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Developing a method for harmonization-based redesign of business processes at DEKRA Certification B.V.

van Gils, S.

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Developing a method for harmonization-based redesign of business processes at DEKRA Certification B.V.

by

Sebastiaan van Gils

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Student identity number 0743486

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Supervisors:
dr.ir. J.J.M. Trienekens, TU/e, IS
dr.ir. R.M. Dijkman, TU/e, IS

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Abstract

Business Process Management, Business Process Reengineering and numerous of quality approaches; all different ways for an organization to help reaching goals such as reduced costs, higher customer satisfaction, reduced cycle-times and competitive advantage. However, no matter what an organization pursues, the strength behind these initiatives is the optimization of business processes. The processes are the basis of an organization, and must be efficient in order to gain the benefits. Next to that, processes must be aligned and be comparable with each other as well. This relates to the redesign of business processes, with a focus on harmonization. Harmonization is defined as *the adjustment of differences and inconsistencies among different processes, to make them uniform or mutually compatible and in line with the business strategy and organization goals.* If successfully executed, the process of harmonization will help optimizing the business processes and enhance the efficiency within the organization. Factors that influence the level of harmonization are described in the literature (Romero et al., 2012a; Romero et al., 2012c), but this theoretical framework is conceptual. Furthermore, practical guidelines for executing a harmonization project are missing in the literature. Therefore, this research focuses on developing a method for a harmonization-based redesign of business processes. By conducting a case study at DEKRA Certification B.V. and participating in the organization, information from real-life business processes is gathered, such as the identification of the influencing factors on the processes in an organization. Information is gathered by modeling the current situation, evaluate the influencing factors and analyze how the differences can be eliminated and the business processes can be improved. With the developed method, not only DEKRA but as well as other organizations struggling with the alignment of business processes are able to use a structured method to redesign different business processes in a harmonized manner.

Management Summary

This research aims to provide organizations struggling with alignment of business processes with a structured method to redesign different business processes in a harmonized manner. By conducting a case study at DEKRA Certification and participating in the organization, the sub-goal becomes to provide DEKRA with suggestions for improvements in order to harmonize the processes of System Certification (SC) and Personnel Certification (PC). In the initial phase of this project, it appeared that DEKRA had several issues and inefficiencies within the processes of SC and PC. Those inefficiencies include the lack of a structured and clear process description, the lack of IT-support and the lack of required resources for PC. The need for a redesign of the processes is high, which is also indicated by the management. To obtain a focus on which parts of the processes could be redesigned and to take into account specific areas that require improvements, the harmonization model of Romero et al. (2012c) is used. It helped to identify important factors that influence the level of harmonization within and between the processes of SC and PC. However, the first step in this research was to model the current situation, which is also a step in a Business Process Redesign project (Covert, 1997). After analyzing the current situation, a clear view is obtained on the differences and similarities between the processes. The major difference appears to be the fact that the end-customer differs, which also implies different audits and certification schemes. Processes that are similar are the processes regarding the ISO audits. The influencing factors that force these variations are *legal regulations, IT-related factors, different services, personal differences* and *process type*. However, most of these factors are in line with the organization goals, which are therefore not relevant for further research. The two factors *IT-related factors* and *process type* are not in line with the organization goals and force variation in the processes that is undesired. These form the areas of focus and are used as direction in improving the business processes.

Using the areas of focus together with findings in the literature (Reijers & Liman Mansar, 2005; Covert, 1997; Mendling, Reijers & van der Aalst, 2010) and empirical experience, some improvements have been made or suggested to the company. First, it is suggested to assign a dedicated Project Office to Personnel Certification. Namely, two major inefficiencies regarding the processes of PC concern the planning and the audit package. By implementing the suggestions of improvements for assigning a Project Office for PC that takes care of the planning and the Audit Packages, the efficiency will increase. Harmonizing the same method as SC will also reduce the throughput time, as auditors are supported by a Project Office and can focus on their job. Further suggestions for DEKRA include to improve continuously in order to keep the efficiency high and to use the process models that are made during the research as a basis for Workflow Management.

Next to new process models, the procedures of PC are also rewritten into the same format as for SC. This will increase the level of harmonization. Advantages include a higher consistency in the quality of outcomes and more uniformity, structure and clarity on the processes for the employees. Next to that, it is expected that this comes with advantages for management such as more control on the processes and the ability to detect and react on inefficiencies more quickly. An action plan, in which the suggestions for improvement and activities for increasing the efficiency are listed, is provided to DEKRA. It also includes a cross reference model regarding the new ISO 17024:2012 norm for PC.

Participating in the organization also contributed to the development of a structured method to redesign business processes in a harmonized manner. The three major steps that appeared essential in a BPR project with a focus on harmonization are (1) Analyze the current situation; (2) Evaluate influencing factors and identify the areas of focus; and (3) Improve and harmonize.
Performing the activities within these steps helps an organization to obtain focus in a BPR project. Also by conducting a validation session at a different business line, the harmonization aspect appeared to be relevant in choosing the direction and degree of harmonization in redesigning the business processes. Further research should focus on detailed activities belonging to the possible areas of focus and a more thorough validation of the method at different organizations.

Preface

'Should I go on with another study? Should I start working, or start a master's program?' These were my thoughts after finishing my bachelor Industrial Engineering and Management, a couple of years ago. Now, after a difficult premaster, hard work in courses of the master and a master thesis of about 30.000 words, I'm facing the same decision again. But this time it is easy; I'm done with studying and ready to start a new phase of my life. The master Operations Management and Logistics at the TU/e has given me scientific knowledge, better analytical skills and more commitment to work hard. Capabilities that will be useful for the rest of my life. I've got the feeling that the choice I made a couple of years ago, was a good one.

I would like to thank some people who supported me during the last part of my 'student life'; my Master Thesis Project. First of all, I would like to thank Jos Trienekens for supervising my project. His valuable comments and discussions on a scientific level and on a practical level were very useful during the project. Furthermore, I would like to thank my second supervisors Remco Dijkman for his feedback and Heidi Romero for her explanations, useful discussions and sharing knowledge about harmonization.

Within the company, my supervisor was Vincenzo Noce. I would like to thank him for the opportunity to perform the research at DEKRA Certification. Also, our conversations appeared to be necessary to stay on the right track.

I also would like to thank my parents in supporting me. I haven't seen them a lot, which I definitely going to chance now, but their phone calls, Whatsapp messages and Skype sessions kept me really motivated. Last but not least, I want to thank Birthe for always being there for me. Even when she kicked me out of bed and sent me to the University Library in my pajamas, she encouraged me when needed.

Sebastiaan van Gils

September 2013

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1   Introduction

Business Process Management, Business Process Reengineering and numerous of quality approaches; all different ways for an organization to help reaching goals such as reduced costs, higher customer satisfaction, reduced cycle-times and competitive advantage. However, no matter what an organization pursues, the strength behind these initiatives is the optimization of business processes. The processes are the basis of an organization, and must be efficient in order to gain the benefits. Next to that, processes must be aligned and be comparable with each other as well. A business process can be seen as "a structured, measured set of activities designed to produce a specified output for a particular customer or market" (Davenport, 1993, p. 5). Hammer and Champy (1993) define a business process as "a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. A business process has a goal and is affected by events occurring in the external world or in other processes." Both definitions state that some input needs to generate output. This is a simplified way of defining a business process, but shows that optimization is possible from different angles.

