identified by Rangel during this phase.

5.2.4 Manual workflows

As mentioned, this process was chosen regarding the amount of manual flows that are used to support it, thus having more potential to get benefits out the digitalization project being held by the company. Some reasons for this manual workflows were already seen in the chapter above, such as the amount of information silos and the lack of integration between enterprise applications identified or the inefficient use of the ERP.

However, the major manual workflow identified regarding the existing process was during the register of invoices, more specifically the transformation of data presented in the invoices to meta-data to be included in the ERP. All data presented in the invoices is registered by the AP team in the different systems, such as *Digiconf* or SAP, manually, since, today, the company does not possess any technology capable of transforming this data into meta-data to be automatically processed by the ERP. The process of registering manually the data of all invoices, besides being a task that does not add any value to the process, it requires 50% of the AP team just to perform it.

Other examples of procedures that were already marked as manual-intensive tasks, thus were found suitable for automation are: the creation of costs provision in RIAM, the creation of Purchase Orders and the automation of the payments cycles by the Treasury team.

5.3 Key Performance Indicators

5.3.1 Lack of Performance Measurement culture in processes

As already mentioned in the chapters above, until the implementation of the Kaizen method, which coincided with the development of this project, the company did not have a culture of measuring its processes, not only in Corporate Center but also in some of the BU. As the Kaizen method started to be implemented, the Corporate Center has initiated the journey of continuous improvement and consequently the measurement of its operational performance. However, the BU are not yet implementing a continuous improvement culture and the practice of measuring its performance is not perfectly refined yet. As such, if we consider a cross-sectional process such the one being redesigned in the present dissertation, the challenge is to design the right Key Performance Indicators from scratch.

Implementing an effective performance management system along with the present project will allow to the parties involved to provide a comprehensive system for recognizing what gets done and reinforcing how it is achieved, align individual goals with key business goals defined with the project, resulting in greater focus, more efficient use of resources, and less time wasted on non-value added activities and also communicate how individuals contribute to business success and how they will be evaluated. Also, in order to achieve the desired results, performance management not only needs to be an ongoing activity, but also to allow a real-time analysis of the performance to the managers, in order to support decision making on the right-time – Real-time Business Intelligence. As such, the performance indicators must also be visually available to all individuals.

6   Developed Solutions and Results

After analysing the process AS-IS and identifying the constraints and opportunities, this chapter aims to present the solutions defined, including modelling the process TO-BE along with the defined solutions. Also it encompasses studying the predicted benefits through the development of a Business Case that will support the decision-making by the Senior Management and define some guidelines to support the implementation phase. Regarding the methodology, this chapter will focus on the application of the last three steps.

The solutions proposed and being implemented in the process comprises 5 lines of actions that will be presented separately in the next chapters. As mentioned in the methodology presented in the third chapter, these solutions correspond to separate sub-projects being implemented in different chronologic phases within this BPR project. This happens for two reasons, first because they represent different kinds of implementation characteristics and then because an abrupt transition to a complete new solution would be very difficult or hard to implement. As such, the solutions developed are the following:

1. Automation of the Invoice Registering Process:
   a. Implementation of an Optical Character Recognition Process;
   b. Implementation of a new workflow system for invoice approval;
2. Streamlining the process through Purchase Order Automation;
3. Implementing a Web Supplier Portal.

It is important to enhance that these solutions cannot be analysed separately, since they all are dependent from each other. For instance, the automation of the Invoice Registering Process must be flexible enough to be implemented gradually, i.e. in the first phase it has to rely on the actual flow of the AP process (Process AS-IS), but in the near future must be adapted to the process streamlined through PO's (Process TO-BE). This will allow to gain quick wins during the implementation phase and promoting a gradual transition to the new process solution, instead of an abruptic modification of the actual procedures.

Since the present dissertation provides a framework for BPR, after an analysis of the payment phase in AP process, the solution defined within the project only predicts an improvement to the actual procedure instead of radical redesign of the invoice payment phase. The major reason behind these choice was the priority of the company in improving the other phases of the process. However, within the present project some guidelines were defined for improvement of this phase, according to the constraints and opportunities identified in the previous chapter:

- Reduce the number of payments by check;
- Increase the number of payments by bank transfer;
- Improve the e-banking payment through generation of SEPA files;
- Automatize the supplier's payments plan in SAP.

Hence, the solutions defined and presented above do not concern this phase of the AP process. However, a radical change of the treasury function and the payment phase of this process might be topic for future projects within the area.

6.1   Methodology

As already mentioned, regarding the dimension and scope of the present project it was not used any specific methodology for process improvement, instead the solutions defined were based on the following actions:

- **Workshops and brainstorming sessions** with all group members of the project, defined during the first steps of the project, aiming to develop creative, but pragmatic new process designs, taking as input the process vision, the change opportunities, and benchmarking knowledge;
- **Benchmarking and best practice analysis** of the process in other companies or in Business Process Outsourcers;
- **Defining the solutions** and **modelling of the process TO-BE**;
- After defining the solutions, it was performed an analysis to decide which **technological solutions** were developed **internally outsourced**, according to the methodology presented in the third chapter;
- Definition of **KPI's and the study of the predicted benefits** regarding the implementation of the present project;
- **Development of the Business Case** to support the decision making, according to the format implemented by the *Kaizen Institute* for the process improvement projects – *A3 Kaizen.*

The workshops and brainstorming sessions were performed once a week with a project team defined in the beginning of the project, and complemented with contextual interviews to specific stakeholders of the project.

Regarding the benchmarking and best practice analysis of the process in other companies or in Business Process Outsourcers, some elements of the project team visited the financial department of *Caetano Auto* in Vila Nova de Gaia. During the visit it was possible to share how the company implemented the process redesign project and how was the improved solution developed. Another visit was performed to a Business Process Outsourcer, more specifically to *Accenture Operations* in Lisbon. *Accenture* outsources the AP process from receiving the invoice till registering it and sending it for approval. During this visit, it was possible to gain a mental image of how the process is performed in a much bigger scale in a company with 15 years of experience as a BPO of this process. The result of this analysis were crucial for defining the optimum solution being presented in this chapter.

After defining the solutions, the TO-BE process was modelled according to the same methodology used for the process AS-IS, i.e. a multi-level process modelling.

Regarding the IT solutions defined, an analysis was performed to decide which technologies would be outsourced or be developed in-house. The factors that influenced the decision have been presented in the third chapter and such decision was taken by the senior management with the analysis performed by the project team.

After defining the solutions, KPI were also defined to control the benefits predicted by the implementation of the present project. This KPI will be the basis for the Business Case being developed for each of the presented solutions.

Although it is not the scope of the present project to apply the implementation of each solution into the case study, since it was not covered by the time span defined for this project.

6.2   Process TO-BE – Define the solutions

6.2.1   Automation of the Invoice Registering Process

Optical character recognition has become one of the most successful applications of technology in the field of pattern recognition and artificial intelligence. This technology allows to automatically recognize characters through an optical mechanism, turning image data into meta-data that can be recognized by Information Systems. Although, OCR is not able to compete with human reading capabilities, this technology has been used by companies to help employees to process image files with more efficiency and reducing human errors.

As such, this technology has been used to automatically identify the common data elements in an invoice, such as vendor, date, amount, invoice number, line item data, etc. According to recent studies, evolved OCR technologies can ensure ninety percent of efficacy in image capturing after a mature implementation.

As stated in the Figure 13, regarding the new solution defined in the present process, the use of this technology has been found suitable for improving the efficiency of the invoice registering process. Although, the OCR technology alone is capable of performing an image capturing and transformation of image data to meta-data, a more holistic approach is needed to catch the full benefits of automatizing the invoice registering process. Hence, the solution was designed to automatize the invoice processing as much as possible, including not only the process of capturing the invoice, but also to perform the invoice data matching and validation with the ERP and also be integrated with a system for managing the exceptions, i.e. invoices that were not validated by SAP. As such, the need for an integration with a system that manages the workflow of invoices for approval was identified as mandatory.
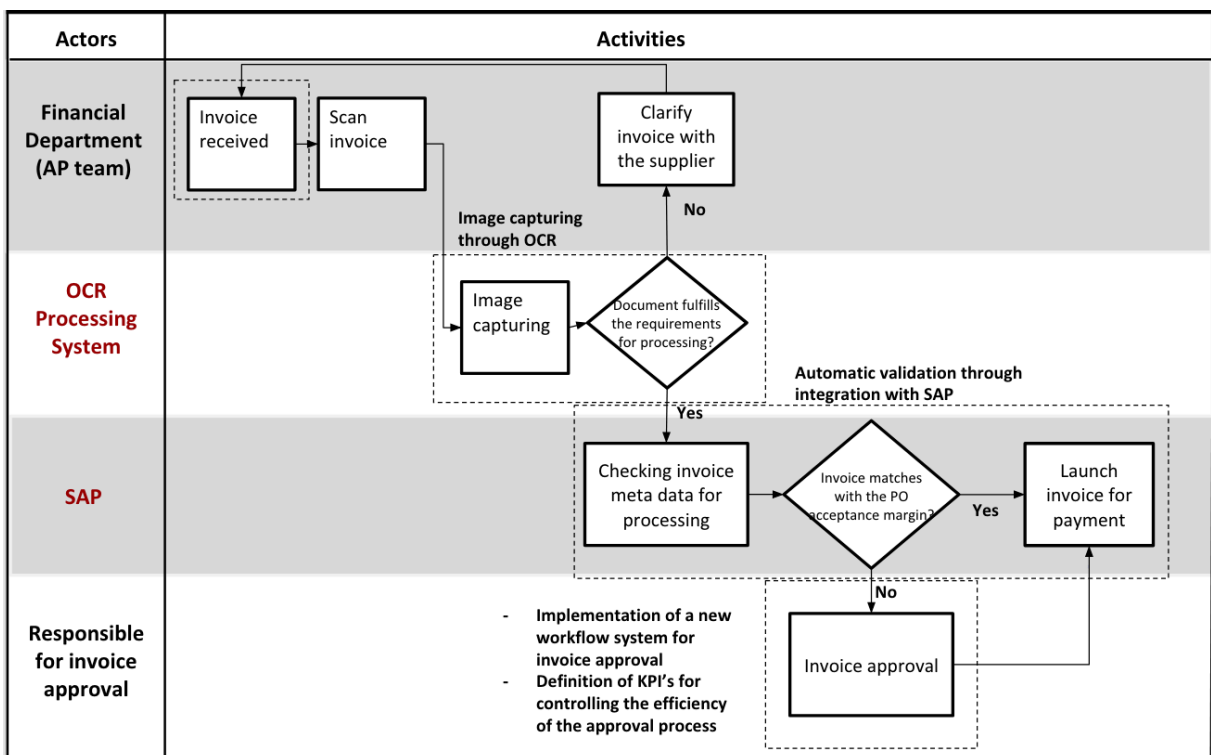
Figure 13 - Process Model TO-BE (2nd level modelling) – Launching invoices for payment

Today, the company does not have a single system to manage the workflow of invoices for approval. As already mentioned, the *Billflow* is used to manage the approval of 72% of the

invoices of Rangel, i.e. RIAM/RT invoices, while the other invoices are approved through e-mail. In addiction, in the workshops developed, the need for new system to manage the workflow of invoices for approval was identified and, as seen, the *Billflow* was customized for RIAM and RT operations and has been marked has an inefficient, non-intuitive and non-flexible system with approval workflows that were not suited for new process, making the approval process a bottleneck.

For reasons concerning the know-how and expertise needed to develop a mature OCR system, the choice for buying an OCR system was obvious. As such, the next step was the benchmarking of the best solutions for automatizing the invoice registering process, in order to request for a proposal. Although it is not the intent of the present dissertation to analyse in detail the solutions proposed, it may be important to highlight that four different suppliers were considered for proposal.

All of the outsourcing solutions analysed offered not only the OCR technology, but an integrated solution for automating the Invoice Registering Process, according to the requirements presented above. Considering the analysis performed to the current state of the process and the amount, type and level of differentiation of the invoices being processed, the project team defined the main criteria that these solutions should have, in order to be suitable for the process TO-BE. These requirements are:

- Machine Learning-based OCR;
- Robust documental workflow system;
- Experienced supplier in the AP process;
- Cost;
- Level of integration with SAP;
- Flexibility for being adapted to the gradual changes predicted in the BPR project.

These requirements represent the basis for supporting the supplier choice and are presented in the Business Case developed, regarding this sub-project.

6.2.2 Streamlining the process through Purchase Order Automation

As seen in the previous chapters, from the purchasing phase till the payment of the invoice the process has different flows, depending essentially on the different type of invoices generated during the purchasing phase. In addiction, after performing an analysis to the Process AS-IS, it was possible to draw two main conclusions: (1) a need to streamline the process; (2) the approval process represents a bottleneck.

Although, the characteristics of services (intangibility, heterogeneity, simultaneity and perishability), affect the purchasing process in the sense that certain aspects become more important and/or difficult than, or just different in comparison with, the purchase process for goods (van der Valk and Rozemeijer 2009), the subcontracting services purchased by the BU are more or less parametrized and with a proper reshape of the contract management process, by narrowing the specification of the service agreements, it is possible to increase the matching levels between the costs provision and the real cost of the service.

Considering this, the solution to streamline the process was through the implementation of Purchase Orders during the purchasing phase. Purchase orders provide benefits in that they streamline the purchasing process to a standard procedure, by establishing a commercial document between a buyer and a seller, indicating types, quantities, and agreed prices for products or services, i.e. it is a document sent from a purchaser to a vendor that authorises a

purchase. As such, the major benefit provided by PO's is the control over the purchase of goods or services, ensuring that the pricing, quantity and material ordered is what is actually being billed, and representing a pre-validation of the invoice.

By creating and managing the PO's through the ERP, when the invoice is received, the AP team only have to check if the invoice matches with the corresponding purchase order, through the PO number presented in the invoice, if so it will be paid promptly and without dispute. If the invoice does not match the PO created, any changes or additions to the initial PO must first be approved by the corresponding BU operations. Once approval is received, a revised PO will be created and sent to the supplier.

This approach aims to solve the actual bottleneck that the approval phase represents, since the BU operations will only manage the exceptions, i.e. the invoices that do not match the corresponding PO. As mentioned, this can only be achieved with an ongoing communication and transparency with the supplier during the purchasing phase, ensuring a better control over the purchase of goods or services.

Today, only 7% of the invoices contain purchase orders. The company objective is to increase this number to 93% in the next years. It is also important to state that, without doubt, this is the most radical change within the solutions defined. Streamlining the process through Purchase Orders not only involves performing operational changes in almost all BU but also it will influence the design of the other solutions presented in this chapter.

Although streamlining the process through PO's is expected to increase the efficiency of the overall AP process, the next step is to move to an automated purchasing process. An automated purchasing process can help facilitate the procurement and purchasing of goods or services by speeding up communication, reducing time for approvals and eliminating unnecessary paperwork, turning the procurement/purchasing process more efficient. A simple example of purchasing automation can be as simple as having a permanent list of trustworthy suppliers ready to be pulled up, automatically generating purchase orders. With an eProcurement system, for instance, the company can communicate electronically with vendors and customers to automatically generate POs for each new order, electronically validate and accept invoices, approve requisitions, track goods received or services performed and pay invoices on a timely basis.

Although having a full automated purchasing process might not be realistic in short period of time, small actionable steps can be taken to automate the process. The first step that is being taken regarding this project is to create PO's automatically through BU operational systems, i.e. the TMS/WMS used in their core businesses.

Once the service provision is approved, the envisioned solution is to aggregate all the services of the suppliers during a certain period of time and create Purchase Orders automatically through the TMS/WMS system used to process the service, and send automatically a pre-defined e-mail to the supplier with the Order. The solution developed is through an integration, via Webservice or RPA, with SAP, as stated in the Figure 14. Once more, this can only be possible through an ongoing communication and a proper specification of the service agreements with the supplier and better control over the purchasing of goods and services.

During the implementation of this solution, an example of Use Case models, specifying the creation of PO's automatically through the Express and Parcels TMS, was developed and are represented in the Figure 15. A detailed analysis to the Use Case models developed, along with some mock-ups, can be found in the Appendix C.

The solutions developed to create purchase orders automatically are going to be internally developed, regarding the actual know of the IT department about the TMS/WMS systems used in the BU. It is important to highlight that some of the Use Cases developed are already being implemented in GCOM (TMS used in Express and Parcels).
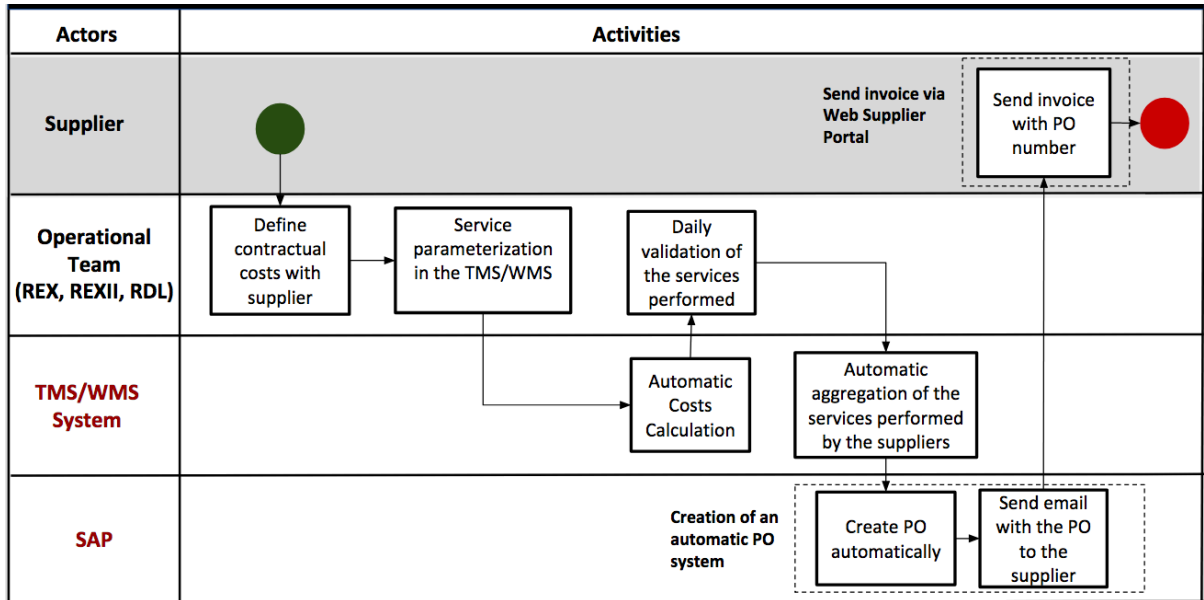
Figure 14 - Process Model TO-BE (2nd level modelling) – Purchasing of subcontracts in REX/REXII/RDL
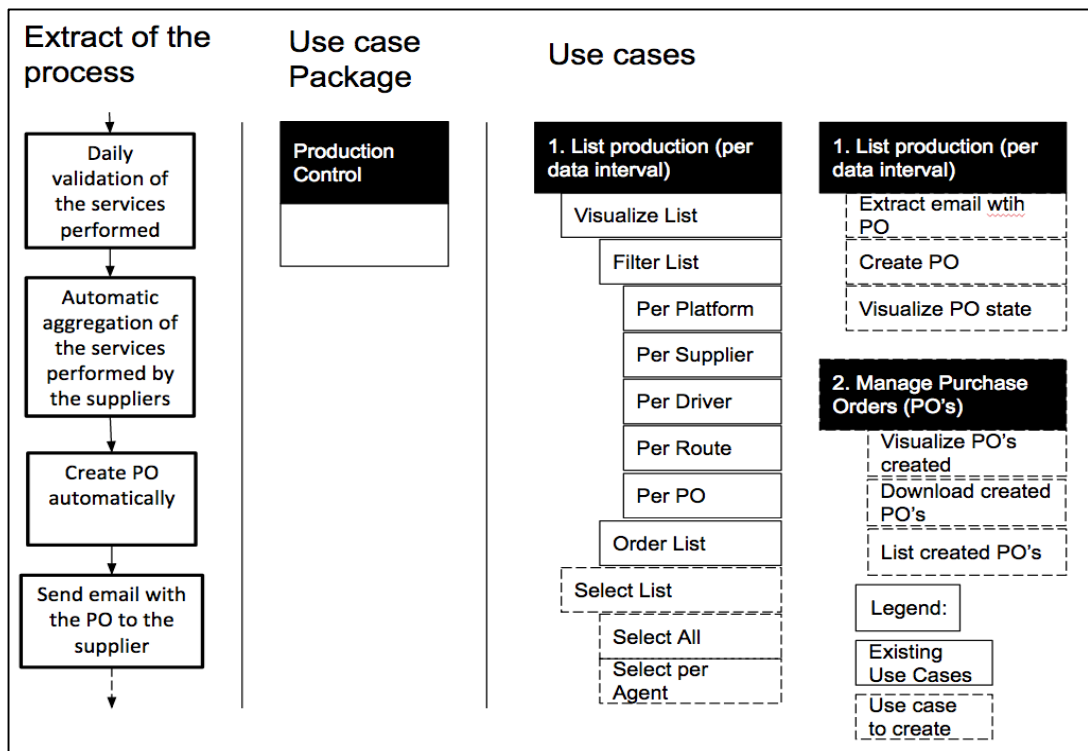
Figure 15 - Use Case models developed for creating PO automatically through GCOM

6.2.3 Implementing a Web Supplier Portal

This solution cannot be seen as a separated implementation, but rather as an integrated solution to be implemented along with the others. Thus, setting up a supplier portal will help increase the level of automation of the AP process, maximizing the level of transparency, collaboration, communication and the speed of the overall process, allowing suppliers to:

- Track the status of orders, PO, deliver schedules, potential product/service shortages and payments received;
- Overcome communication barriers, strengthening relationships with suppliers and the level of reciprocal trust;
- Gain visibility into transactions, invoices and PO through integrated work areas;
- Reducing the time spent on specific processes;
- Cut down manual errors;
- Improving order accuracy and PO matching;
- Respond to discrepancies easily.

Besides this, a proper implementation of the Supplier Portal can reduce the work processed by the procurement team by streamlining the supplier management procedure through a self-service portal where on board suppliers can easily perform a simple online registration process. As such, through a supplier self-service portal, the company can eliminate manual paper processing, miscommunication and reduce the time spent providing support and information to the supplier. Other major advantage envisioned for this solution is the possibility to work as EDI (electronic data interchange), increasing the level of automation of the company's accounts payable systems.

The short-term vision studied for this solution is the adoption of the portal as the only channel available to receive invoices, forcing all the suppliers to move towards a new standardised way of interacting with Rangel, consequently removing any other kind of communication channel. Hence, the aim is to align the implementation of the portal with the implementation of e-billing, eliminating manual paper processing as well.

Other function analysed for the implementation of the portal was the possibility to generate automatically an invoice associated to the purchase order of the corresponding supplier, according to a standard format provided by Rangel. This would allow to automate the process of registering the invoice without the intervention of an OCR technology and through an integration with SAP, since the supplier is providing the invoice meta-data in digital format.

The implementation of a web portal for suppliers cannot succeed without providing an initial proper support, so that all suppliers could integrate in the platform. A period of time must be allowed for progressive entry of the suppliers in the portal. Also, focused communication plan must be designed and disseminated along with some meetings to introduce the platform and to train users. In addiction, a help desk for assistance might be necessary.

The implementation of this solution can also be followed by an action to segment the suppliers, followed by a definition of activities and a plan of action for each of these segments.

In the future, some additional features can also be thought, such as the publication of the vendor rating, handle the electronic requests for quotation to suppliers, address online auctions and

tenders or promote the exchange of other type of documents, for example CMRs or Proofs of Delivery (POD).

The implementation of a supplier portal is considered a strategic move to increase the relationship with suppliers through collaboration and transparency with benefits that surpasses the improvements in the efficiency of the AP and purchasing process, as such, prior to the implementation, the top management must clarify the strategic goals involved.

6.3   Measure the predicted benefits and develop an implementation plan

6.3.1   Key Performance Indicators of the project

According to the methodology presented in the third chapter of the present dissertation, a set of Key Performance Indicators (KPI) should be defined in order to measure the benefits related to the implementation of the present project. This KPI must reflect the business vision and the objectives defined for the implementation of BPR project, but also considering the solutions defined.

Following the best practices of a BPM principles, no more than 5 Key Performance Indicators should be defined, representing a high-level vision for the project implementation.

As mentioned in the methodology developed, this KPI differ from those being developed during the implementation of this solutions. The last ones aim to analyse the operational efficiency of the processes being influenced by the present project after the implementation of the solution, with a deeper drill-down and with the goal of improving continuously the respective processes. Considering the scope of the present dissertation only the first ones are being presented in the case study.

Along with the KPI's definition, for each KPI, the predicted benefits must be measured and represented in conjunction with the data of the current state of the process. The project KPI's defined and the corresponding predicted benefits are represented in the Figure 16.

KPI	Drill-down criteria	Unit	Freq. of calculation	Type				Current State	Predicted Benefit	Target State
				Effici.	Effect.	Lead.	Lag.			
Number of invoices approved	RIAM	invoices/FTE. month	monthly	X	X	-	-	1252 invoices/month.FTE	60%	2003 invoices/month.FTE
	RT	invoices/FTE. month	monthly					457 invoices/month.FTE	60%	730 invoices/month.FTE
Approval LT	RIAM	days	monthly	X	-	X	-	8 days	63%	3 days
	RT							10 days	60%	4 days
Number of Invoices registered	AP team	invoices/FTE. month	monthly	X	X	-	-	2003 invoices/month.FTE	57%	4675 invoices/month.FTE
PO invoices	-	%	monthly	-	-	X	X	7%	86%	93%

Figure 16 - KPI defined for the project under study

Since the objectives defined for the implementation of the project are predominantly related to the improvement of the overall efficiency of the process, cost reduction and dematerialization processes, the types of KPI defined are mostly focused on efficiency measurement. On the other

hand, the measurement of the percentage of PO invoices is directly related with the solution defined for the process, and the intention is to measure not only the result produced by the solution but also anticipates the performance of the overall AP process.

As seen during the constraints analysis, the approval flow of RIAM/RT invoices was considered a bottleneck in the process, as such, and after performing an analysis regarding the productivity and LT of the approval process, the drill-down considered for this phase was only related to RIAM/RT. Also, this invoices represent nearly 72% of the total amount.

For the calculation of the current state of each one of the KPI, some data was directly extracted from the database of the *Bill flow* through an SQL query or by extracting reports from SAP. Other data was obtained through observational study and questionnaires, since BU do not have the culture of measuring their operational performance. For example, to calculate the productivity data about the approval of invoices per FTE, it was necessary to understand how much time the operational team spent approving invoices through observation and a specific questionnaire. For obtaining the data for the calculation of the Approval LT, a statistical analysis was performed to a sample of nearly 33.000 invoices.

The predicted benefits were defined during the workshops and take into account the solutions defined for the project, and making some pessimistic assumptions. However, the target percentage for the PO invoices is probably the most important KPI regarding the envisioned solution for the project, and will influence the future results of the other KPI.

The predicted benefits estimated in the present chapter will support the development of the Business Case.

6.3.2   Development of the Business Case

A business case is a well-structured written document that supports the decision for initiating a project. The primary reason for its development is whenever resources such as money or sufficient effort are consumed, requiring approval from a decision-maker. As such, the business cases being developed can differ depending on the solutions being implemented, but the intention is to follow a standard structure being presented in this chapter. However, it is important to enhance that the structure defined for this Business Case is to support the implementation of a BPR project, as so the structure is proportional to the dimension of this kind of projects.

The main goal behind the creation of a Business Case is simple: help the decision-maker ensure that the proposed solution will have value based on the objectives and expected benefits laid out in the business case, in comparison with the investment required. As such, the development of this document should be an iterative process along with definition of the solution, in order to ensure that the solution defined is the optimal one.

Considering this, a financial analysis highlighting the benefits for the implementation of the project must be included. Besides this, a good business case report, must briefly compile all the information regarding the project and solution that the Business Case addresses. Also, during this phase, the chronological plan developed in the initial stages of the BPR project is reshaped with the details regarding this sub-project, such as the tasks and duration times, as well as important event dates.

As defined in the BPR model developed, each solution defined represents a different sub-project implementation, although the solutions are closely related. Given the dimension of the BPR

project developed, the Business Case developed for the purpose of the present dissertation supports the implementation of the sub-project "Automation of the Invoice Registering Process".

Along with the creation of the Business Case a chronological implementation plan was developed, as well as the inclusion of important deadlines and deliverables.

To sum up, the Business Case was developed specifically for this project, and results from an adaptation developed to the template used by Rangel for the implementation of Business Improvement projects – *A3 Kaizen* – and originally developed by *Kaizen Institute*. Figure 17 shows the original template (before the adaptation developed for the creation of the Business Case). The adoption of this template was considered suitable, since it was already known by all stakeholders in the Corporate Center, promoting a more natural comprehension of the Business Case being developed.

Figure 17 - Template used by Kaizen Institute in process improvement projects – A3 Kaizen

The contents of the Business Case are very similar to the template *A3 Kaizen*, but with more emphasis in the Financial Analysis of the IT solutions. As such, the contents developed are the following:

1. Objectives – definition of the objectives and the scope of the project;
2. Current State of the Process – presentation of some data about the current state of the process, probably related with the KPI defined for the project implementation;
3. Definition of the Target State - presentation of some data about the target state of the process, probably related with the KPI defined for the project implementation;
4. Problems and Constraints – presentation of the problems and constraints in the process, that the solution aims to solve;
5. Solutions Proposed – presentation of the solutions proposed regarding the sub-project;

6. Solutions Testing and Comparative Analysis – presentation of the application of the solution through testing and comparative analysis of the solutions, for instance if the solution involves IT outsourcing, a presentation of the solutions for each vendor should be addressed;

7. Financial Analysis – presentation of the financial analysis for the implementation of the solutions, adapted for the type of implementation being analysed, such as costs of investment, operative costs, accumulated investment/benefits in certain period of time, breakeven analysis for each of the solutions and the assumptions considered;

8. Chronological Plan – presentation of the chronological plan for the sub-project;

9. Lessons Learned – presentation of the lessons learned with the sub-project.

The solution proposed for the Business Case is not only thought to be able to be presented to the decision-makers of the project, but also to be a deliverable document to all stakeholders. As such, the template offered by *Kaizen Institute* was also found suitable to fulfil these requirements. A more detail analysis of this Business Case can be found in the Appendix D.

6.3.2.1 Business Case - Automation of the Invoice Registering Process

Regarding the Business Case for the implementation of the sub-project "Automation of the Invoice Registering Process", the Business Case developed was obviously constructed upon the IT solutions provided by the suppliers considered for the implementation. Although, the solutions proposed are slightly different, the objectives, the problems and constraints as well as the chronological plan are addressed to the overall subproject and do not depend on the solution.

As seen, the main requirement for the solution was to comprise along with the OCR technology, a system to manage the workflow of invoices for approval, offering an integrated solution to automate the Invoice Registering Process, and replacing the various channels used, for a robust single solution. Thus, the basis for choosing the vendor for requesting a proposal was defined. Also, some other requirements, such as a machine learning-based OCR, cost, level of integration with SAP, were considered to support the choice for the optimal solution.

Regarding the financial analysis performed, and since we are analysing proposals for outsourcing IT systems, the following topics were considered:

- CAPital EXPenditure (CAPEX) and Operational Expenditure (OPEX) analysis for each one of the proposals;
- Accumulated Cost/Benefits analysis in the year n+5 (n=year of implementation) for each one of the proposals;
- Breakeven analysis for each one of the proposals.

The benefits considered for each one of the solutions were based on the productivity improvements studied in the previous chapter, by analysing the predicted reduction of FTEs in the invoice registering and approval processes for each one of the vendors' solutions. For an optimal solution that fulfils all the criteria defined for the solution, the annual benefit estimated was 80.938,00 €. However, this analysis did not consider other indirect benefits provided and already analysed, such as the time wasted for providing support to the suppliers or the LT reduction in the invoice approval, since this data was not simple to quantify.

Also, the benefits considered for each one of the proposals were different depending on the solution offered by the supplier. The estimation of these benefits depended on a multi-criteria analysis to each one of the proposals, based on the requirements defined for the solution, as represented in the Table 1. The result of this multi-criteria analysis was a weighting factor

between 0 and 1, that is multiplied to the annual base benefit for each one of the solutions. As can be stated in the same table, one of the solutions include the licensing and integration of RPA in the proposal, and for that reason, this solution represent an additional 10% of benefits being added to the solution, since RPA has the potential to add other benefits than those already studied.

Table 1 - Multi-criteria analysis to the requirements defined

	OCR Technology	System for Documental Workflow	Supplier know-how and credibility	Include RPA licensing and integration
Weighting Factor	40%	40%	20%	+ 10 %
Score	1 to 5	1 to 5	1 to 5	Yes or No

For determining the accumulated profit with the solution along the years, the total annual benefit was considered according to the scale represented in the Table 2. As can be stated, only in the third year of implementation, the solution is fully operational to provide the total amount of benefits predicted.

Table 2 - Scale of benefits considered

Scale of Benefits n= Year of the solution implementation			
n	n+1	n+2	n+3
30%	60%	70%	100%

Considering the requirements defined above, proposals from four different suppliers were analysed. Then, the financial analysis to support the decision making was developed, considering the ground rules defined above. The graphic of the Figure 18 shows an example of the cost/benefit analysis performed in the year n+5 for each of the suppliers' proposals. The net profit of the solutions is the difference between the accumulated costs and the benefits as highlighted in the graphic of the figure below. For a detail analysis of the Business Case developed, applied to this solution, the Appendix D shall be consulted.
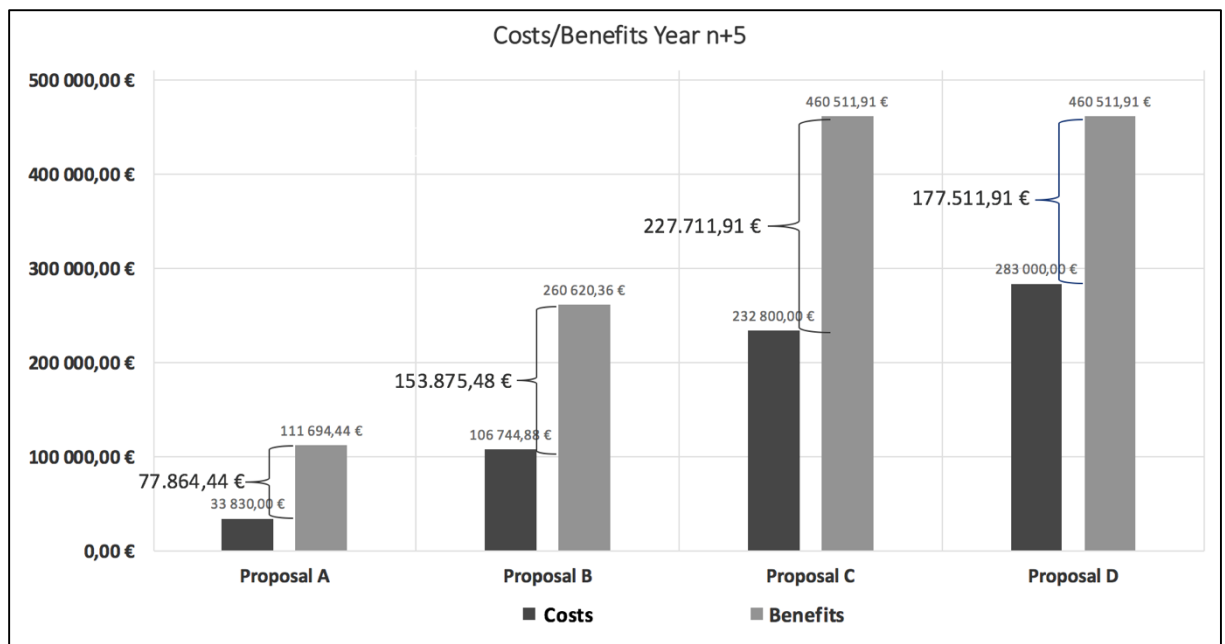
Figure 18 - Costs/Benefits analysis performed to the proposals in the year n+5

7 Conclusion and future research

The present project aimed to develop a model designed to reengineer processes and apply it to a process in the Corporate Center of a Logistics Company with an end-to-end focus, bearing in mind the main intention held by the company, i.e. the digitalization of the Corporate Center. The importance of this project within the company increased not only with the external/internal pressures to increase the actual inefficiencies but with the shift in the mindset to a continuous improvement culture.

Regarding the multi-portfolio of businesses that supports the company's business model, the need to change the actual vision of the company to a "Global Corporate Vision", taking advantage of the synergies between the BU by streamlining the processes as much as possible, can be considered the starting point for the BPR project. With this in mind, the project presented in this dissertation and all the developments undertaken contributed to this goal.

7.1 Main results

The model developed in the present dissertation revealed great acceptancy levels, since it is currently being applied in Rangel's Corporate Center.

It is important to highlight that the model was supported in all phases by a Power Point presentation, given the flexibility to not only use it as process modelling tool but also to establish a constant communication with the project stakeholders. The multi-level modelling technique used for process modelling was found highly suitable to communicate with stakeholders that were not used to work with process models, revealing high levels of comprehension of the process in each phase. Also, the same presentation was found appropriate to be delivered to IT suppliers, serving, along with some complementary information, as a Request for Proposal, especially in the case of including Use Case models.

The development of Use Case models along with mock-ups had also a positive feedback from the internal Information Systems department of Rangel, being considered highly appropriate for IT development.

Regarding the workshops developed, not only allowed all stakeholders to describe all the problems felt with the actual procedures but also to create a mindset for problem solving and continuous improvement, promoting an environment that supported the development of a complete and creative new solution for the process. Hence, the model developed has proved to be suitable for Business Process Reengineering projects, but with a dimension much greater than a Business Process Improvement project requires. In contrast to BPR, the improvement of business processes is more about getting quick results rather than radical changes, with lower risk but also with much lower rewards.

The analysis performed to the predicted benefits for the implementation of this project, although it considered a conservative perspective, showed high level rewards after the third year of implementation, as well as an adequate payback time taking into account the dimension of the investment. This statement proves well the difference between a BPR project and a simple improvement of business processes. While the first builds a new way of doing things, the second just tries to do things the way they are but with more efficiency.

Considering the company vision of creating a closer connection between the Business Units and the Corporate Center, the identification of the right project stakeholders has revealed to be an essential first step to start building a new procedure. As such, and although the project was

developed in the Corporate Center of the company, the inclusion of important BU stakeholders was mandatory to achieve the intended vision.

The benchmarking of the process in other companies as well as visiting Business Process Outsourcers and attend to suppliers' demonstrations was crucial to the definition of the solutions for the new process, as well as to generate new ideas. For instance, the visit to *Accenture Operations* in Lisbon was very useful to provide a mental vision of the process happening onsite and revealed the importance of redesigning the current operational procedure of registering invoices. Also, the visit to *Caetano Auto*, showed the importance of having an efficient system to manage the approval of invoices as well as the importance of an effective change management approach during a process of radical change. In addiction, the state of the art research has revealed itself to be very beneficial too.

The implementation of this project aroused the importance of measuring the operational performance of the processes as well as displaying the respective indicators visually available to all process owners on real time, contributing to the culture of continuous improvement of business processes. As a result, the company has created more awareness for subjects such as Data Analytics and Business Intelligence, and started to create internship challenges regarding these areas.

The development of the Business Case has proved to be an important tool for decision making. During the presentation of the developed Business Case, the decision makers demonstrated real concern for the validation of data behind the financial analysis, i.e. the costs and the predicted benefits as well as its influence on the decision. As such, after some iterations the final result, as shown in the Appendix D, resulted in a positive feedback during the solution presentation, being considered highly suitable to be used in future projects. This has also shown the importance of two things: (1) estimate precisely the predicted benefits based on facts rather than assumptions; and (2) the validation of the specifications of the suppliers' proposals, in order to make an effective comparative analysis between the proposals.

In a nutshell, a BPR project is more than improving an existing process through automation, since it requires not only a complete redesign of the actual procedures but also a holistic organizational change that is bound to be disruptive, starting on the current people's roles. Hence, a robust model that relies on constant communication and transparency among all stakeholders may be the starting point to a successful result. Because BPR is more than technology, it people's reengineering.