Optimization by redesigning the business processes is a radical approach. It is defined by Hammer and Champy (1993) as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed". Although the literature includes numerous approaches for redesigning business processes, it lacks a focus; it is difficult for an organization to define its starting point.

From a quality point of view, the optimization and alignment of business processes are described in the literature as different concepts, such as process harmonization, unification, standardization and integration. Discovered in more detail in a previous done literature review (van Gils, S., 2013), it seems that the different terms are used interchangeably and have no uniform understanding. However, the core goal of every concept is optimization and alignment of business processes. For example, Wuellenweber, Beimborn, Weitzel and Koenig (2008) state that "the objective of standardization is to make process activities transparent and achieve uniformity of process activities across the value chain and across firm boundaries", and El-Halwagi (2006) defines process integration as "a holistic approach to process design, retrofitting, and operation which emphasizes the unity of the process." Also, process harmonization is defined differently, but comes from the same paradigm of optimizing processes. This research defines process harmonization as *the adjustment of differences and inconsistencies among different processes, to make them uniform or mutually compatible and in line with the business strategy and organization goals.* If successfully executed, the process of harmonization will help optimizing the business processes and enhance the efficiency within the organization. Although the different concepts share most benefits, one of the differences can be found in the number of processes. Harmonization, standardization and unification relate to optimizing multiple processes without changing the number of processes, whereas integration could combine multiple processes and create one single, unified, integrated process. However, the meanings of the concepts are significantly overlapping. Literature is showing an increasing interest in the concept of process harmonization, as the need for harmonization in organizations is growing. Siviy, Kirwan, Marino and Morley (2008) give a list of tangible and intangible benefits that can be realized by a harmonized multimodel approach, including cost and cycle-time reduction, process robustness and the ability to deal effectively with different structures. Also, some other valuable papers on the topic of harmonization have been published recently. Romero, Dijkman, Grefen and Weele (2012c) developed a conceptual framework on factors that influence the level of harmonization.

Previous points make the redesign of business processes by harmonization an interesting topic under research. Missing validations and detailed understandings of harmonization serve as a starting point for this research. The aim is to develop a structured method for a harmonization-based

redesign of business processes. This will help organizations to harmonize the business processes in a structured manner. The research will be conducted at DEKRA Certification B.V. (from here on referred to as DEKRA). This company, a certification institute for auditing, inspection and certification of products, medical devices, management systems and personnel, is suitable for an in-depth investigation on their business processes and a possible harmonization of them.

The next section gives an overview of the company. From there, the methodology of the research will be described in more detail in chapter 3. The remainder of this master thesis is structured according to the relation between influencing factors, process harmonization and business performance, as defined by Romero et al. (2012c) and shown in figure 1.
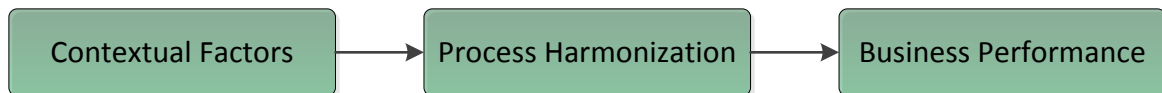
Figure 1. Relation between contextual factors, process harmonization and organizational performance

The conceptual model developed by Romero et al. (2012c) is based on these relations and is used as a framework for this master thesis project. Therefore, in section 4 and 5, the current situation within DEKRA is described, regarding the processes and the influencing factors on the harmonization of those processes. Section 6 is focused on the harmonization of processes and providing the company with suggestions for improvements. In section 7, a method is developed for a harmonization-based redesign of business processes based on the information gathered in the research. The last part of this report concludes the project and refers to the last part of the model of Romero et al. (2012c); the effects on business performance. An illustration of the report structure is shown in figure 2.
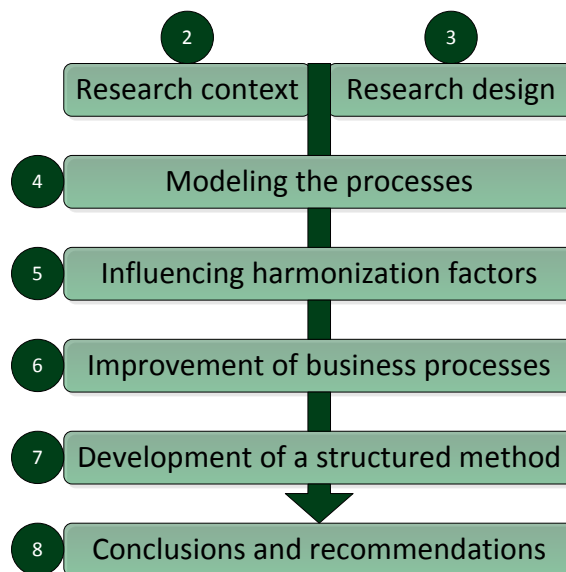
Figure 2. Illustration of the report structure

2   Research context

A general view of the organization is obtained by performing desk-research and by conducting semi-structured interviews with employees related to the research. For an integral and objective outline of DEKRA and the relevant problems, employees from different organizational levels are interviewed. Not only the CEO, Operational Manager and the Business Development Manager, but also employees in support and staff functions have been approached, such as a Lead Auditor and the QMS administrator. In total 7 interviews are conducted. The open questions were partly based on the 7S-model (Peters & Waterman, 2004), depicted in figure 3. This model can be used to identify the organization and describe the quality of performance of the organization as a whole. The model focuses on seven aspects: Strategy, Structure, Systems, Staff, Style, Skills and Shared Values. Mainly questions on Structure and Systems were asked, as this has relevance to the topic of harmonization. Also, questions about management style, strategy and goals were asked, but served merely as a clarification and understanding for the researcher. An example of the interview can be found in the appendices (appendix I). With an integral description of DEKRA, problems can be detected and understood more easily.
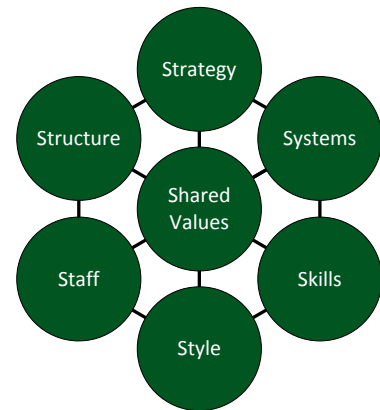
Figure 3. The aspects of the 7S-model

2.1   Company context

DEKRA started in 1925 in Germany as a vehicle inspection organization. It is a registered association and has over 30.000 members. The business operations are carried out by DEKRA Societas Europaea (DEKRA SE), which is fully owned by its association. DEKRA has its headquarters in Stuttgart, Germany, and is active in more than 50 countries worldwide. With 27.321 employees the revenues exceeded ▮▮▮▮▮▮ in 2011.