7.2 Future work

At the end of this dissertation, one of the future works regarding this project is almost obvious: the phase of implementing the solutions and the corresponding measurement of the process post-implementation. Due to time constrains, and although the final solutions were already pre-approved for execution, this phase was out of range of the present dissertation. Thus, studying the specific details of the implementation of each one of the solutions is a mandatory step of the model, including the organizational change and the definition of the corresponding details for performance management.

Also, as already been mentioned, other opportunity raised during this phase. The opportunity to start a Business Intelligence/Data Analytics project regarding the measurement of operational performance. As a result, the company has already launched a challenge regarding this subject.

As a consequence of the significantly positive results of this project, there are several projects suitable for the application of this model. Processes such as the management of operational expenditures or the procurement management have already been marked as inefficient by the company senior management. As such, there is an assumed desire to change and to apply this BPR model to those processes.

One major opportunity identified for future work was to develop a study for the application of Robotic Process Automation to low-value-added tasks, mainly in the Financial Department. Today, this department relies in many manual-based, routine and transactional tasks that do not add any value to the company. As such, RPA has the ability, at a relative low cost, to automatize these kind of tasks, thus eliminating any human intervention.

References

Davenport, TH & Short, JE 1990, 'The new industrial engineering: information technology and business process redesign'.

Davenport, TH 1993, Process Innovation: Reengineering Work Through Information Technology, Harvard Business School Press.

Eikvil, L 1993, 'Optical character recognition', citeseer. ist. psu. edu/142042

'IEEE Recommended Practice for Software Requirements Specifications' 1998, IEEE Std 830-1998, pp. 1-40.

BarNir, A, Gallaugher, JM & Auger, P 2003, 'Business process digitization, strategy, and the impact of firm age and size: the case of the magazine publishing industry', Journal of Business Venturing, vol. 18, no. 6, pp. 789-814.

Melchert, F, Winter, R & Klesse, M 2004, 'Aligning process automation and business intelligence to support corporate performance management', in, Association for Information Systems.

Pinheiro, AJF 2004, 'BP2IT: dos processos de negócio às tecnologias de informação'.

Scheer, A-W, Abolhassan, F, Jost, W & Kirchmer, M 2004, Business process automation, Springer.

Pal, N & Pantaleo, D 2005, The agile enterprise: Reinventing your organization for success in an on-demand world, Springer Science & Business Media.

Weber, A & Thomas, R 2005, 'Key performance indicators', Measuring and Managing the Maintenance Function, Ivara Corporation, Burlington.

Baglieri, E & Secchi, R 2007, 'Strategic goals and design drivers of the supplier portal: lessons from the Ferrari case', Production Planning and Control, vol. 18, no. 7, pp. 538-547.

Wendy, vdV & Frank, R 2009, 'Buying business services: towards a structured service purchasing process', Journal of Services Marketing, vol. 23, no. 1, pp. 3-10.

Dekier, Ł 2012, 'The origins and evolution of Lean Management system', Journal of International Studies, vol. 5, no. 1, pp. 46-51.

Mithe, R, Indalkar, S & Divekar, N 2013, 'Optical character recognition', International journal of recent technology and engineering (IJRTE), vol. 2, no. 1, pp. 72-75.

Todorović, M, Mitrović, Z & Bjelica, D 2013, 'Measuring project success in project-oriented organizations', Management, vol. 68, no. 2013, pp. 41-48.

Fung, HP 2014, 'Criteria, use cases and effects of information technology process automation (ITPA).

Andrés-López, E, González-Requena, I & Sanz-Lobera, A 2015, 'Lean Service: Reassessment of Lean Manufacturing for Service Activities', Procedia Engineering, vol. 132, pp. 23-30.

Lacity, M, Willcocks, LP & Craig, A 2015, 'Robotic process automation at Telefonica O2'.

Leite, HdR & Vieira, GE 2015, 'Lean philosophy and its applications in the service industry: a review of the current knowledge', Production, vol. 25, no. 3, pp. 529-541.

Martinho, R, Rijo, R & Nunes, A 2015, 'Complexity Analysis of a Business Process Automation: Case Study on a Healthcare Organization', Procedia Computer Science, vol. 64, pp. 1226-1231.

Parmenter, D 2015, Key performance indicators: developing, implementing, and using winning KPI, John Wiley & Sons.

Coimbra, EA 2016, Kaizen: uma estratégia de melhoria, crescimento e rentabilidade, McGraw-Hill/Interamericana de España.

Rahimi, F, Møller, C & Hvam, L 2016, 'Business process management and IT management: The missing integration', International Journal of Information Management, vol. 36, no. 1, pp. 142-154.

Van Der Aalst, WM, La Rosa, M & Santoro, FM 2016, Business process management, Springer.

Aguirre, S & Rodriguez, A 2017, 'Automation of a Business Process Using Robotic Process Automation (RPA): A Case Study', in Workshop on Engineering Applications, Springer, pp. 65-71.

Caitlin, T, Lorenz, J-T, Sternfels, B & Willmott, P 2017, 'A roadmap for a digital transformation', McKinsey on Finance.

Kiran, DR 2017, 'Chapter 28 - Business Process Reengineering', Total Quality Management, pp. 405-414. Butterworth-Heinemann.

Messenböck, R, Hilberath, C & Kopinitsch, B 2018, 'The Coporate Center of the Future'.

Plaschke, F, Seth, I & Whiteman, R 2018, 'Bots, algorithms, and the future of the finance function', McKinsey on Finance, vol. Numb. 65, pp. 19-23.

van der Aalst, WMP, Bichler, M & Heinzl, A 2018, 'Robotic Process Automation', Business & Information Systems Engineering.

APPENDIX A: AS-IS Process Modelling

The present appendix presents the modelling of the AP process AS-IS. As already mentioned in the present dissertation, the approach used for the purpose was the multi-level process modelling technique:

- 1ˢᵗ level – macro-view of the process describing the main phases of the process in a responsibility matrix, highlighting also the main actors of each phase;
- 2ⁿᵈ level – process modelling of each one of the main phases represented in the 1ˢᵗ level, either using a swimlane notation or a flow-chart notation;
- 3ʳᵈ level – representing an activity of the 2ⁿᵈ level with more detail, either using a swimlane notation or a flow-chart notation;

It is also important to highlight that this images are part of Power Point developed and presented during the workshop sessions of the project.
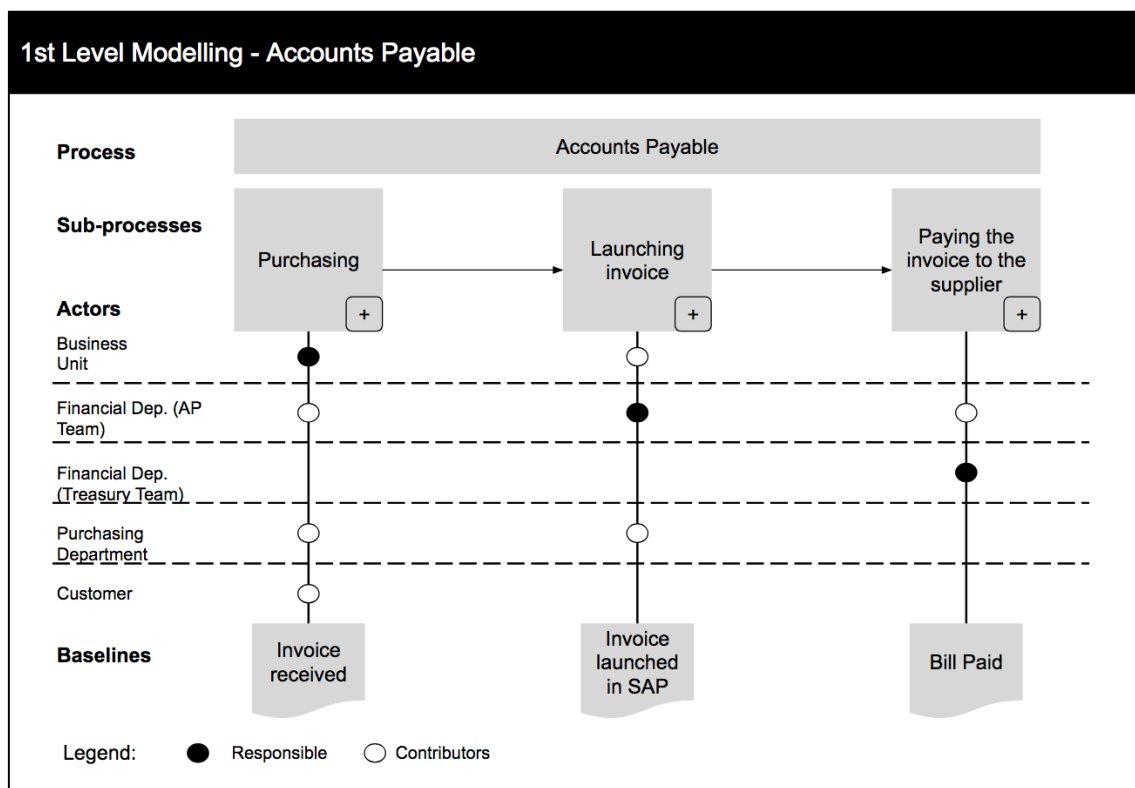
Figure 19 - Process Model AS-IS (1st level modelling) – AP process
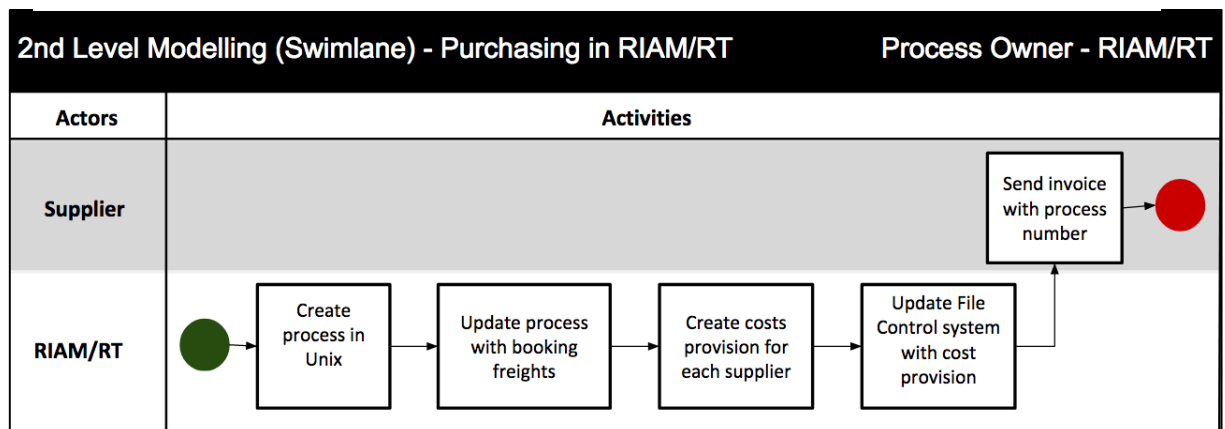
Figure 20 - Process Model AS-IS (2nd level modelling) – Purchasing process in RIAM/RT
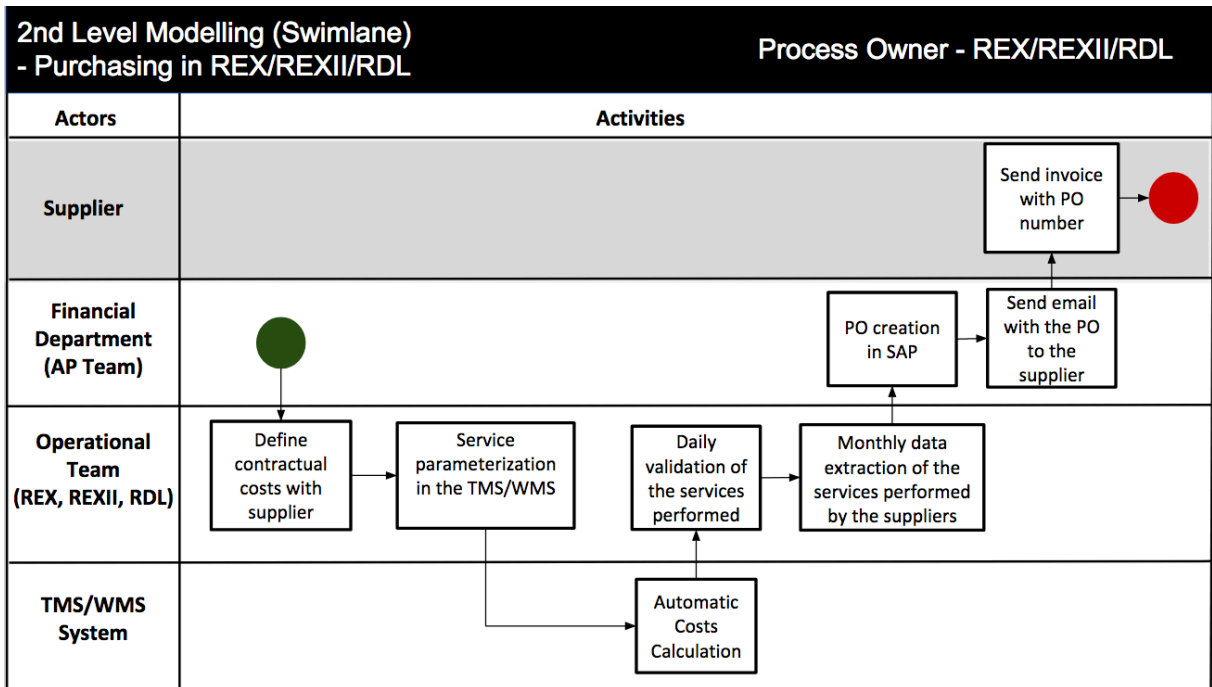
Figure 22 - Process Model AS-IS (2nd level modelling) – Purchasing process in REX/REXII/RDL
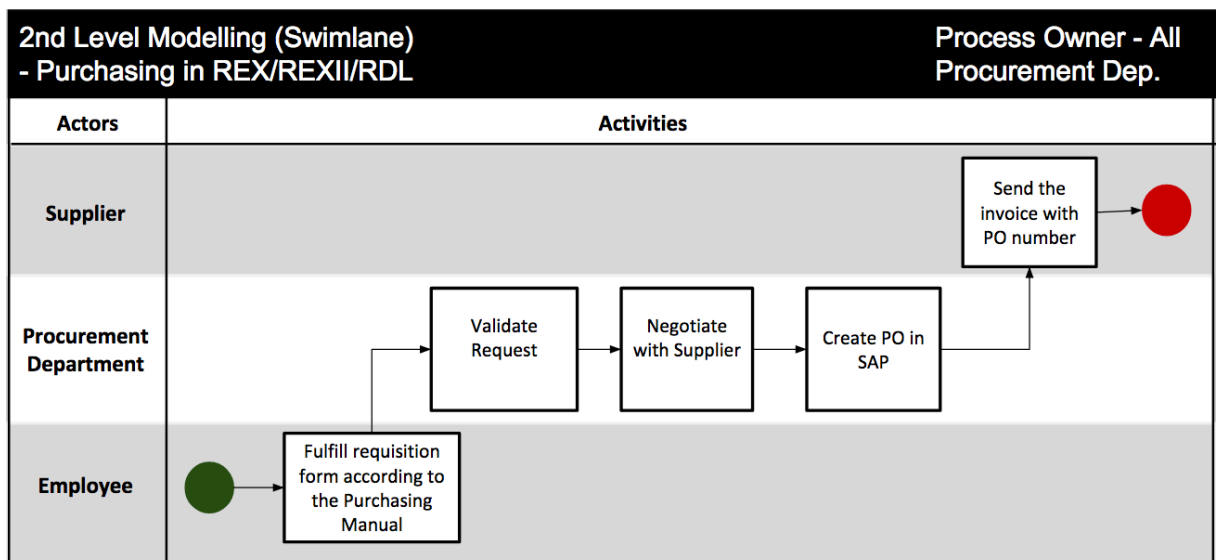
Figure 21 - Process Model AS-IS (2nd level modelling) – Purchasing of consumables and supplies (Procurement Department)
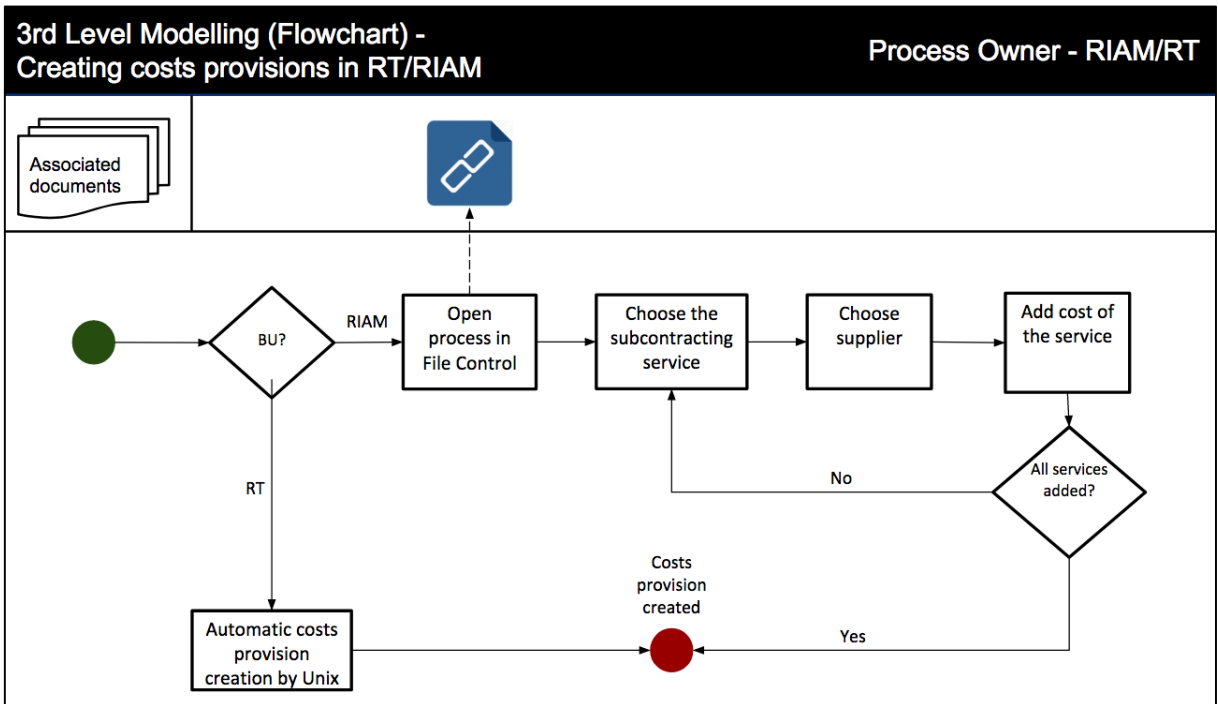
Figure 24 - Process Model AS-IS (3rd level modelling) – Creating costs provisions in RT/RIAM
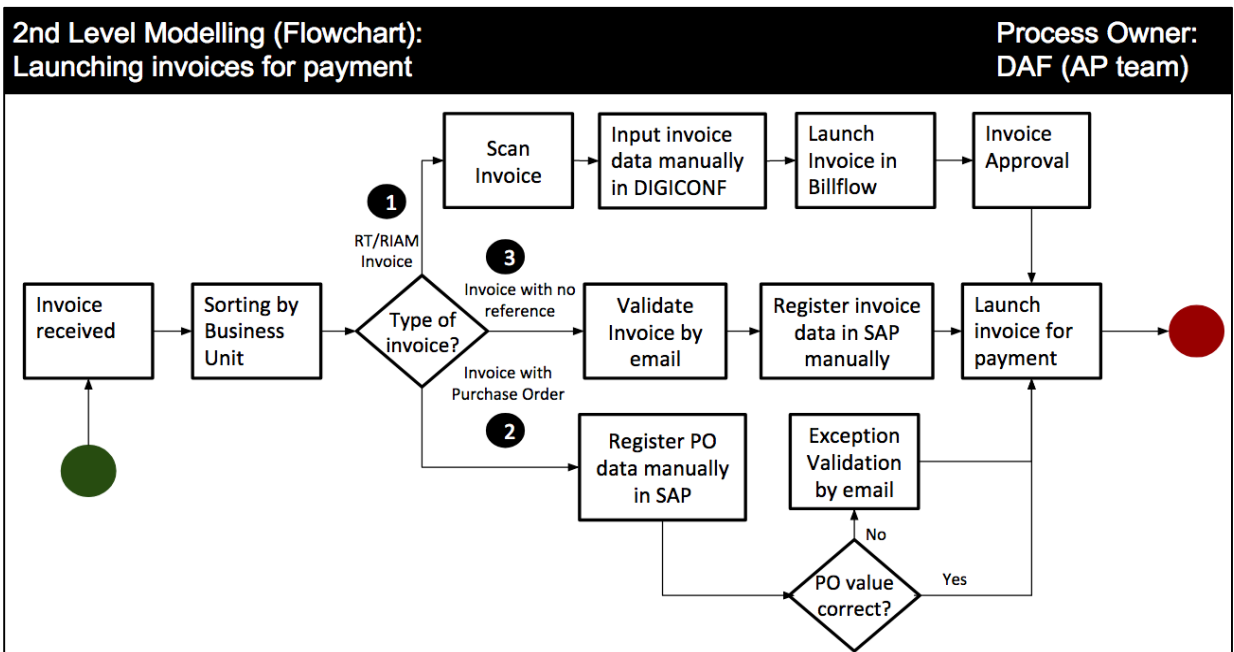
Figure 23 - Process Model AS-IS (2nd level modelling) – Launching invoices for payment
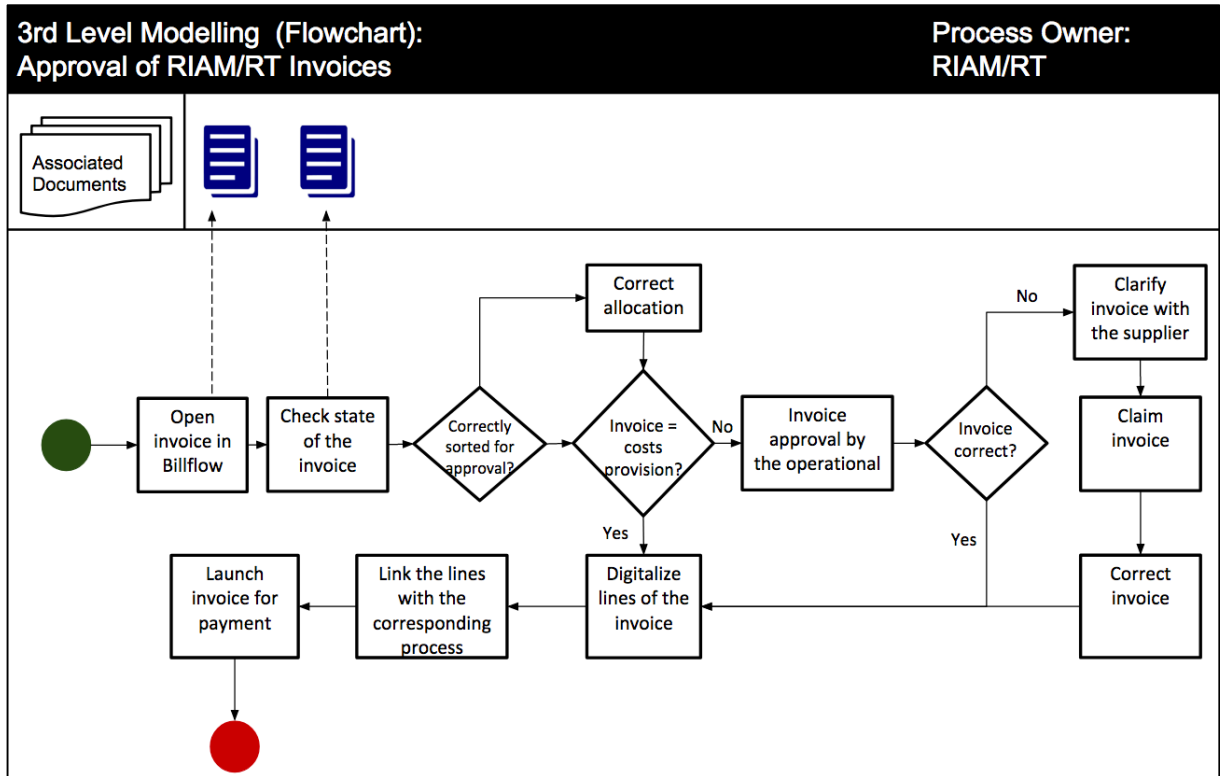
Figure 26 - Process Model AS-IS (3rd level modelling) – Approval of RIAM/RT Invoices

Figure 25 - List of invoices for approval in Billflow

2nd Level Modelling (Flowchart):
Paying invoice to the supplier

Process Owner:
DAF (Treasury team)

Associated Documents

Update of the payments cycle file (.xls) with the invoices launched for payment

(1x per month)

Sort of the payments due dates according to the agreements with the supplier (30, 60, 90 dias)

Payment of the invoices

(2x per month)
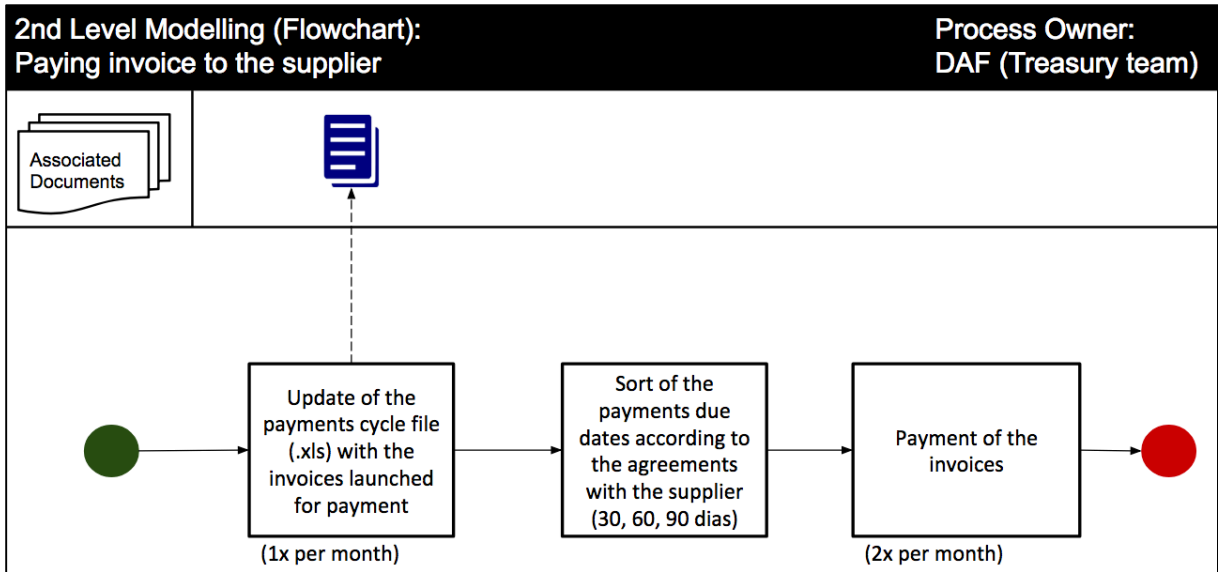
Figure 28 - Process Model AS-IS (2nd level modelling) – Paying invoice to the supplier

3rd Level Modelling (Flowchart):
Payment of the invoices

Process Owner:
DAF (Treasury Team)

Associated Documents

Open payment cycles file (.xls)

Import data of the payment cycles file to SAP

Amount to pay correct?

No

Find payments already performed

Yes

Type of payment ?

Bank transfers

Eliminate from the payments cycle

Find supplier NIB/IBAN in SAP

Access e-banking portal

Check

Perform transfers manually to each supplier

Payment done

Send letter with check

Print and sign checks

Define checks details in SAP

Figure 27 - Process Model AS-IS (3rd level modelling) – Payment of the invoices

59

APPENDIX B: Constraints and Opportunities

As mentioned, the roots associated to the problems identified became natural during the phase of analyzing the process AS-IS. As such, during that phase, it was possible to state a set of constraints in each phase of the process. Those constraints were visual assigned with an arrow, not only to provide a visual impact but also to root it to the respective part of the process.
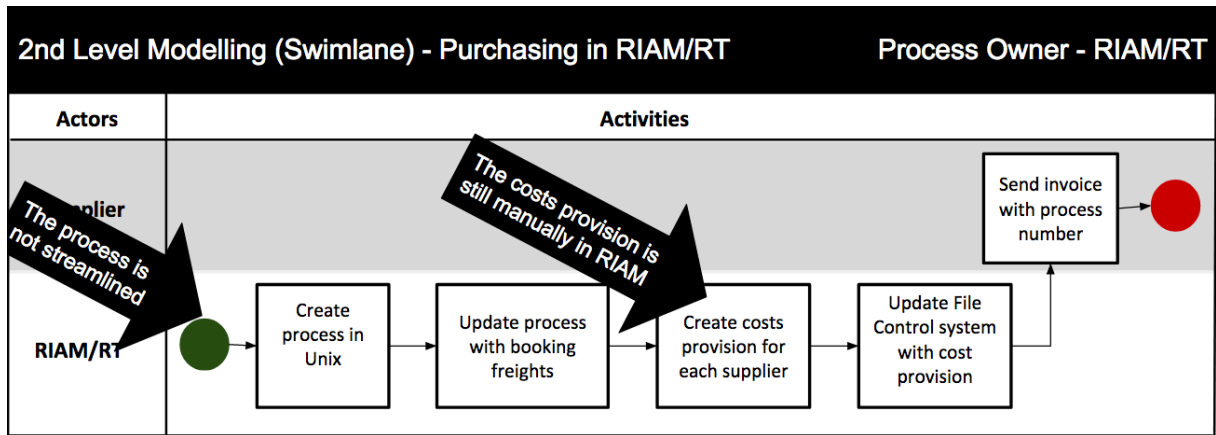
Figure 29 - Example of constraints assigned to the Purchasing phase in RT/RIAM
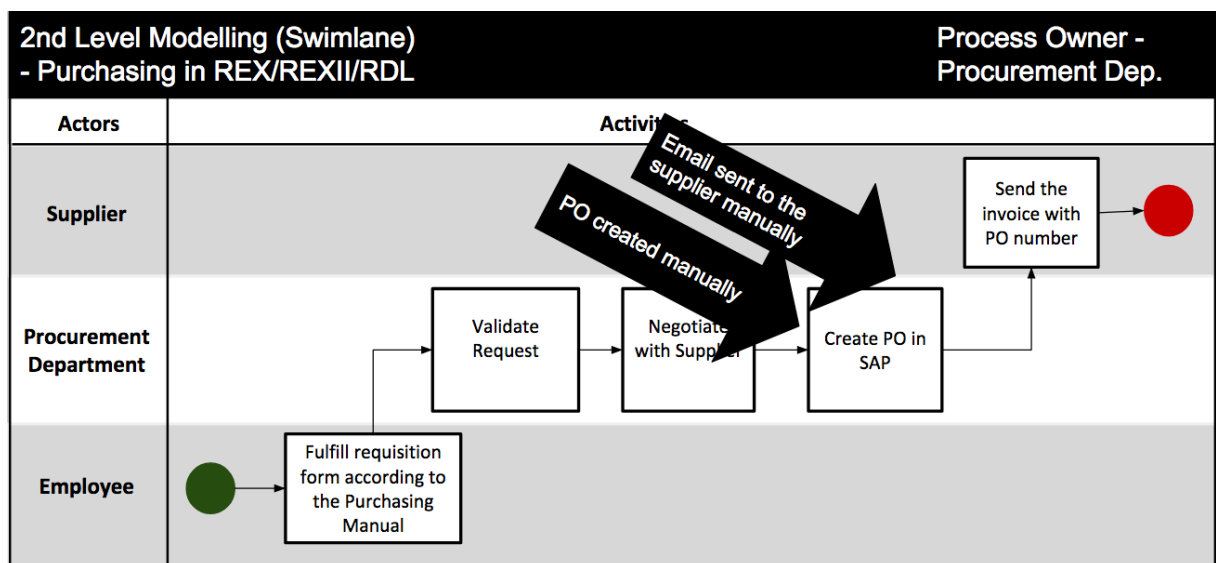
Figure 30 - Example of constraints assigned to the Purchasing phase in REX/REXII/RDL
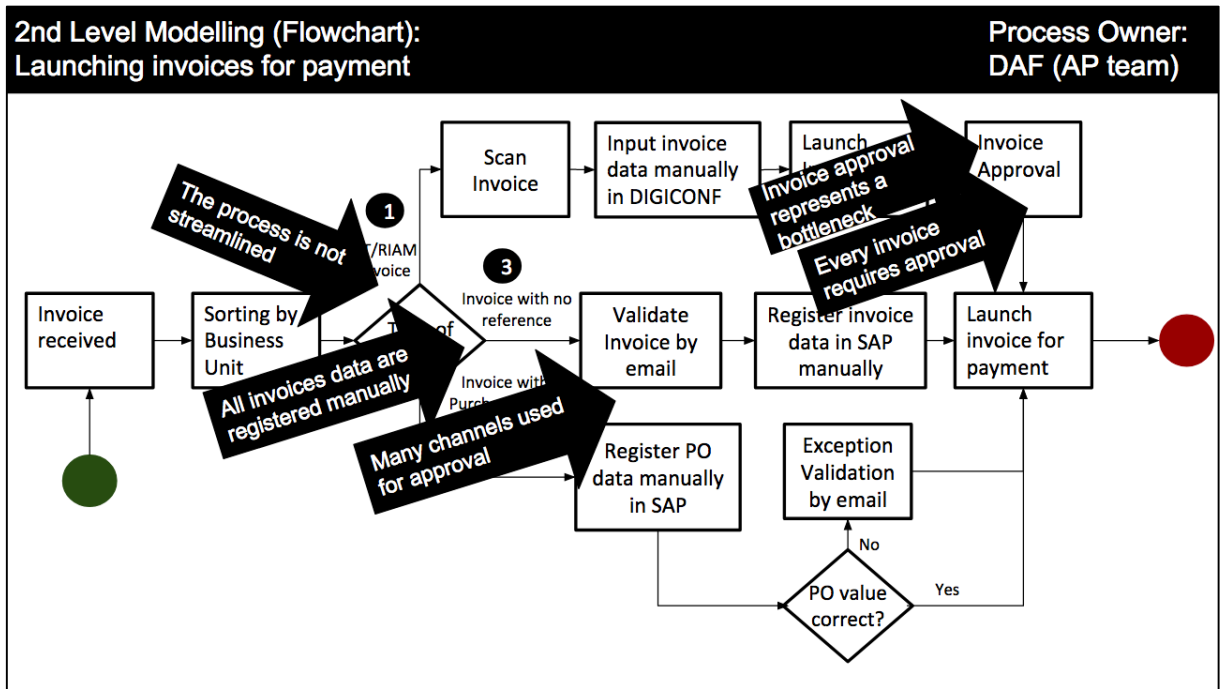
Figure 31 - Example of constraints assigned to the phase of Launching invoices for payment by the AP team
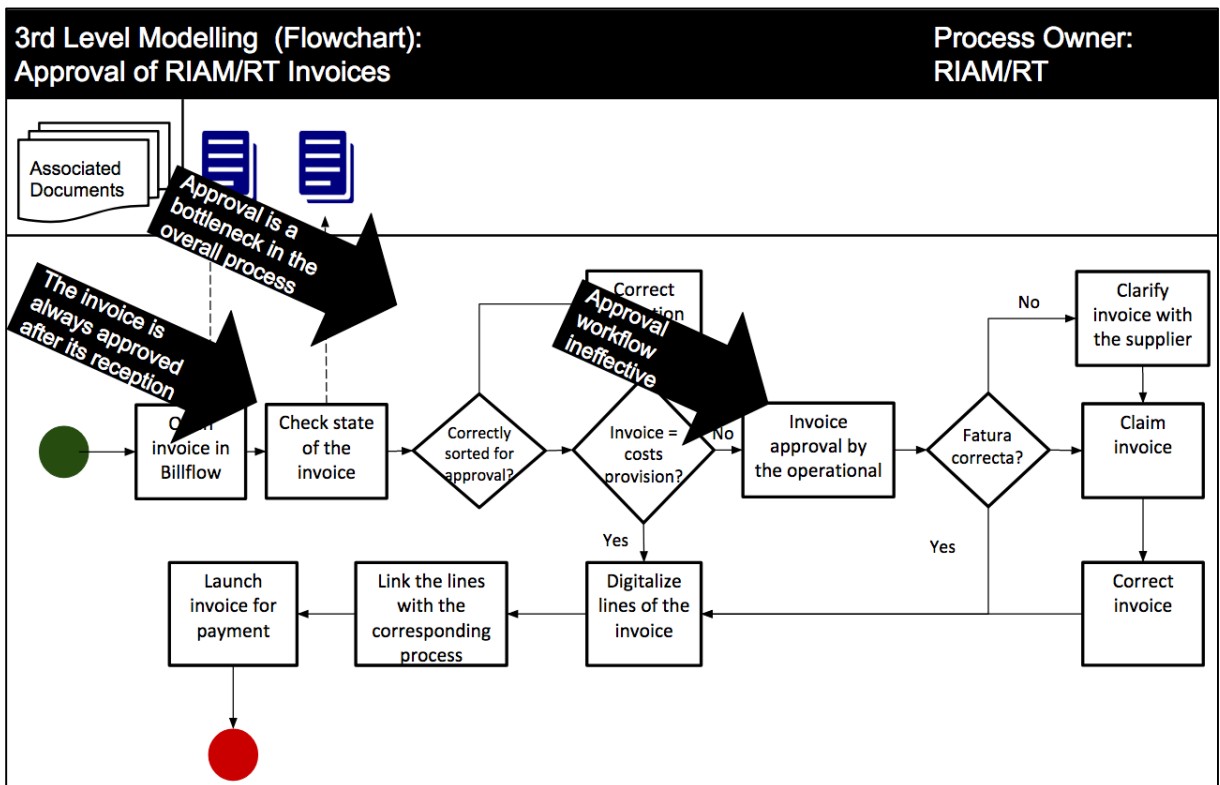
Figure 32 - Example of constraints assigned to the Approval of RT/RIAM invoices

3rd Level Modelling (Flowchart):
Payment of the invoices

Process Owner:
DAF (Treasury Team)

Ad-hoc payments are not updated in the payments cycle file

There are still suppliers without NIB/IBAN in the system

Bank transfers are still performed manually for each supplier instead using SEPA files

Payments by check do not add value and are marked as costly

Open payment cycles file (.xls)

Import data of the payment cycles file to SAP

Amount to pay correct?

Find payments already performed

Yes

Eliminate from the payments cycle

Find supplier NIB/IBAN in SAP

Access e-banking portal

Bank transfers

Type of payment?