2.1.1   DEKRA SE

Since 1998, DEKRA SE has focused more on internationalization what resulted in a broader business field. Automotive is still the majority of operations, but after some large company takeovers, such as the French Norisko and the Dutch KEMA Quality, the organization operations included industrial inspection and certification as well. Today, DEKRA SE is divided into three major business units; Automotive Services, Industrial Services and Personnel Services. Those business units are subdivided into 12 underlying strategic business fields which are illustrated in figure 4.
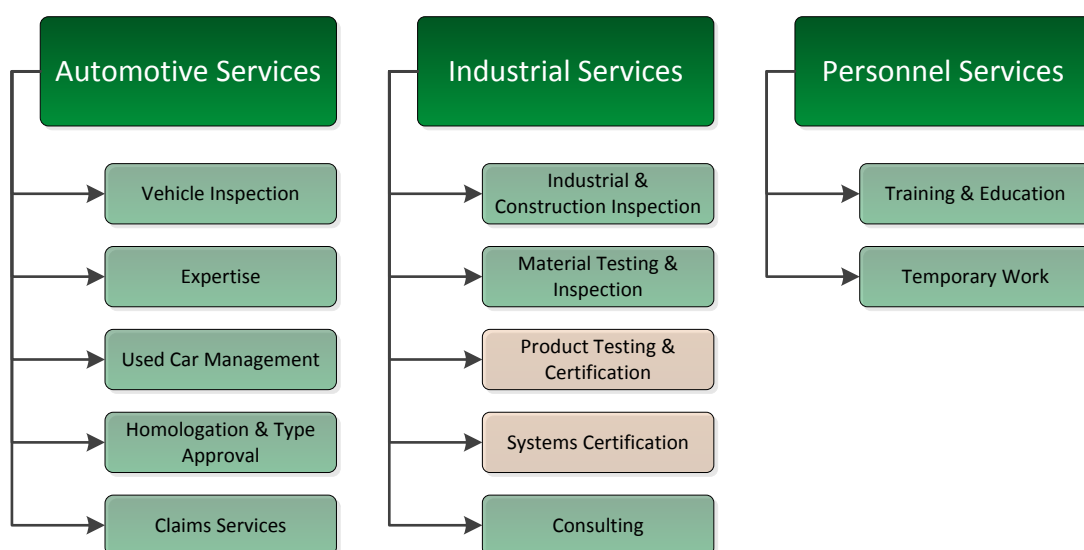
Figure 4. DEKRA SE: Three business units with 12 strategic business fields

2.1.2 DEKRA Certification Group

The highlighted two business fields in figure 4 account for DEKRA Certification Group, which is also active in about 50 countries. DEKRA Certification Group has a growing number of employees; over 1200 employees worldwide by the end of 2011. A target as a group revenue is set at ▮▮▮▮▮▮ by 2015. The mission statement of DEKRA Certification is as follows:

DEKRA Certification's mission is to be a leading provider of international testing, certification and related inspection services, offering services that create value in support of client requirements for quality assurance, market access, risk reduction and performance improvement.

DEKRA Certification Group is again subdivided by different service areas and expertise:

- *Product Testing & Certification* consists of laboratory services for testing and certification of products and consumer goods;
- *Component Testing & Certification* is as product testing, but specialized on components like switch gear, control panels, cables and installation components;
- *Certification of Medical Devices* includes testing and certification of high risk medical devices.
- *Explosion & Safety* is focused on testing with chemicals, gas, fluid and fire, to test the safety of products on explosions and processes regarding that;
- *Systems Certification* includes auditing and certification of work safety-, environmental- and quality management systems. Also, Personnel Certification is covered by Systems Certification, which involves independent testing and certification of technical and management staff. Personnel Certification must not be confused with the business unit Personnel Services, which is not concerned with certification, but incorporates DEKRA Academy (training and education) and an employment agency for temporary work.

The initial project assignment is intended for Personnel Certification. However, for a broad view with relevant insights for the research, the whole organization of Systems Certification will be described next. The other service areas have no link with the processes of Personnel Certification and will therefore be left out of scope of this research.

2.1.3 Systems Certification

As showed before, Systems Certification (SC) is part of the DEKRA Certification Group. Figure 5 depicts the organizational chart for SC in the Netherlands, which belongs to the Dutch department of the group; DEKRA Certification B.V. Systems Certification roughly consists of 5 clusters; four markets for certification of management systems and one cluster for the certification of personnel.

Systems Certification in the Netherlands had ▮▮▮▮▮▮ FTE employed in 2012. Furthermore, external auditors are subcontracted in times of high demand. A last-years total turnover for SC of ▮▮▮▮▮▮ is reached, and the profit for 2012 was ▮▮▮▮▮▮.
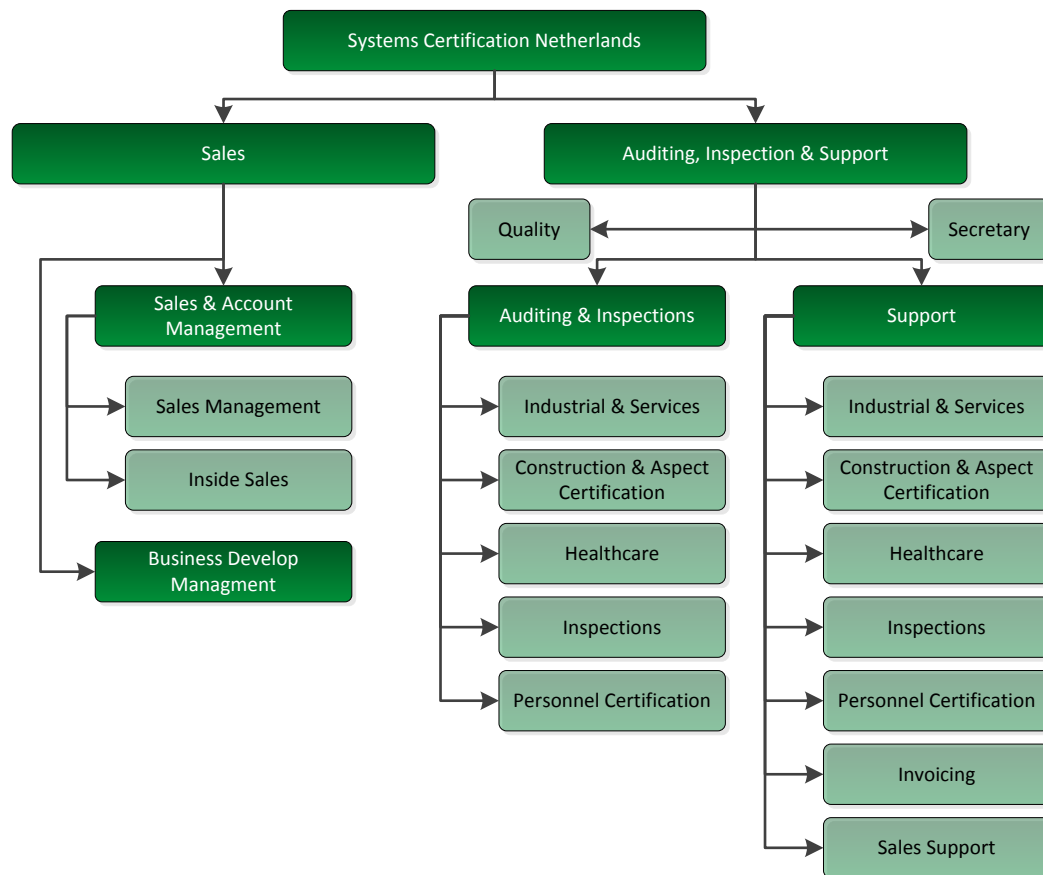
Figure 5. Organizational chart for Systems Certification in the Netherlands

2.2　　Current situation

This section describes the current situation regarding the processes of Systems Certification and Personnel Certification. In their paper, Nurcan, Grosz and Souveyet (1998) suggest to describe business processes as use case specifications. They state that this includes "a description of the context of the business processes, the interactions between the agents involved in the business processes and the interactions of these agents with an automated system supporting the business processes". Therefore, this section starts with describing the important business processes of SC and PC. Followed on that, the agents interacting with the business processes are given, but are referred to as the different roles (internal or external) in this report. Lastly, the supporting infrastructure of the processes will be described, such as the Information Technology and the Quality Management System. The descriptions are based on the information gathered from desk-research and the conducted interviews and, where found, includes issues regarding the processes. As a conclusion, this section ends with an explanation for the need for harmonization-based redesign.