Check

transfer manually to each supplier

Send letter with check

Print and sign checks

Define checks details in SAP

Figure 31 - Example of constraints assigned to the Payment of the invoices

APPENDIX C: TO-BE Process Modelling

The present appendix presents the modelling of the AP process TO-BE. As already mentioned in the present dissertation, the approach used for the purpose was the multi-level process modelling technique, the same used in the AS-IS process modelling.
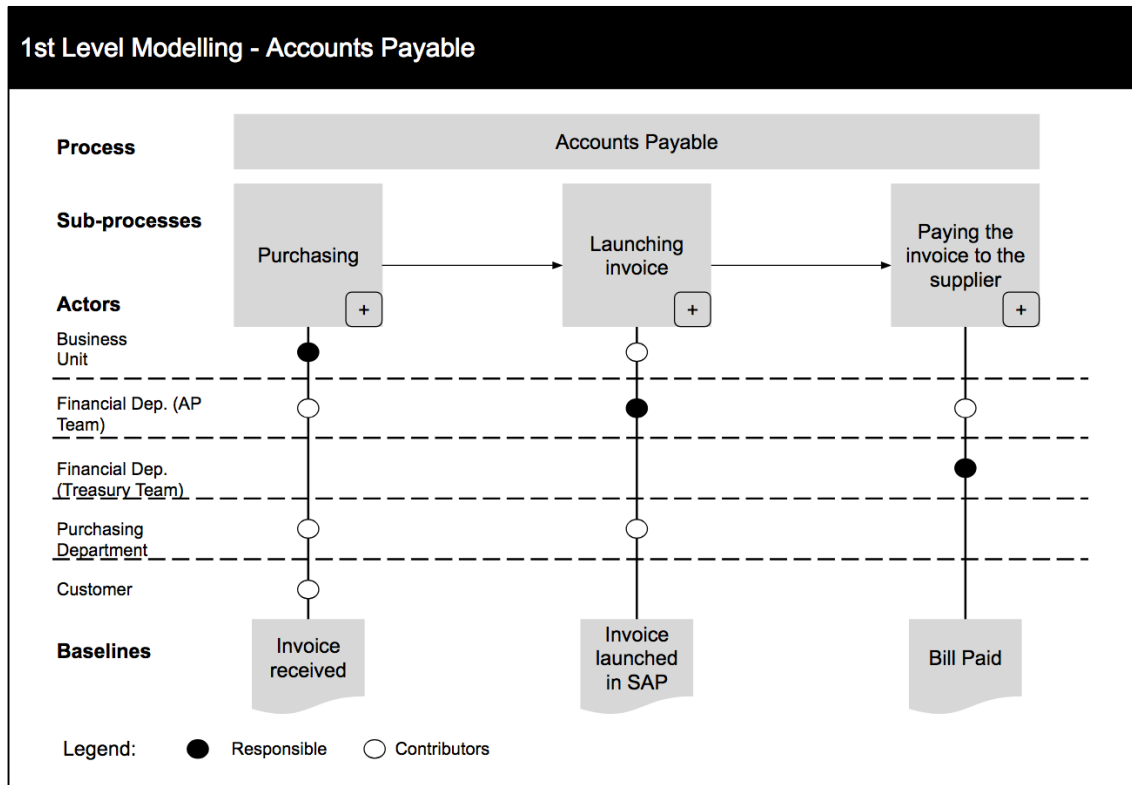
Figure 34 - Process Model TO-BE (1st level modelling) – AP process
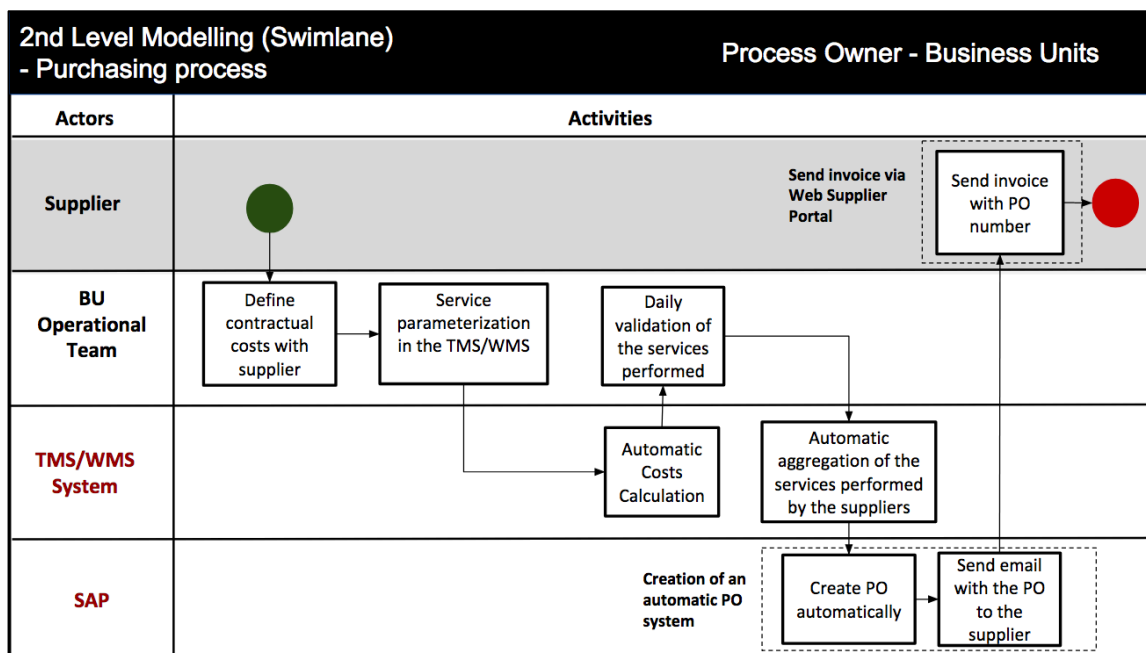
Figure 35 - Process Model TO-BE (2nd level modelling) – Purchasing phase
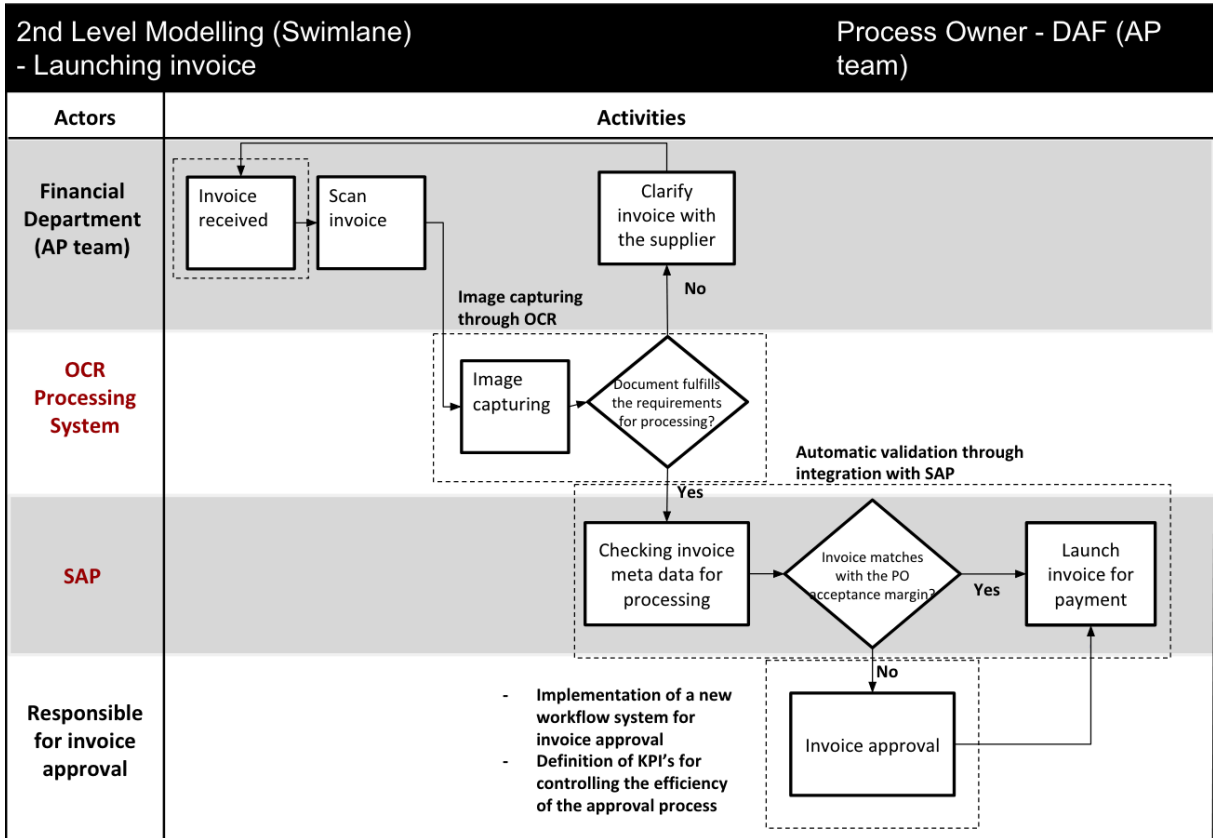
Figure 36 - Process Model TO-BE (2nd level modelling) – Launching invoice phase
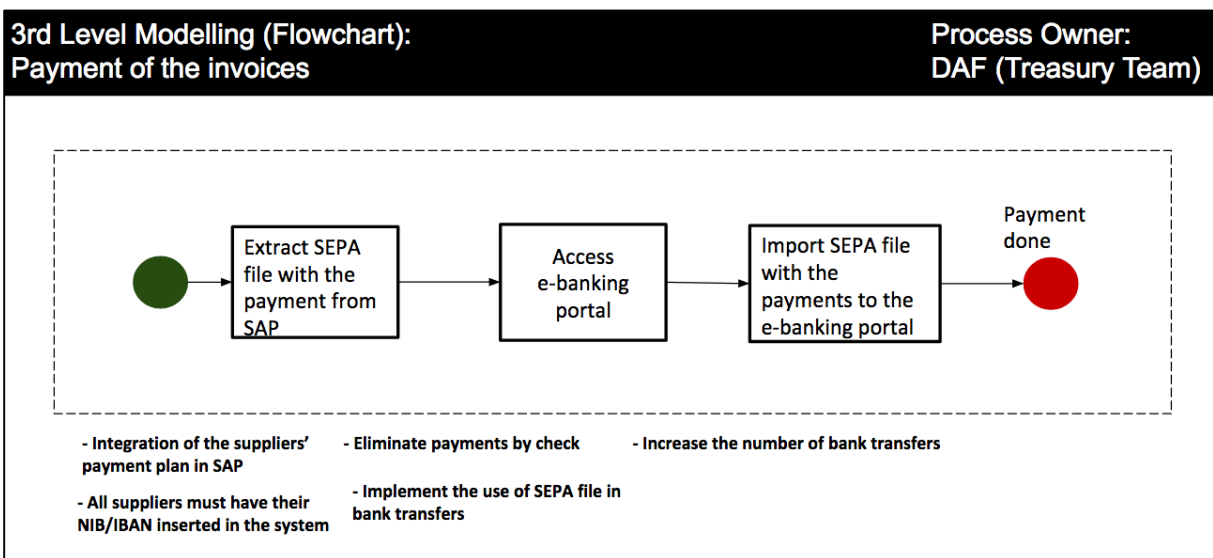
Figure 37 - Process Model TO-BE (2nd level modelling) – Payment of the invoices
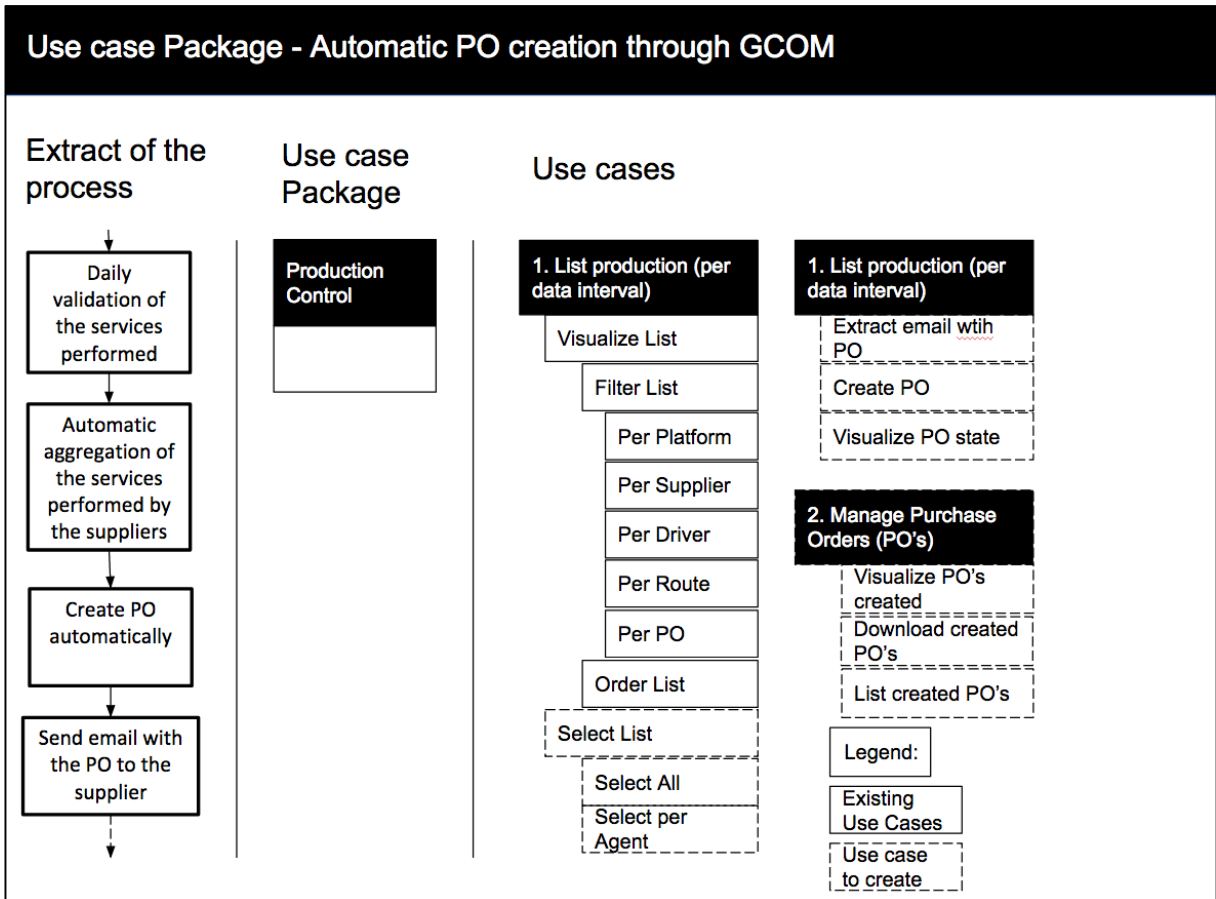
Figure 38 - Use Case Package developed for automatic creation of PO through GCOM
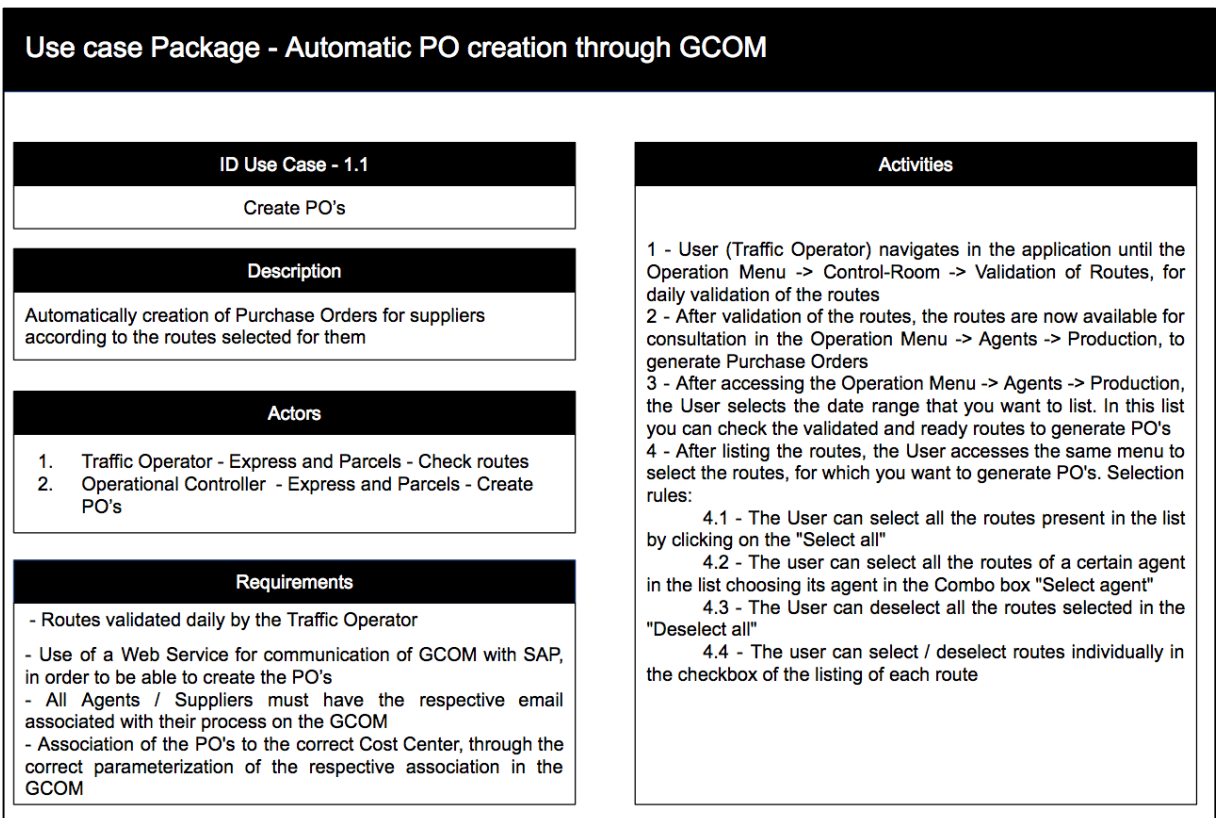
Figure 39 – Use case 1.1 - Automatic PO creation through GCOM 1/2

Use case Package - Automatic PO creation through GCOM

Activities

5 - After selecting the desired routes, the User can generate PO's for the routes by clicking the "Generate PO" button. After clicking this button, the system should display a confirmation message to the User, such as "Are you sure you want to generate PO's for the defined routes?".
Rules for generating POs:
    5.1 - The system can not be allowed to generate the same PO for different suppliers
    5.2 - If the user selects several routes for the same supplier / agent, they should be aggregated in the same PO
    5.3 - The PO should be associated to the cost center to which it refers, by parameterizing the information of the respective association in the GCOM
6 - When generating the PO, the GCOM should send an automatic email to the respective agent / supplier according to the following template

Activities
- Generation and sending an automatic email with an PO to the Agent / Supplier - Weekly / monthly activity to issue invoices by suppliers

Figure 40 - Use case 1.1 - Automatic PO creation through GCOM 2/2

Email template with the PO - Automatic PO creation through GCOM

Pedido de Compra Nº 4800014369

Mensagem   Opções

Para:
Cc:
Assunto: Pedido de Compra Nº 4800014369
📎 : 4800014369.pdf (289,3 KB)

Caros Senhores,

Segue em anexo Pedido de Compra relativo aos serviços do mês de Fevereiro de 2018.

Qualquer dúvida deverá ser exposta à plataforma a que reportam. As faturas deverão ser enviadas para o endereço contasapagar@rangel.com.