2.2.1　　Business processes

The main activities within the process of SC include order preparation, planning, auditing, corrective actions and invoicing. This can be done for different meanings, such as an initial certification, surveillance activities, recertification or decertification. The clusters focused on certification of management systems account for about 50 different services including audits for ISO certificates, HKZ certificates (quality in hospitals) and BRL certificates (guidelines for construction companies).

Personnel Certification (PC) has similar activities in the main process, but is focused on different services. PC performs audits regarding the examination of persons and has about 60 different services. These services are certification schemes on which a certificate is based. Because the examination is outsourced to different examination institutes, the audits include the evaluation of

exam questions, examiners and exam locations, surveillance of examinations and ISO audits of the examination institute itself.

DEKRA Certification started PC around 1996-1998 (when it was still called KEMA Quality B.V.). PC has outsourced the examinations to ▮ certified examination institutes, and certified ▮ persons in 2012. In 2011 this number was ▮▮▮▮▮, and ▮ person certificates in 2010. Also, turnover increased with ▮ since ▮. The increase is largely due to the fact that PC started certifying persons in the energy market. However, compared to SC, it is still a relative small business. PC only audits the ▮ examination institutes and their associating examinations, examiners, locations, etc., whereas the audits of SC count up to ▮ in 2012. The number of certificates from SC in that year is ▮. The total turnover of PC is only ▮% of that of the total turnover for SC. Also, just ▮ FTE is officially employed for PC, which is ▮% of the total amount of employees working at SC.

Due to the fact that PC is relative small in comparison with SC, there is not much management focus on PC. This is noticed by e.g. the organizational structure (PC is seen as a cluster of SC), no specific goals for PC and no explicit page in the quality management system (QMS).

Throughput time

One relevant problem regarding PC which is probably caused by the growth of PC, is the throughput time. When candidates have been examined, DEKRA must confirm the results and send the appropriate certificates of the candidates who passed the examination to the examination institute. The time between the examination and the distribution of the certificates is referred to as the throughput time of the person certificates. For some specific certification schemes, this should be less than a month. Due to the growing number of certificates, it could take ▮▮▮▮ before the certificates are sent to the customers. This causes candidates and examination institutes to complain. Currently, one employee is responsible for the confirmation of results and distribution of the certificates.

Some issues that could be the cause of this problem:
- When an examination institute sends the examination results, all relevant documents such as the name and address of the candidate, certification agreement and an official report is needed. It happens that essential information is missing, which cause a delay in distributing the certificates;
- If there is doubt about the approval of an (mainly practical) exam result, that specific case is sent to an expert in that field, who takes a closer look and approves or disapproves the result. This extra step delays the distribution of certificates, especially when the expert replies late.

Another measure of throughput time is the time between an ISO audit at an examination institute and the (re)certification of that institute. The examination institute itself is audited by DEKRA according to ISO 9001 and issues regarding ISO 17024. However, according to some examination institutes, the time between the audit and receiving the report with conclusions is too long. One found issue regarding this problem could be that the time that DEKRA plans for auditors to write the audit report, is sometimes planned relative late. This causes that the examination institute has to wait for the report of (re)certification.

2.2.2 Interacting roles

The roles involved in the business processes are listed below.
- Customer;
- Sales Assistant / Account Manager;
- (Lead) Auditor;
- Project Office;
- Certification Manager;
- Product Expert;

- Quality Manager;
- Team Manager;
- Examination Institute (for PC only);
- Candidate / Certified Person (for PC only);
- Committee of Experts (for PC only);
- ITEM Bank (for PC only).

As can be seen in the list, several roles are only involved in the processes of PC. The most important difference between SC and PC regarding the roles, is the end-customer. For SC, this is a company asking for certification of their management system. For PC, the end-customer is a participant that passes the course at the certified examination institute. DEKRA will take care of the certification of that person, but the examination is outsourced to a third party.

Another difference to mention is that the Project Office for SC is different from the Project Office for PC. Whereas the planning, support, customer contact and processing of audit packages is being done by the Project Office of SC, only evaluation and certification of candidates is being done by the Project Office of PC. All other activities are done by other resources; planning is done by a Lead Auditor, customer contact mainly by the Auditor performing the audit, and processing an audit package is not being done due to the fact that it not exists.

2.2.3 Supporting information systems

For the interaction of business processes with the information systems, this section describes the information technology supporting the business processes and one part in more detail, which is the Quality Management System.

2.2.3.1 Information Technology

During the conducted interviews, several issues were raised that all can be traced back to one major shortcoming, which is IT support. The IT architecture of DEKRA consists of numerous individual systems, which are not all connected to each other. Some of the systems are listed below.

- *InFocus*. Used by management for business reports and financial figures.
- *JobInfo*. Mainly used by auditors for work orders.
- *Axiant*. System for storage of client information.
- *Planboard*. Used by the Project Office and auditors to plan and check audits.
- *Timesheet*. System for weekly reports and timesheets.
- *MijnHRM*. Used for employees for requesting leave and holidays.
- *Opportunity Management System (OMS).* System for inter alia quotations.
- *Quality Management System (QMS).* System for quality management purposes, and includes organizational information, processes and documents such as work instructions, ISO audits and guidelines for other services.
- *PerC.* System only for PC, where information of examination participants and their certificates is stored.

One issue relating to IT is that some information like working hours, holidays, information of certificate holders and planning information of PC must be entered and checked manually. This is time consuming and causes inconsistencies in the system. Another issue is that there seems to be no possibility of planning audits for PC through the system of SC. SC uses *Planboard* to plan audits, but the audits of e.g. the examiner and examination locations within PC is not planned in this system. This also causes the problem that no hours can be dedicated to a work order of PC.

It can therefore be said that required resources are not fully supported by IT, which means that there are inefficiencies or shortcomings within the IT-support.

2.2.3.2   Quality Management System

The Quality Management System of DEKRA Certification serves as support for the processes by describing the processes, organization information and linked documents, work instructions, etc. This was a reason to do desk-research on the QMS. The information from this desk-research is described next.

The main departments of DEKRA Certification are shown on the main screen of QMS, including staff, sales and the different service areas such as Product Testing & Certification, Certification of Medical Devices and Systems Certification. Each department has a visualized process (flowcharts) and, for the service areas, a list of services provided by that area. Systems Certification has its services split up in 4 clusters; Construction & Aspect, Health Care, Industrial & Service and Personnel. The cluster Inspections is not taken into account in QMS. The process view of SC is the same for each cluster. The flowcharts in this view have a certain hierarchy, which means that the given five main processes have a second layer of flowcharts or linked documents describing the steps in the process. Those main processes are the following:

- Initial Certification;
- Ongoing Surveillance Activities;
- Recertification;
- Corrective Action Audit;
- Decertification.

Each main process has 6 to 10 steps visualized and can be investigated more by clicking them, which will lead to the second layer. In only three steps, the second layer will show another flowchart, namely the steps 'Perform corrective action at office', 'Perform corrective action at customer' (both in main process *Corrective Action Audit)* and 'Perform Last Surveillance audit' in *Ongoing surveillance activities.* In the other 36 process steps, no flowchart is visualized. However, every step has a link that refers to the relevant documents such as work instructions and explained process steps.

It is also noticed that the referring document of the step 'Perform corrective action at customer' is inconsistent with the process flowchart, and that the step ´Planning corrective action at office or at customer´ has an exact duplicate, which may cause confusion for the users. Furthermore, the document for the step 'Perform Last Surveillance audit' refers to other steps in the process when a corrective action is needed, but this is not shown in the process flow.

By investigating further on PC, the QMS website leads to the same process as used for SC. PC in QMS only contains documents necessary within PC, such as procedures and work instructions to perform audits, assessment forms and lay-outs for certification contracts. The documents describing the process steps are different from the documents that describe the process steps for SC in terms of lay-out, terminology, language and last date of modification (several PC documents appeared to be not up-to-date). Next to this difference in documents for SC and PC, it becomes clear that for PC, no process flow is visualized.

Concluding, the processes of SC in QMS lack structuredness, clarity, visibility and uniformity. Furthermore, the processes of PC are not visualized in QMS and the documents for process descriptions or work instructions differ between SC and PC.

2.2.4   Need for harmonization-based redesign

Several issues within the business processes and their support cause inefficiencies in the department System Certification. Another difficulty for DEKRA is recognizing similarities and differences between processes. Siviy et al. (2008) state that this is one of the problems when dealing with processes in a multi-model environment. Due to a diverse structure and terminology it is harder to compare processes. DEKRA tries to connect services that are slightly different from each other (like some ISO certifications) to a general process, and make notifications where a service deviates from the main process. This is not the case for services within PC, partly because it lacks a process model. The similarities and differences between the processes of SC and PC are not clear enough to know where

inefficiencies can be detected. Also, it can be said that since PC is still growing, it is experiencing several problems. It is expected that PC will continue to grow. This means that the current organization of PC and its resources will no longer be sufficient. The fact that PC has no clear description and structure of the business process causes inefficiencies. Not only issues within the business processes and its supporting IT, but as well as control of management and communication between SC and PC can be problematic when the processes differ.

Concluding, a deeper investigation in the organization has made a clear view of the problems within SC. Using semi-structured interviews and desk-research, key issues became apparent. Mainly the following issues cause inefficiencies in the organization of SC:

- Lack of a structured and clear process description for SC. Differences in lay-out, terminology, language and last date of modification of the documents regarding procedures and work instructions between SC and PC;
- Lack of IT-support. Inefficiencies due to individual information systems at SC and insufficient support from systems of SC for processes of PC;
- Lack of required resources. Differences in the Project Office for SC and the Project Office for PC. Within PC, planning and support is done by auditors and audit packages do not exists.

Linking this to benefits of business improvement programs such as Business Process Management (BPM), Business Process Reengineering (BPR) and Quality Management, it is noticed that such a program could lead to e.g. manageable business processes, qualitative better service, controllable costs and reduced production times (Rampersad, 2000; Sallis, 1993; Zink, 1997). For a redesign of business processes, it is often unknown where to start. Therefore, looking at the differences of SC and PC, a more specific method is the harmonization of business processes. Harmonization of processes will lead to effective robust business processes (Siviy et al., 2008), cycle-time reduction and overall operational efficiency (Romero et al., 2012c). For DEKRA this means that efficiency could be increased if both SC and PC have a structured process with similar process descriptions, IT that supports both the processes of SC and PC, and receive similar resources in both SC and PC. This necessity for higher efficiency and more uniformity within the processes of SC and PC implies that DEKRA's need for a harmonization-based redesign is high.

This gives reason to focus this research on a harmonization-based redesign of the business processes of SC and PC. According to the definition of Romero et al. (2012a), the process of harmonization is the elimination of differences and inconsistencies among processes in order to make them uniform or mutually compatible. Also, Pardo, Pino, García, and Piattini (2012) discuss harmonization as "an activity that seeks to define and to configure the strategy which is most suitable for the organization's goals with the aim of relating two or more models". To harmonize business processes, differences within and between processes need to be adjusted on the basis of a strategy that fits the organization goals. Relating this to the situation of DEKRA there are multiple options to harmonize these processes. Copy-paste in order to eliminate differences could be one extreme, but it is not sure if the process of the certification of management systems can be used for the certification of personnel. The other extreme is to redesign both processes from scratch. In between are different alternatives like using the efficient parts of one process and design the process of PC on the basis of those existing parts. It also depends on the practical need of DEKRA; how harmonized must the processes be? More investigation on the similarities and differences between the two processes will give DEKRA insights in the possibilities of optimizing the organization by harmonization. Furthermore, it will help this research in generating a structured method on how to redesign business processes in a harmonized manner. The next section discusses the methodology of the research in more detail.

3 Research design

The initial phase of this research discovered several issues within the processes of DEKRA. It appeared that the need for a redesign of the processes is high, and the focus on harmonization could give direction on where to start. This section focusses on the design of this research. First, more insights will be given on the conceptual framework of Romero et al. (2012c) and how this can give focus to the redesign of the business processes. Also, the goal, research questions and the methodology of this research will be discussed in this section.

3.1 Research in harmonization

In recent years, the interest by researchers and practitioners in the concept of process harmonization is increased (Romero et al., 2012c). Fernandez and Bhat (2009) propose a methodology to execute process harmonization initiatives, Pardo, Pino, García, Piattini and Baldassarre (2010) focus on the harmonization of multiple reference models, and numerous other researchers provide insights in the concept of harmonization (including Richen and Steinhorst (2005), Tregear (2010) and Siviy et al. (2008)). Romero et al., specially focus on the relationship between contextual factors, process harmonization and business performance. Their contribution includes research to the effect of contextual factors in process harmonization and research to the development of measures of process harmonization. According to Romero et al. (2012b), harmonization is the trade-off between how standardized or how specific an organization should design their business processes. This trade-off is relevant for the issues found in the business processes of SC and PC of DEKRA. Due to the fact that it is unknown how standardized the processes of SC and PC should be in order to reach optimal efficiency, a harmonization project should be started. Going back to the concept of harmonization as defined earlier in this report, a harmonization project must eliminate or adjust differences and inconsistencies among different processes, in order to make them uniform or mutually compatible and in line with the business strategy and organization goals. The work from Romero et al. can help practitioners determine how standardized or how specific they should design their business processes, and provides a conceptual framework that can be used as a tool to analyze the level of harmonization of an organization. This will be useful in obtaining direction for the redesign of the processes. Therefore, a description of their conceptual framework will be given next.