Rangel innovating EXPRESS & LOGISTICS   35 1980-2015

Ricardo Moço

Rangel Logistics Solutions
Rua da Serra, 654 - Folgosa (Maia)
Apartado 1193 - 4446-909 Ermesinde - Portugal
T: (+351) 229 699 200

808 300 500 | www.rangel.com

Figure 41 – Email template with the PO - Automatic PO creation through GCOM

Figure 42 – PO template to be generated - Automatic PO creation through GCOM

Figure 43 - Mockup for PO creation - Automatic PO creation through GCOM

Parameterizing SAP cost centers for each platform - Automatic PO creation through GCOM

Platform	Type of Route	SAP Cost Center
Alentejo	Frota	17018
Algarve	Frota	17019
Aveiro	Frota	17020
Covilhã	Frota	17021
Leiria	Frota	17022
Maia	Frota	17023

Platform	Type of Route	SAP Cost Center
Montijo	Frota	17024
Vila Real	Frota	17025
Espanha	Frota	17165
Maia	Linehaul	17014
Montijo	Linehaul	17015
Internacional	Linehaul	17017

Figure 44 – Parameterizing SAP Cost Centers - Automatic PO creation through GCOM

Use case 1.2 - Management of PO's in GCOM

ID Use Case - 1.2

Management of PO's in GCOM

Description

Management of the PO created

Actors

1. Traffic Operator - Express and Parcels - Manage created PO's
2. Operational Controller - Express and Parcels - Manage created POs
3. Accounting Assistant - Corporate Center - View PO's Created

Requirements

- Use of a Web Service for GCOM communication with SAP
- PO's created in GCOM according to Use Case 1.1

Activities

1 - After generating their POs, they will be available to be visualized in a new Menu to create (Agents -> Manage PO's).
2 - To visualize the PO's, the user chooses the desired date range, being able to filter the platforms according to:
    2.1 - Platform
    2.2 - Agent
    2.3 - Type (Linehaul or Route)
3 - In this menu the User can view and download the PO file created for the respective platforms. In this menu the user can list the generated PO's for a defined date range

Results

- Visualization of PO's already generated
- Possibility of downloading the PO's generated (pdf file) or the message sent to the supplier

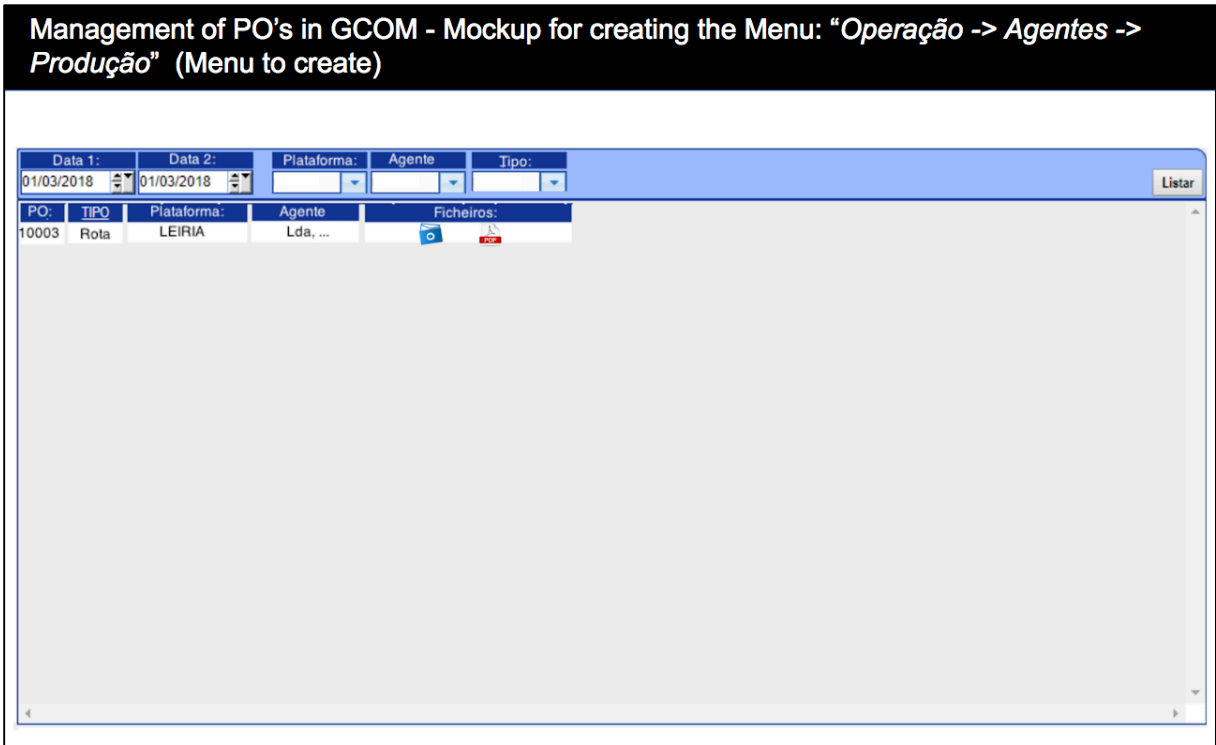Figure 45 – Use Case 1.2 – Management of PO's in GCOM

Figure 46 - Mockup for managing the PO created in GCOM – Management of PO in GCOM
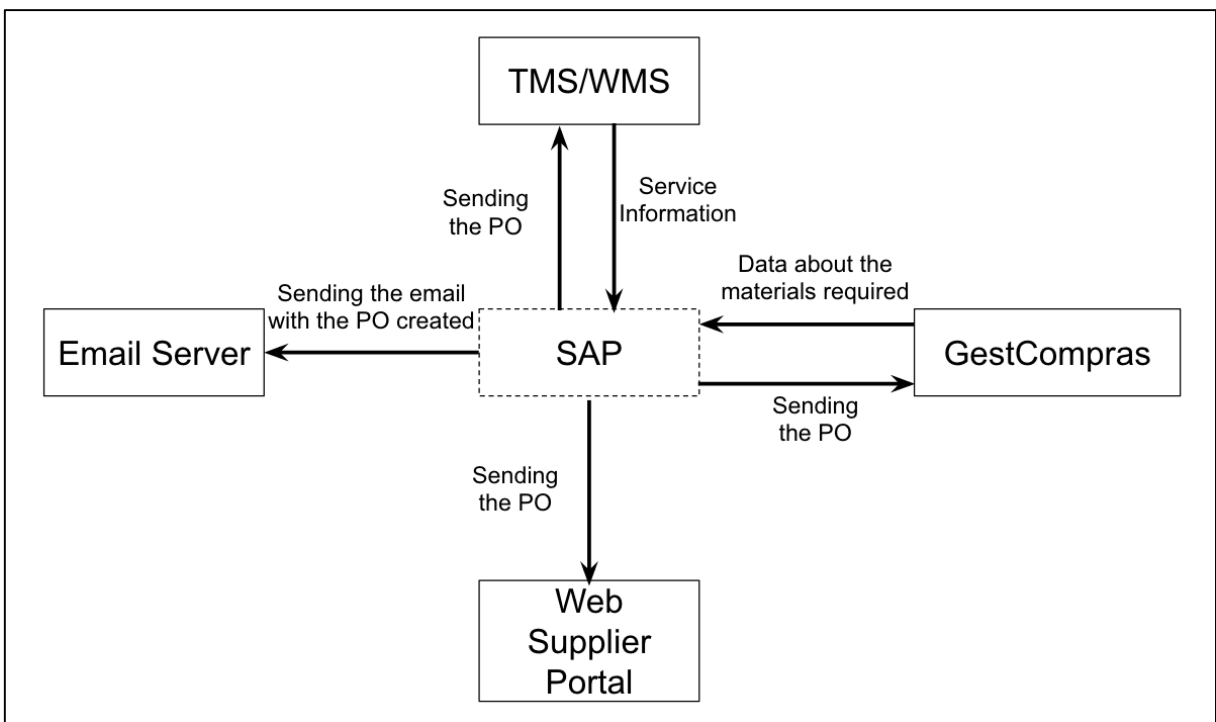

Figure 47 - Information flows between Enterprise Applications - AP process - Purchasing Phase
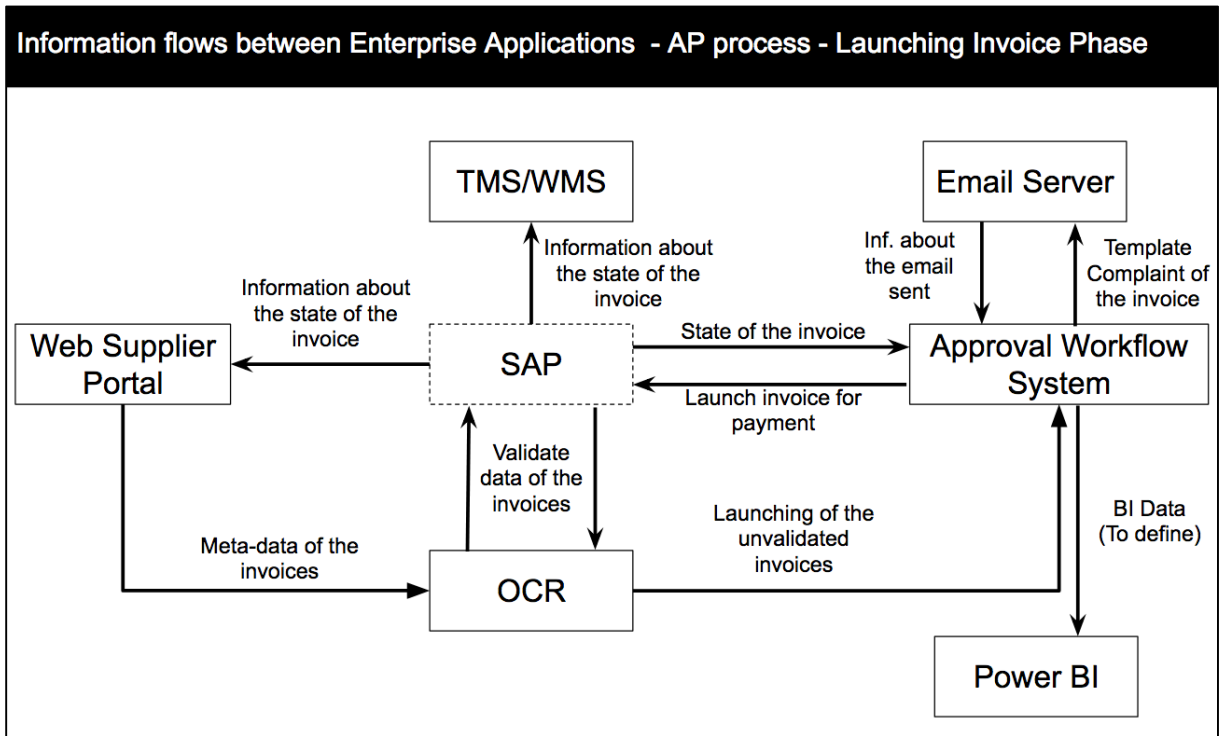
Figure 32 - Information flows between Enterprise Applications - AP process – Launching Invoice Phase

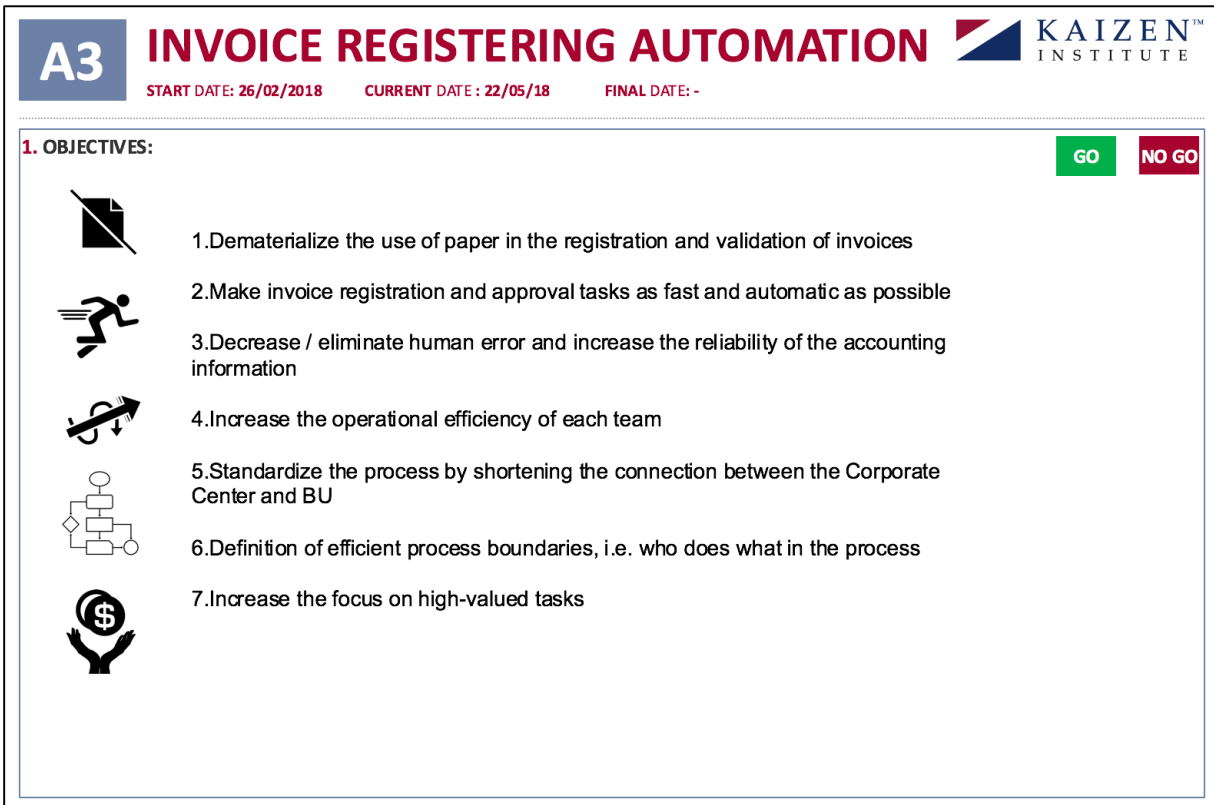**APPENDIX D: Business Case –** *Automation of the Invoice Registering Process*
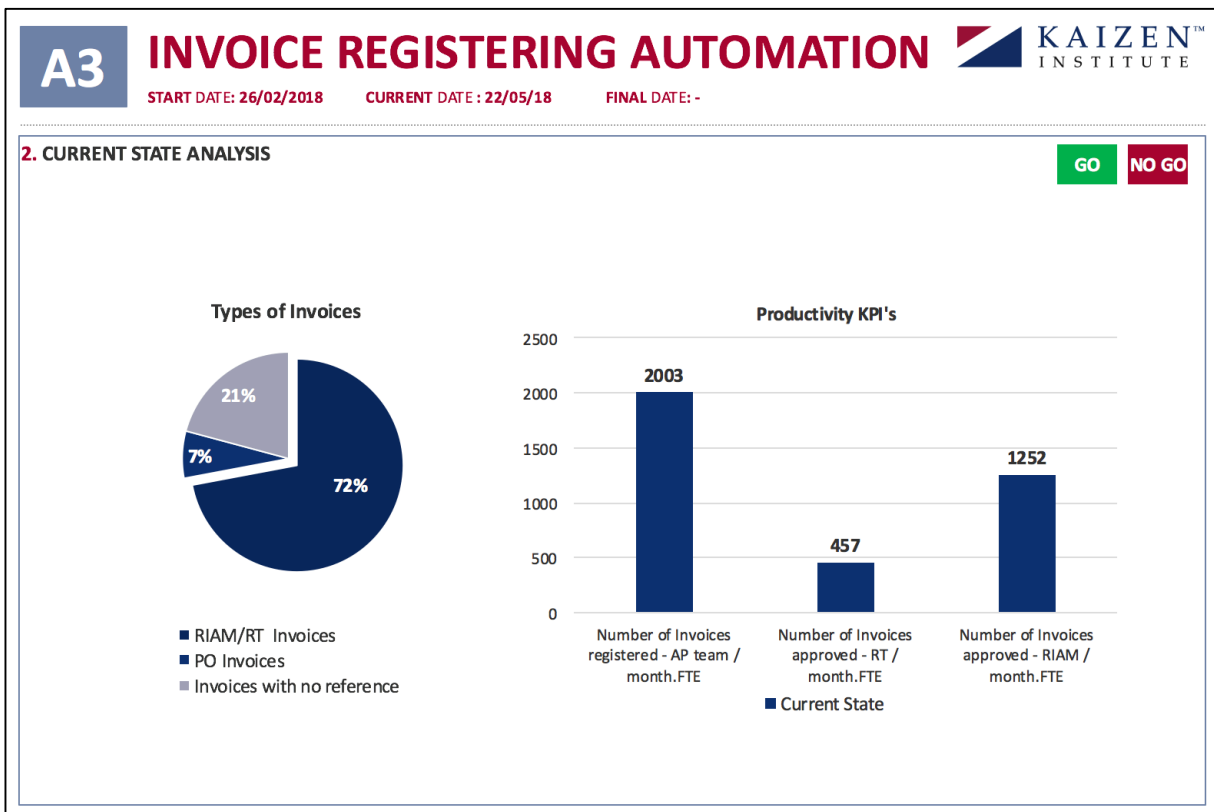

Figure 33 - Business Case - Objectives
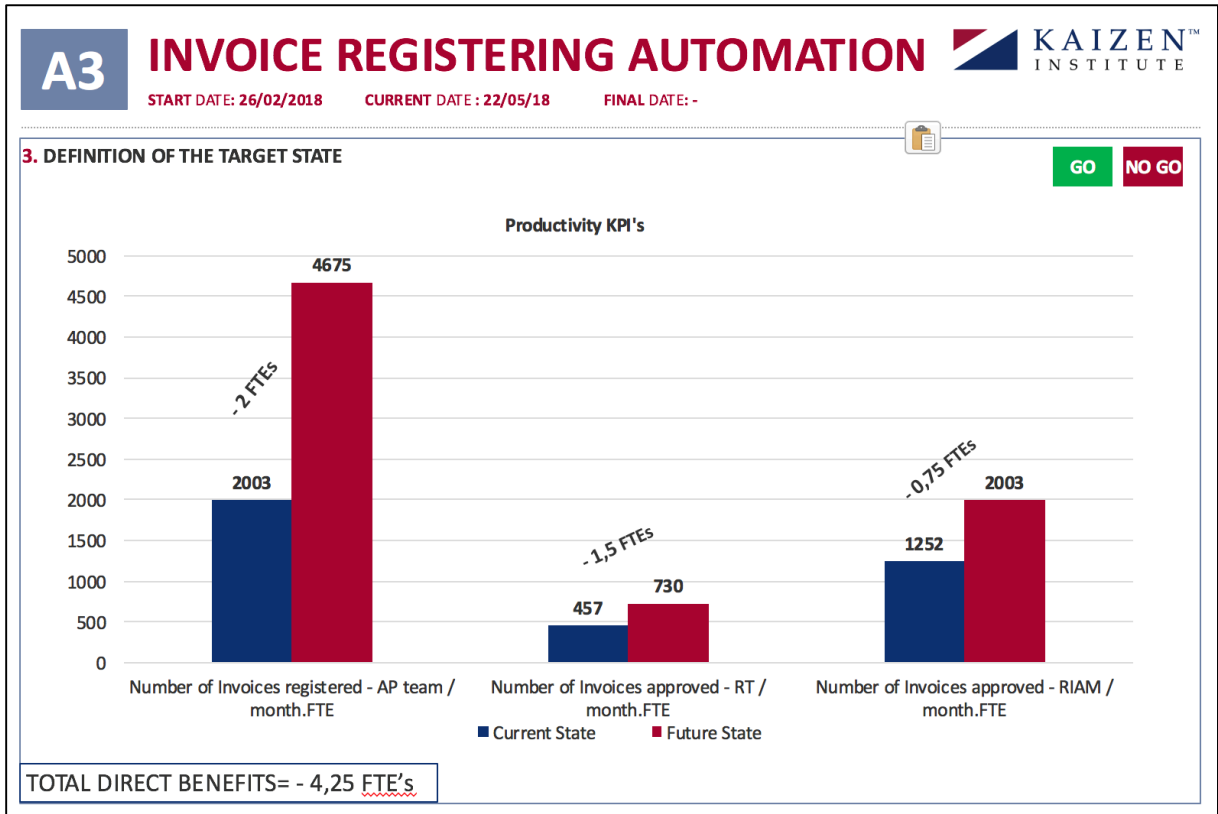

Figure 34 - Business Case - Current State Analysis

Figure 35 - Business Case - Definition of the Target State
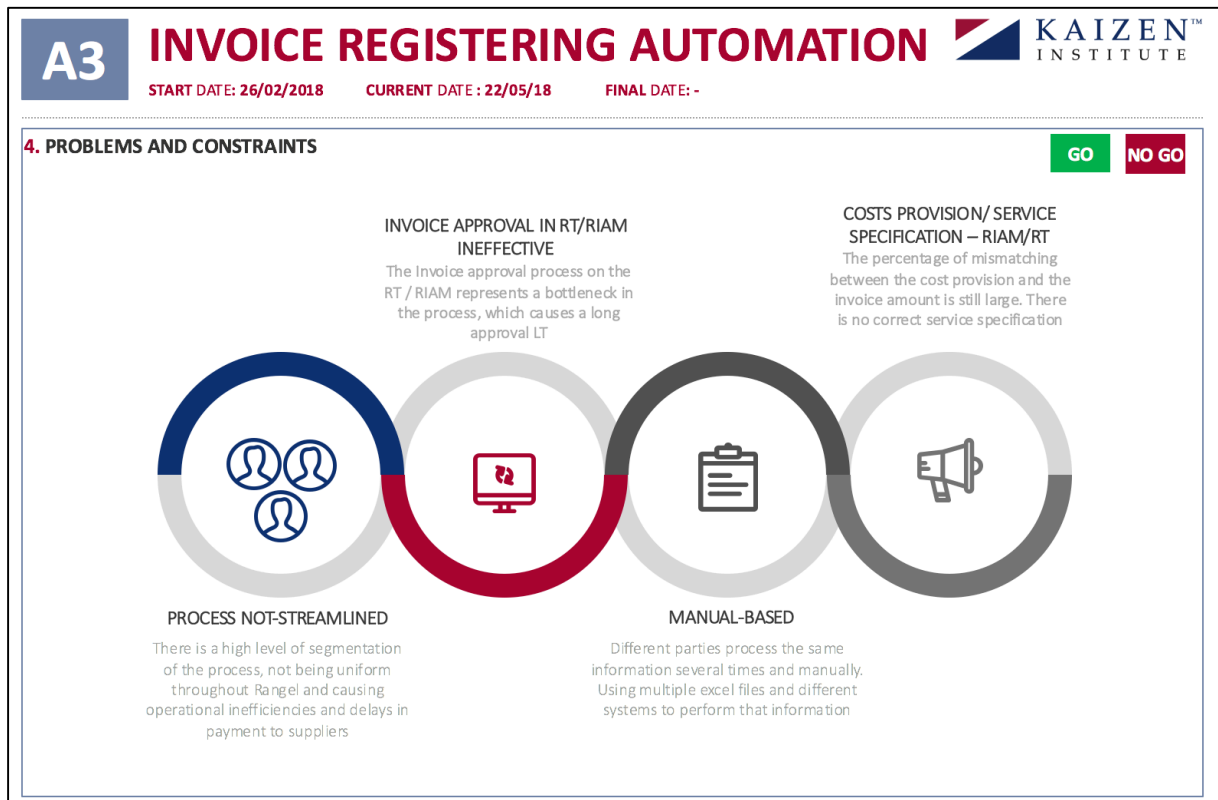
Figure 36 - Business Case - Problems and Contraints
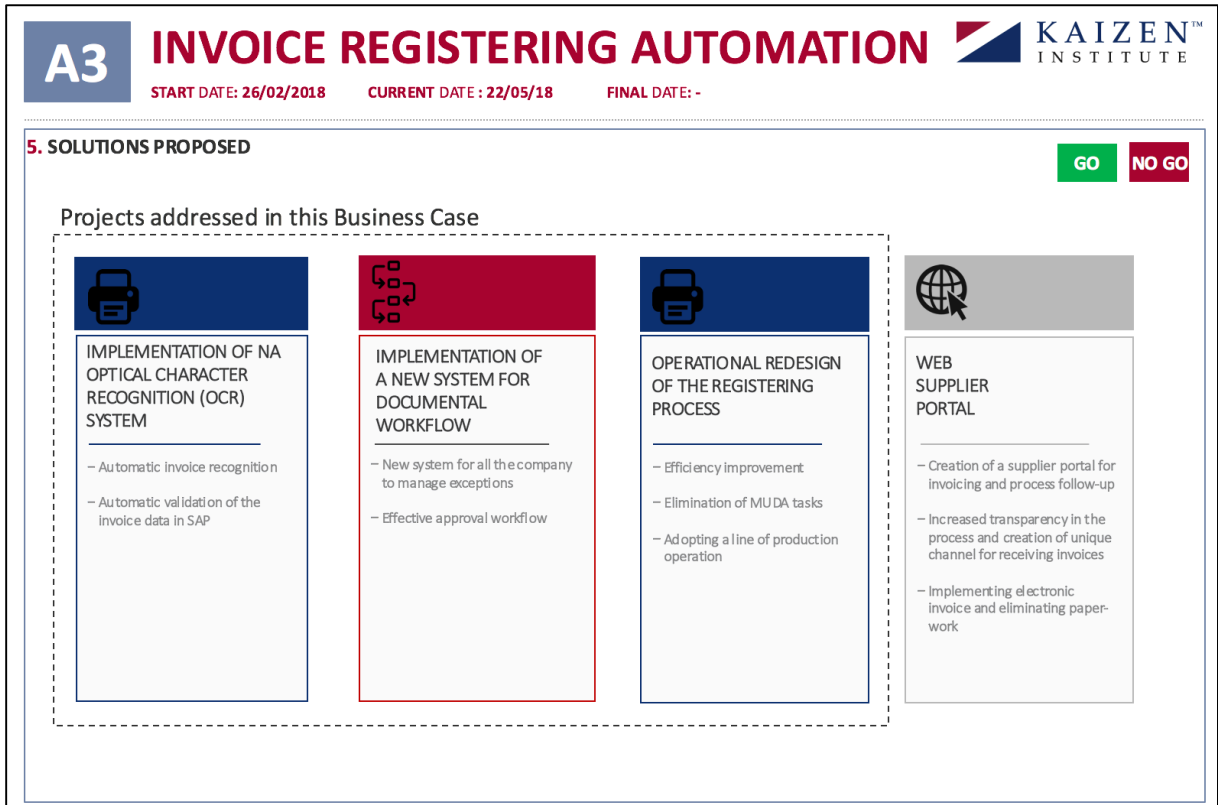
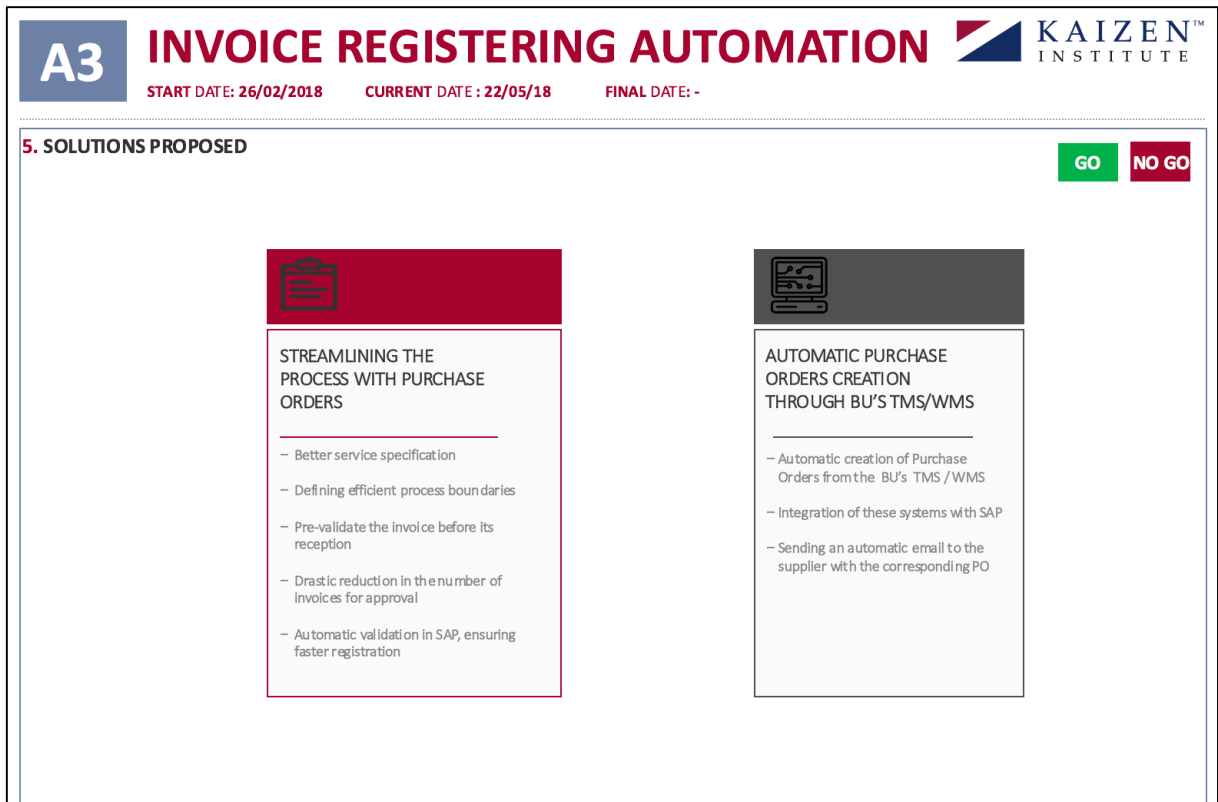Figure 53 - Business Case - Solutions Proposed 1/2

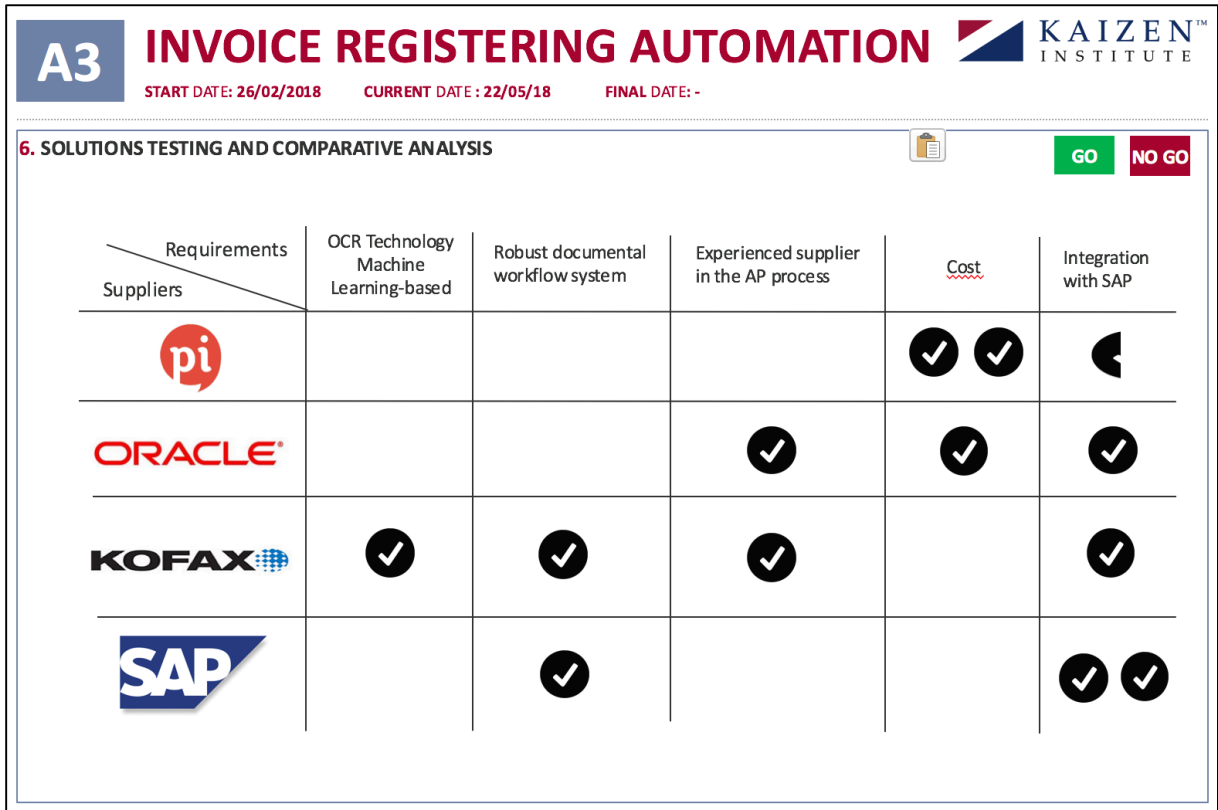Figure 54 - Business Case - Solutions Proposed 2/2

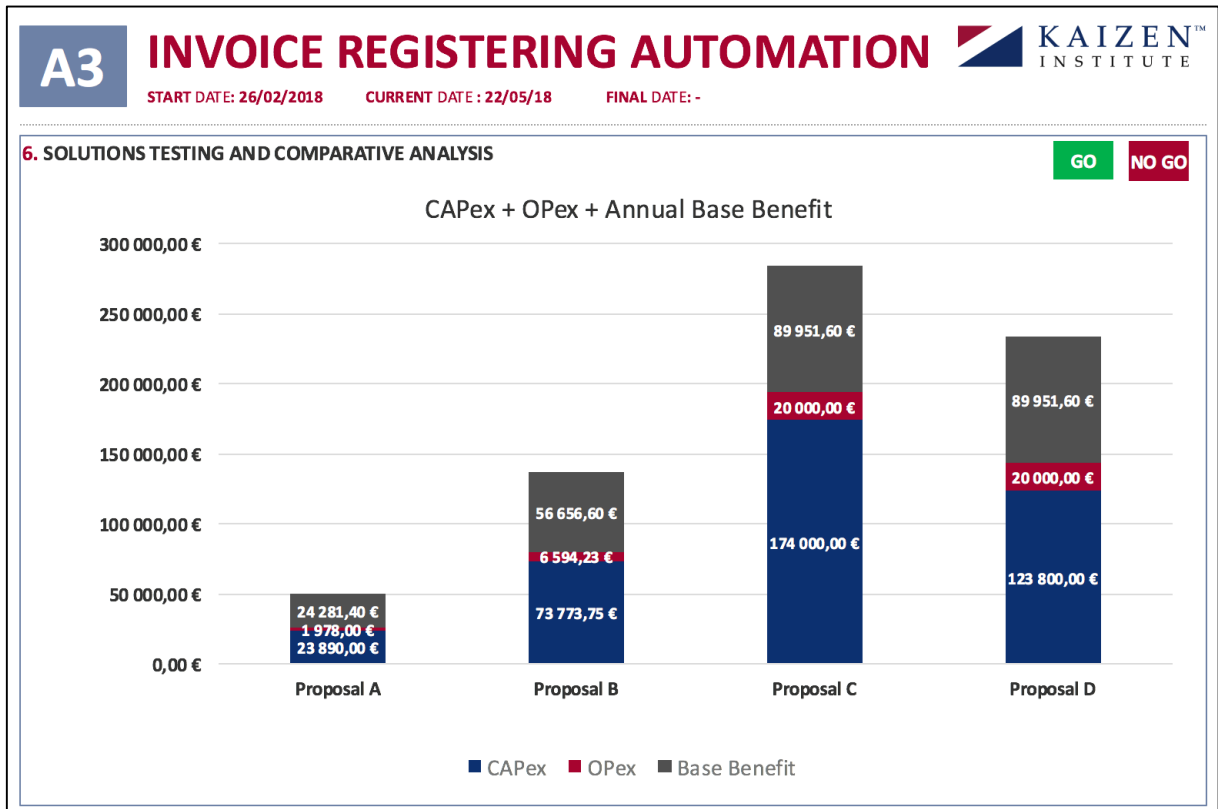Figure 55 - Business Case - Solutions Testing and Comparative Analysis 1/2

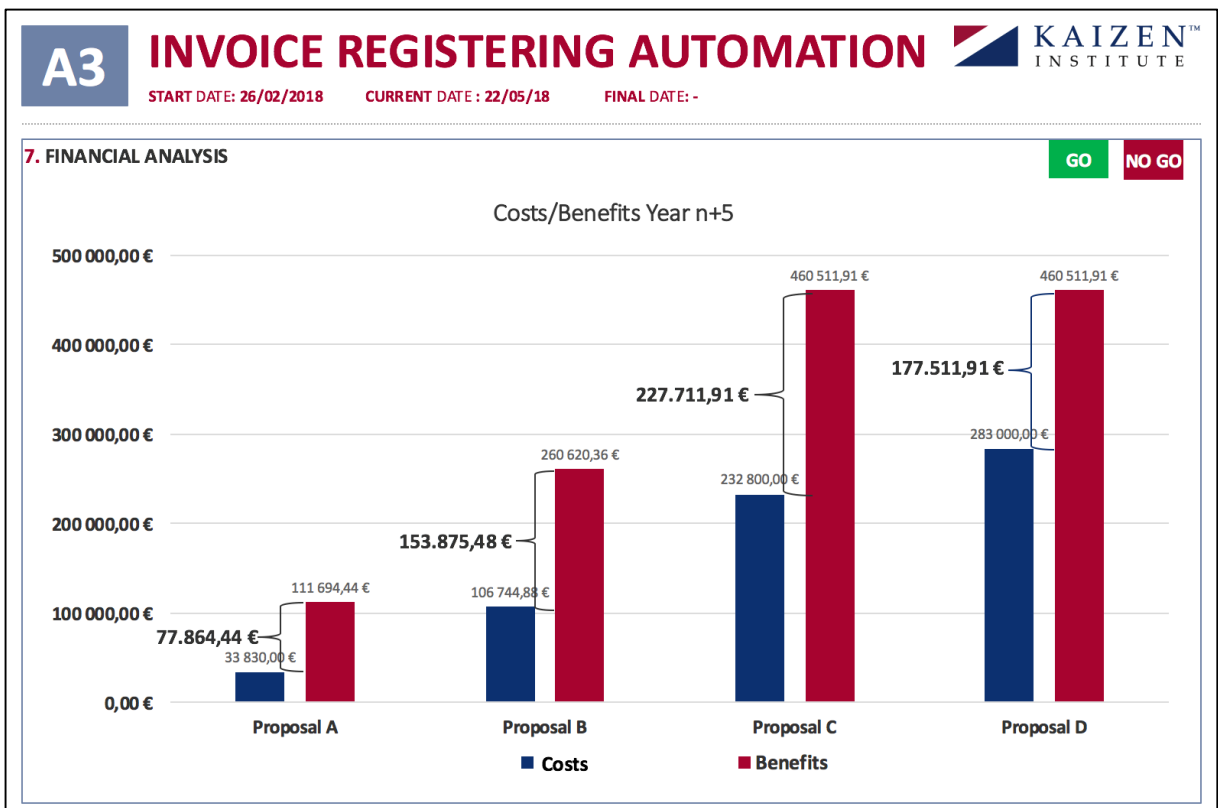Figure 56 - Business Case - Solutions Testing and Comparative Analysis 2/2

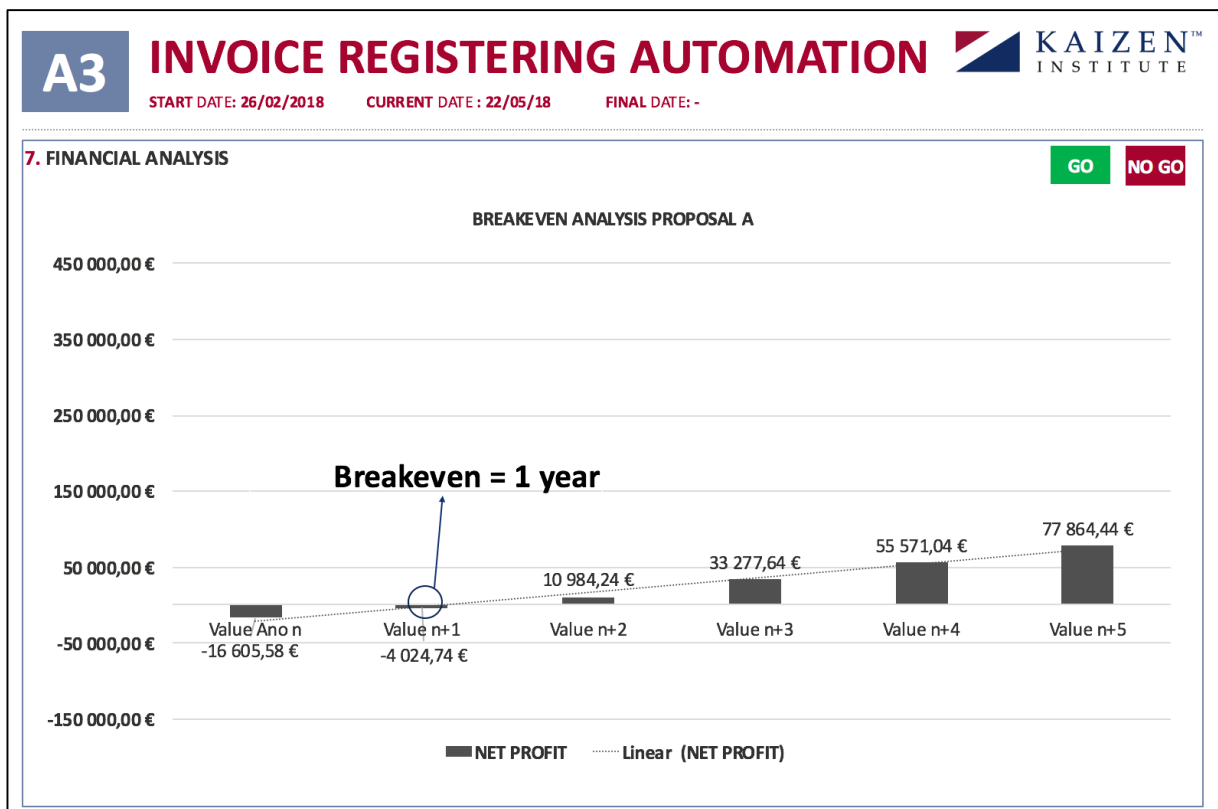Figure 57 - Business Case - Financial Analysis 1/6