The conceptual framework of Romero et al. (2012c) consists of three parts, and is depicted in figure 6. The first part shows the contextual factors that appeared to have interdependencies between the factors identified and the level of harmonization of the business processes in an organization. The factors are classified as follows (Romero et al., 2012c):

- External: Factors that characterize the business network and the macro-economic context in which the organization operates and that are beyond the control of an individual organization, such as legal requirements for specific industries;
- Internal: Factors that are part of the internal environment of the organization, i.e. organizational structure and number of different locations;
- Immediate: Factors that are internal and directly related to the process under study, such as the process type.
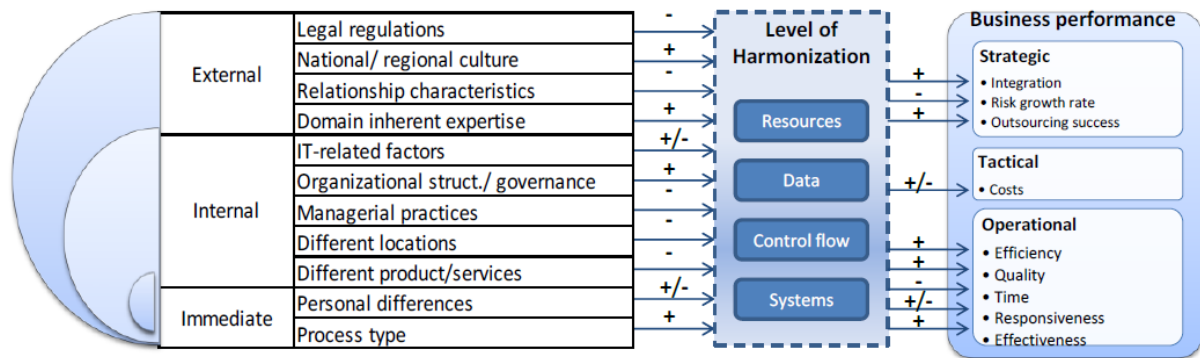
Figure 6. Conceptual framework by Romero et al. (2012c)

The second part of the model indicates the level of harmonization that can be affected by the contextual factors, and is divided into four aspects of harmonization, which are resources, data, control flow and systems. The third part includes the business performance indicators and measures the effect of the level of harmonization on the business performance. The arrows between the three parts, together with the sign on the arrows, represent the type of relationship. For example, an increase in the number of different locations implies a decrease in the level of harmonization. Or an increase in the level of harmonization implies an increase in the efficiency.

Next to the work of Romero et al., other researchers discuss the notion of influencing factors. Pardo et al. (2010) state that "there are several factors that may influence an organization in needing to work with more than one reference model." Furthermore, Schäfermeyer, Grgecic and Rosenkranz (2010) argue that "not every business process is standardizable". Therefore, to focus on the trade-off that Romero et al. (2012b) talk about, the framework provided by Romero et al. (2012c) can be used as a guideline through this research. The first part will help to identify factors that influence the level of harmonization at DEKRA. The type of relationship with the second part will serve as a tool to indicate how the level of harmonization is affected by the identified factors. With these insights, it will be possible to provide DEKRA with suggestions on how to improve the processes of SC and PC, by eliminating and adjusting the differences and inconsistencies within and between the processes. Although the aim of this study is not to exactly measure every aspect of the business performance in the third part of the framework, indications could be given on the level of harmonization and the expected effects on the business performance.

3.2 Design and research goal

To contribute to the literature of BPR, this research will provide a structured method to redesign business processes by focusing on harmonization. In addition, this research will also reflect on the framework of Romero et al., as this is used as a guideline through this research. Furthermore, Yin (as cited in Schäfermeyer et al., 2010) argues:

> Case studies are ideally suited if the investigator has limited control over events and boundaries of a phenomenon (e. g., the characteristics of real-life business process) and if the phenomenon and the context in which it is investigated (e. g., business processes in companies and across value chains) are unclear or closely related. (p. 5)

Therefore, a case study is a suitable methodology in order to gather specific insights in the real-life business processes and inefficiencies between and within the processes of SC and PC. Since the case study at DEKRA is done by participating in the organization, the design also relates to participatory action research. As stated by Whyte (1991), this type of action research "involves practitioners in the research process from the initial design of the project through data gathering and analysis to final conclusions and actions arising out of the research". For clarity, the terminology in this research will be stating that a 'case study' is done at DEKRA. However, this refers to a participatory research of the researcher within DEKRA. On the basis of the case study, a method can be established for the harmonization-based redesign of different business processes.

Research goal
The goal of this research can be formulated as follows:

The goal of this research is to provide organizations struggling with alignment of business processes with a structured method to redesign different business processes in a harmonized manner.

Next to providing DEKRA Certification with the structured method, the sub-goal during the case study is to provide the organization with suggestions for improvements in order to harmonize the processes of System Certification and Personnel Certification.
Another sub-goal is to conduct a limited validation session of the method to a different business line. In this case it will be possible to state more precise directions for further research.

3.3 Research questions

This section explains the research questions (RQs) for this research. Project deliverables will be described afterwards. The RQs are defined by using the information from the initial phase of this project and the model of Romero et al. (2012c) that is used as guideline through this research.

Looking at the goal of this research, a structured method should be developed, which leads to the following **main research question**:
What kind of framework (such as a model, a stepwise approach or practical guidelines) could provide a structured method in a harmonization-based redesign of different business processes?

A framework will be developed and will include practical guidelines or a stepwise approach and should help managers of other service areas or other organizations in optimizing the processes by harmonization. The aim is to generate a structured method with essential steps for redesigning different business processes in a harmonized manner. To answer the main research question, three sub-research questions for the case study are formulated. The first RQ focuses on the part in the main research question about different business processes. It is important to know what differences can be found in the processes. The second RQ deals with the influencing factors of harmonization, which relates to the harmonization-based approach used in the main question. To complete the answer on the main question, RQ3 focuses on actions of improvement and the effect on the level of harmonization. The essential steps and insights in the effect on harmonization can be used to develop the structured method. The RQs are described in more detail next.

(RQ1)   *What significant differences and similarities can be detected when analyzing the business processes by using an appropriate process modeling technique?*
First, an appropriate process modeling technique will be selected, which will be the tool for representing and analyzing the business processes. The different techniques, such as IDEF, UML, BPMN and EPC, will be evaluated in relation to the need and situation within DEKRA Certification. The modeling technique is used to represent the business processes. This RQ is focused on analyzing these representations and will detect the differences and similarities between and within the processes of SC and PC. It is also the first step in developing structured and more clear process descriptions for DEKRA.

(RQ2)   *To which extent are the influencing factors of harmonization (from the conceptual framework of Romero et al., 2012c) present at DEKRA Certification and how could these factors give focus to the redesign of the business processes?*
This part will be the identification and specification of the influencing factors on harmonization. Romero et al. (2012c) did a study on different factors and made a framework, which is fairly conceptual. This RQ focuses on analyzing and mapping the influencing harmonization factors to the organization under research. This will answer how and to which extent the factors are influencing

the processes at DEKRA Certification. By linking this to the organization goals, areas of focus can be defined which will give direction for the redesign of the processes.

(RQ3)   *What actions should be taken in order to eliminate differences, harmonize the business processes and optimize the organization of DEKRA Certification, and what is the effect of these actions on the level of harmonization?*

This RQ tries to find solutions on how to optimize the business processes. The outcomes generated by the modeling analysis and the most influencing factors are used to describe the areas of improvement. This will harmonize the processes and could solve the issue of uniformity. Furthermore, an evaluation will be done on how the actions affect the level of harmonization. The result of this evaluation can be used as input for answering the main research question.

Project deliverables

The main project deliverable is the following:

➔ A structured method which can be used to help optimize business processes within or between the other service areas (for DEKRA: Product Testing & Certification, Component Testing & Certification, Certification of Medical Devices, Explosion & Safety) or in other organizations. The method will be validated by examining a different business line.

Furthermore, the following deliverables are expected for the company and for the research:

➔ New process models of the business processes under research; SC and PC. This will be done according to an appropriate process modeling technique;

➔ Insights in the level of harmonization of current processes, and clarification of the factors influencing this harmonization, which will give a focus for the redesign of processes;

➔ Insights in the inefficiencies, differences and similarities within and between the processes of SC and PC, and actions that DEKRA should take in order to improve the efficiency.

Project scope

The scope of the research project is as follows:

➔ Time boundary: the project must be executed within 21 working weeks. The planning of the master thesis project is shown in figure 7;

➔ Theoretical boundary: the project uses a theoretical framework from Romero et al. (2012c), which has not yet been validated by other researches. The advantage is that this research is innovative in the sense of bringing new views into the scientific world of harmonization;

➔ Project boundary: the project will focus on the service area Systems Certification, including the business processes of Personnel Certification. Developed process models and suggested actions of improvement will therefore be for the processes of SC and PC. The other service areas are outside the project boundaries, due to the fact that there is no link with the initial assignment within PC;

➔ Company boundary: the project depends on the cooperation of the company. An example is the evaluation of the actions for harmonization; If DEKRA does not, or not in time, implement the suggested actions, the evaluation of the harmonization can only be based on an expected change of the harmonization level. The aim is to give an evaluation which is as complete as possible.
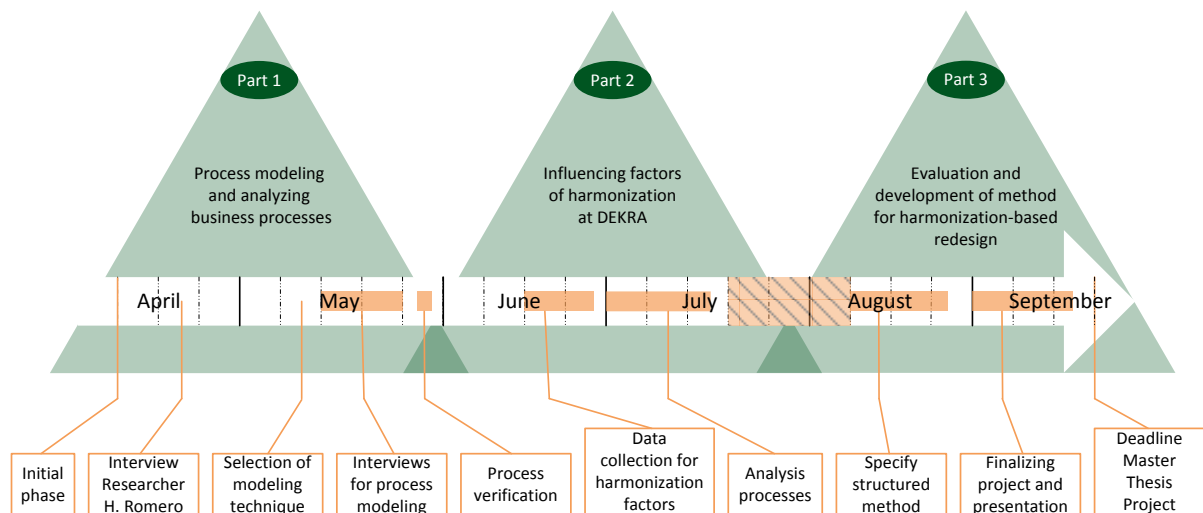
Figure 7. Week planning of the Master Thesis Project

3.4 Research methodology

From the initial phase, it became clear that there is a need for a redesign in processes within DEKRA. However, a full fundamental redesign of business processes would be too radical. It also became clear that using the harmonization model of Romero et al. (2012c) would gain a focus that is needed in order to know where to start redesigning the processes. Next to that, it can indicate to which extent the processes should be harmonized. The research methodology of the project is described in this section and gives more information on how the research questions will be answered and how the harmonization model is used in this research. To structure this, a closer look is taken to the BPR phases defined by Covert (1997). The first three phases have been done internally at DEKRA; section 2 describes the need for redesign and that the BPR opportunity is identified at the processes of SC and PC. For this research, phase 4 will be the starting point. Also, phase 7 is a part that will be done by DEKRA and is outside the scope of this research. So although not every phase is followed exactly and it is merely used as guideline, it creates structure to the rest of this research. This structure is depicted in figure 8, illustrating that this research consists of three parts relating to the research questions. It is also shown how it relates to some of the BPR phases and where the model of Romero et al. (2012c) is used to obtain a focus within the project.
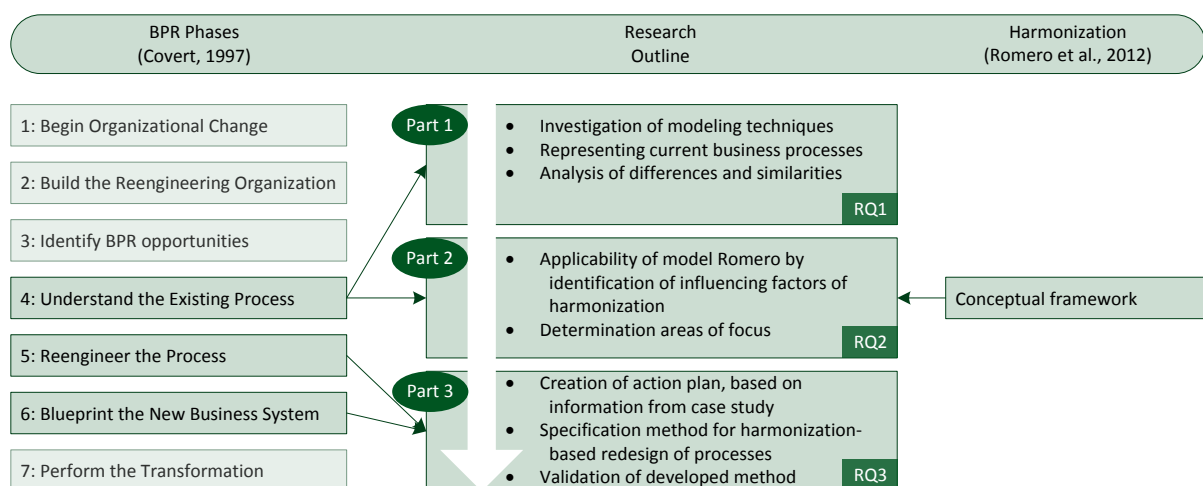
Figure 8. Outline of the research on harmonization, relating to BPR and harmonization

The case study that is conducted at the organization serves as a means to validate specific parts of the research, such as further specification and validation of influencing factors of harmonization and evaluation of actions to harmonize real-life business processes. By participating in the organization,

it becomes possible to gather insights and information that can be used for the development of a structured method for the harmonization-based redesign of business processes. This relates to the earlier mentioned participative action research. How this will be done is described next.

The first part of the research relates to phase 4 of BPR; understand the existing process. Due to the fact that the process descriptions of SC and PC differ and are not comparable, it is needed to model the current processes into a similar format. Therefore, this part will start with an in-depth investigation of different existing process modeling techniques discussed in a previous literature review (van Gils, S., 2013). Different criteria are established, depending on the situation of DEKRA. First, it must be clear what criteria are important to this research and to DEKRA, before the techniques will be compared in a comparison matrix. Criteria will be selected in cooperation with the mentor within the company, who is a business development manager and involved in the processes of System Certification. The chosen technique will be used as a tool to represent the current business processes of SC and PC. The data collection will include analyzing the existing flowcharts and documents in QMS and interviewing different employees. The desk-research will be done prior to the interviews, so that the interview questions can be based on already gathered information. Again, this mixture of desk-research and interviews will gain information on what is documented, added with empirical experience of employees working with it. The process models will be validated by planning a discussion with several employees, where the process will be verified step by step. Relevant employees include at least a manager and employees from different clusters. Next to validating, another reason to involve employees is that this will increase support for the implementation of new process models or the changes that will result from the harmonization. Once the process models represent the processes of SC and PC correctly, an analysis will be done on the differences and similarities of those processes. This analysis will consist of following the dataflow of both processes and check where actions differ. Also, visual checks of the process models will give insights in the differences and similarities.