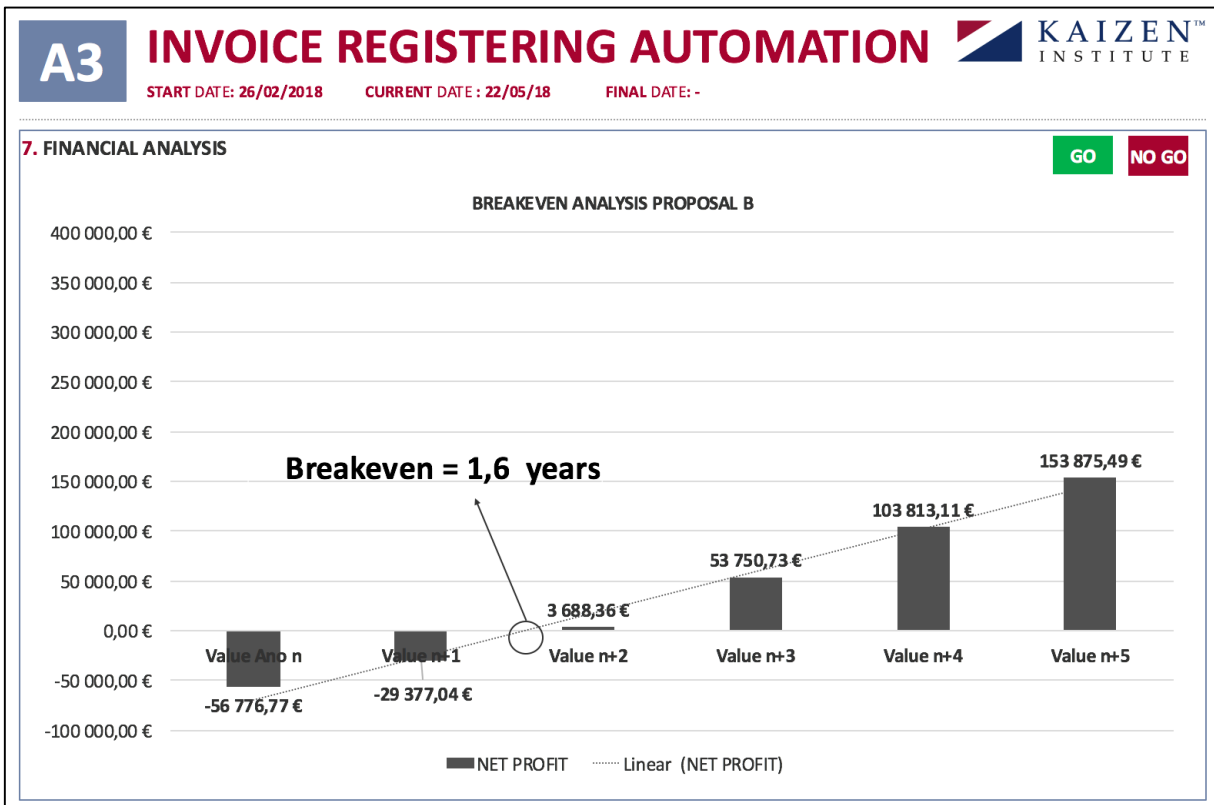
Figure 58 - Business Case - Financial Analysis 2/6

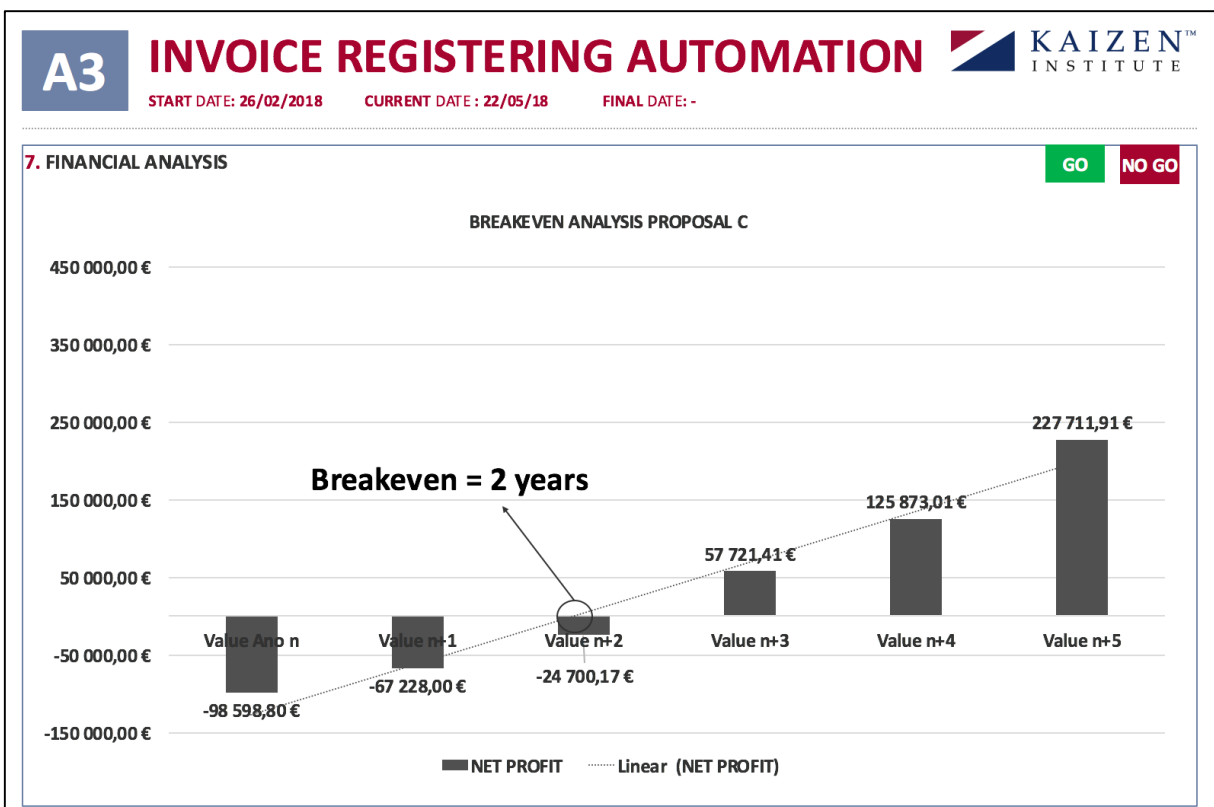Figure 59 - Business Case - Financial Analysis 3/6

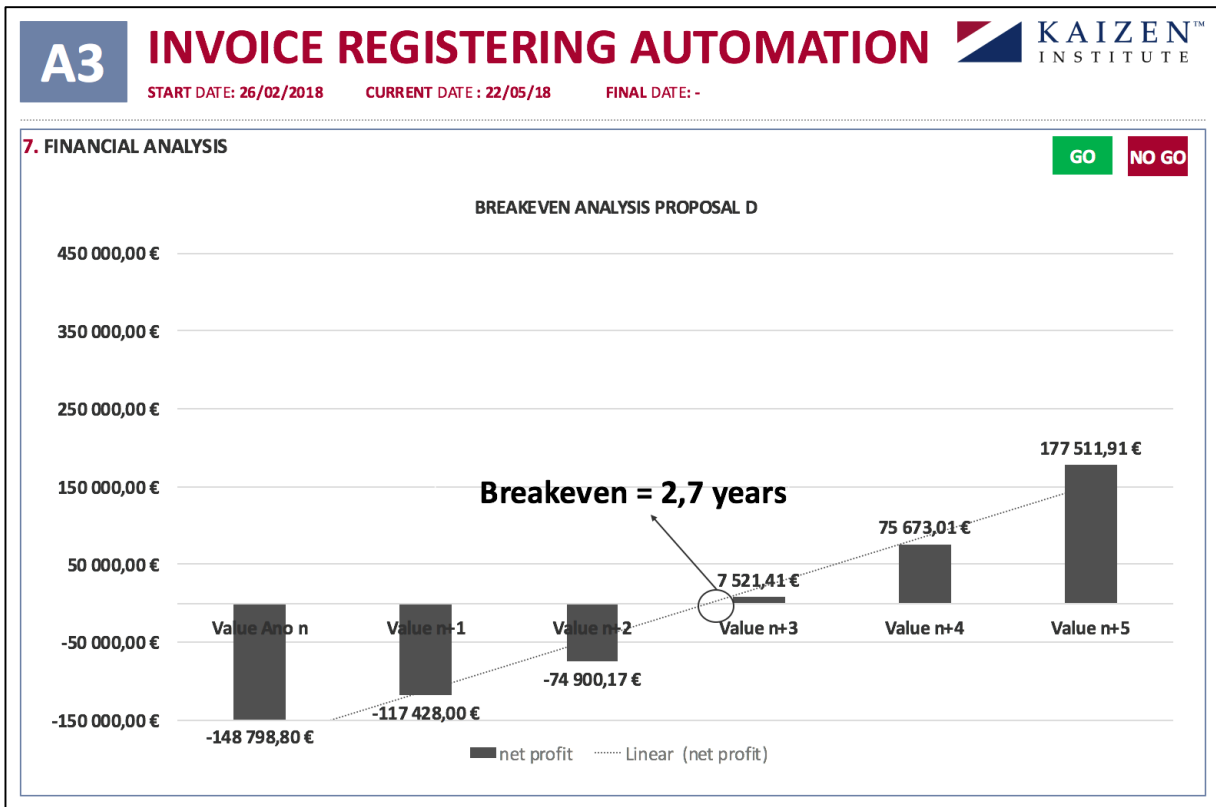Figure 60 - Business Case - Financial Analysis 4/6

INVOICE REGISTERING AUTOMATION

A3

KAIZEN INSTITUTE

START DATE: 26/02/2018   CURRENT DATE : 22/05/18   FINAL DATE: -

7. FINANCIAL ANALYSIS

GO NO GO

Figure 61 - Business Case - Financial Analysis 5/6

INVOICE REGISTERING AUTOMATION

A3

KAIZEN INSTITUTE

START DATE: 26/02/2018   CURRENT DATE : 22/05/18   FINAL DATE: -

7. FINANCIAL ANALYSIS

GO NO GO

Pressupostos assumidos:

1. Only the direct benefits were taken into account for the analysis of the present solution:
   1.1 DAF Invoice Productivity Benefits
   1.2 Productivity Benefits in Invoice Validation by RIAM and RT

2. Examples of indirect benefits not considered of the analysis of the present solution: decrease in conference lead time and payment of invoices; increase on leverage and bargaining power with supplier; decrease in the time wasted in supplier support; improvement in the quality of the accounting information

3. Some assumptions were considered for the analysis of the current productivity of RT / RIAM. The scale of benefits considered for the present solution was the following:

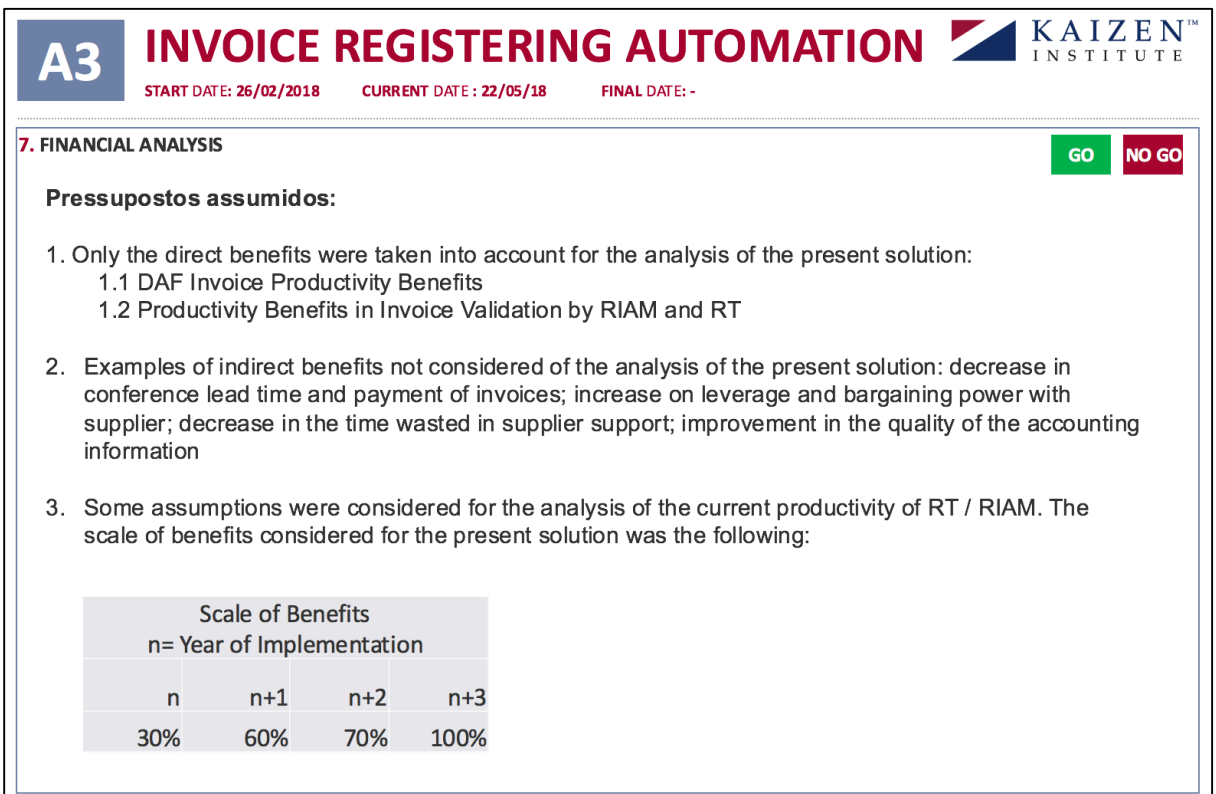| Scale of Benefits n= Year of Implementation			
n	n+1	n+2	n+3
30%	60%	70%	100%

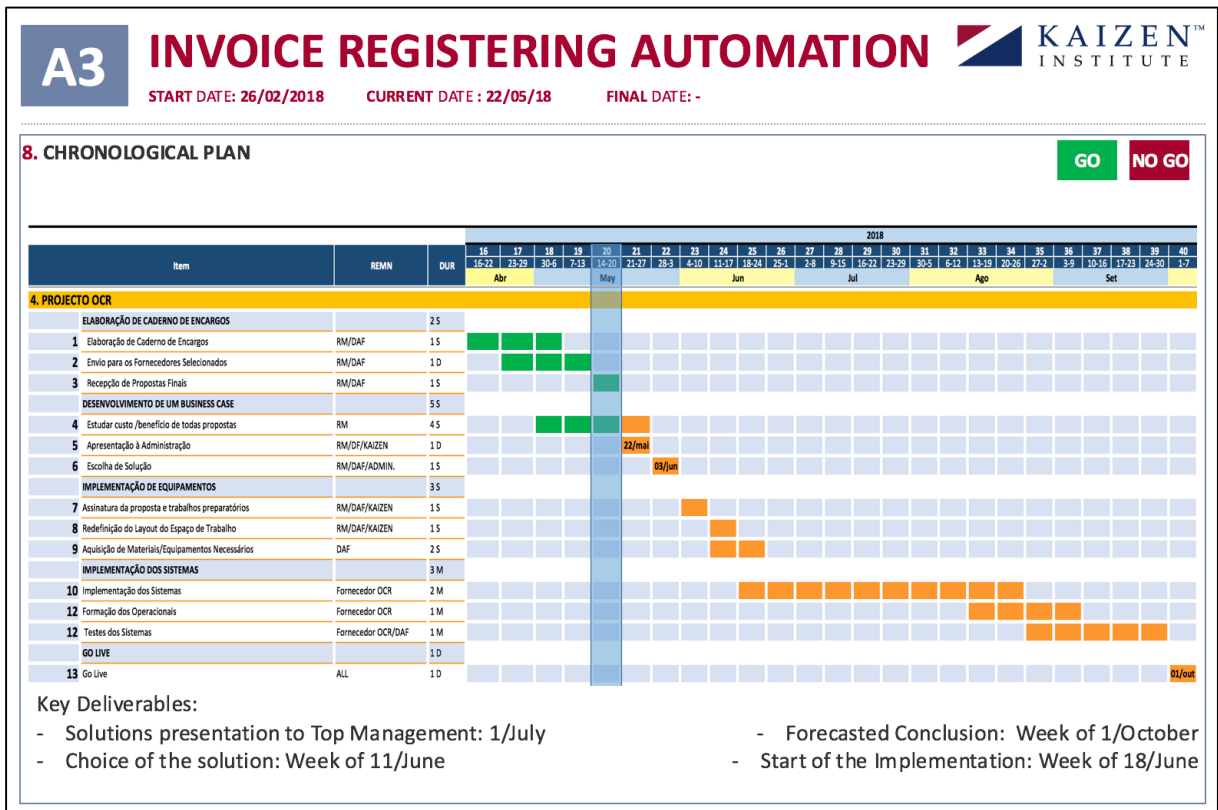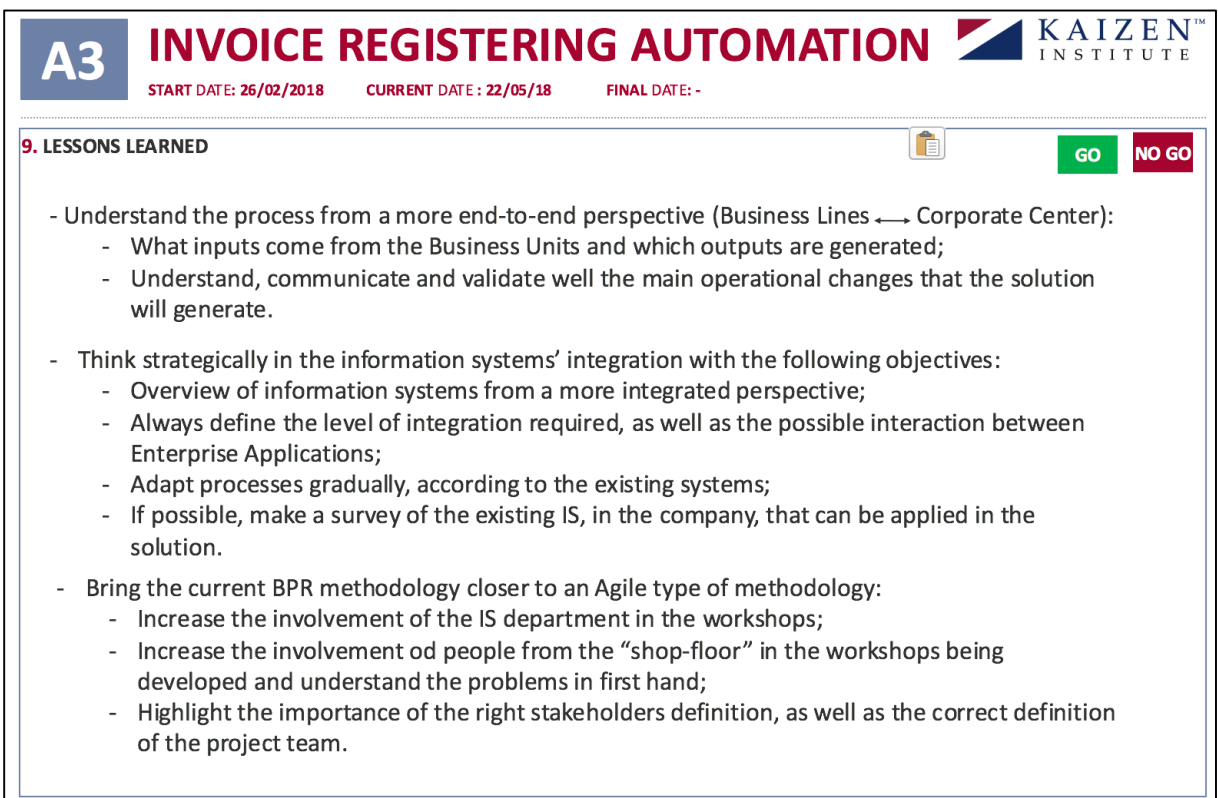Figure 62 - Business Case - Financial Analysis 6/6

Figure 63 - Chronological Plan for the Sub-Project

Figure 64 - Lessons Learned with the sub-project