The second part of the research also relates to the fourth phase of BPR. However, now the model of Romero et al. (2012c) is used. This part deals with examining the organization by focusing on the contextual factors that influence the harmonization of business processes. From here on, the contextual factors are being referred to as influencing factors, since the factors influence the level of harmonization to some extent. Further investigation will be done on the influencing factors from the study of Romero et al. (2012c), such as legal regulations, organizational structure and process type. The factors stated in their research, are quite abstract and perhaps not all relevant for this research. Therefore, the factors will first be identified and specified. The aim is to find out how to measure them (operationalize) and what the effect is on the level of harmonization. In order to reach this, literature will be consulted on which the research of Romero et al. is based. Next to consult the meaning, every factor will be checked on whether the measurement is quantitative or qualitative and how exactly one can measure the factor at an organization. This will also identify the factors clearly. Furthermore, the questionnaire that Romero et al. uses as a tool to gather information about the factors, will be used in this research for the same goal. Next to this similar goal, it will also be useful in the sense that developing a measurement tool can be left out of the scope of this research. However, to use the questionnaire correctly, it must be understood well by the researcher. Therefore, a semi-structured interview will be planned with the researcher H. Romero. In this interview, the questionnaire will serve as a guideline. Namely, for every question in the questionnaire, it is being asked what the researcher wants to measure, what the relation is with the factors and how the result can influence the level of harmonization in the business processes of an organization. With this insight in the factors, it will be possible to select relevant factors to investigate within the company. The factors that have no relationship with the business processes of SC and PC, will be left out of the research. This is being checked by the unit of analysis, defined as "the major entity that is being analyzed in a study" ("Unit of Analysis", n.d.). Romero et al. use the

unit of analysis to split the questionnaire into three parts; (1) organizational level; (2) organizational unit, and (3) process level. The major entity for the analysis in this research will be the business line Systems Certification of DEKRA. Depending on this, the relationship with the factors can be outlined, and irrelevant factors will be omitted from further research.

To gather information, the questionnaire will be conducted to several employees within SC. The information will be registered in an Excel file in order to make appropriate calculations. Furthermore, desk-research will serve as addition to the information gathered from the questionnaire. This desk-research will include analyzing business reports and company related presentations. Lastly, empirical evidence will be valuable when describing the influencing factors.

With the results, a description of the influencing factors of the processes of SC and PC, an indication can be made about the influence of those factors on the level of harmonization, in terms positive and negative. This will be based on the relationship between the factors and the level of harmonization, as defined by Romero et al. (2012c). From the overview of influencing factors, the factors with a negative influence on the level of harmonization and that are not in line with the organization goals, will form the areas of focus. These areas of focus will be used in the improvement of the business processes of SC and PC.

The final part of the research relates to phase 5 and 6 of BPR; it gives suggestions for redesigning the processes and provides DEKRA with new process descriptions. For the focus on harmonization, an analysis of every area (negative influencing factor from the previous part) is made on what can be done in order to increase the level of harmonization caused by that factor. This will be done on the basis of best practices in BPR (Reijers & Liman Mansar, 2005), principles of BPR (Covert, 1997) and on empirical work of the researcher, and will be incorporated in an action plan for DEKRA. DEKRA can use this action plan in order to eliminate differences and harmonize the business processes of SC and PC. Next to that, new process models will be developed for PC. Previous interviews and desk-research on the current situation discovered that documents regarding procedures and work instructions of PC differ from the documents within SC in term of lay-out, terminology and language. Further on, the procedures and work instructions of PC are outdated, which gives reason to develop new process models and associated documents for PC. Also, the areas of focus should be held in mind when developing this material.

Furthermore, this part will evaluate the information gathered during the research at DEKRA. The important actions that are done will be reviewed and evaluated on the importance of their contribution to the project. It will be checked what aspects played a significant role in the harmonization of business processes. This will give a clear view on what the basic actions should be in order to perform a harmonization-based redesign project. Furthermore, literature on harmonization is being reviewed once more. This applies especially for the work of Romero et al., because their model serves as a guideline in this research. Therefore, important relationships, tools (such as the questionnaire) and hypotheses are being reviewed in order to decide how to use them in a structured method for the harmonization of business processes. Altogether, this information will be the input for the specification of the method, and will be presented in this research. In order to validate the developed work, another business line is being analyzed with a similar method as used for SC. However, due to time limitations, this will not be as profound as at SC. The same questionnaire will be conducted at the business line Explosion & Safety to gain insights in the important influencing factors. On the basis of this quick-scan, an expectation will be made on the possibility to use the developed method for the harmonization of business processes at the other business line. This expectation will be based on a comparison of the two business lines Systems Certification and Explosion & Safety. With this final part of the research, an answer can be given to the main research question and will therefore reach the goal of providing a structured method to redesign business processes with a focus on harmonization.

4   Modeling the processes

This section describes how the current processes are modeled. As stated by Pardo et al. (2012), "one comparison technique widely used for harmonizing models is mapping. Mapping is necessary from the point of view of the differences between models (structural and semantic)". Since the process descriptions at DEKRA differ from each other, a proper comparison will be difficult. Therefore, an appropriate modeling technique is chosen to map the current situation in detail. This contributes to the research goal by supporting the first research question of analyzing the processes on differences and similarities. The modeling of processes is done on the basis of desk-research and interviews. The last paragraph defines similarities and differences between the processes of SC and PC.

4.1   Selection of an appropriate modeling technique

This part explains the procedure of selecting a modeling technique. There are many existing techniques and only a few are suitable for analysis and optimization of business processes (Vergidis, Tiwari, & Majeed, 2008). Therefore, several process modeling techniques have been studied in a previous done literature review (van Gils, S., 2013), in which the purposes of the techniques and their advantages and disadvantages became clear. In order to make a grounded decision on the modeling technique, selection criteria are being established on which the decision can be made. According to Kelemen (2013), aspects such as intelligibility, coverage of process elements, ability of expressing workflow patterns and the widespread in different areas can be considered. However, the modeling role occupied by the modeling stakeholder (e.g. process modeler, model user, process modeling coach) and the modeling purpose (e.g. to analyze a process, to document a process, to improve a process), could be factors to consider as well (Recker, Indulska, Rosemann, & Green, 2009). In literature, more different criteria are being discussed and are reviewed in the literature review (van Gils, S., 2013). In a meeting with the Business Development Manager of DEKRA, who is involved in the processes of SC, relevant criteria are chosen to evaluate the different modeling techniques. These criteria are described next, together with the minimum requirements that the modeling technique must have and the aspects that will not be desirable.

Classification of modeling techniques

Vergidis et al. (2008) classify modeling techniques in three sets; mathematical models, diagrammatic models and business process languages. The need for a certain type of technique based on this classification, or a combination of it, is one of the criteria. For DEKRA, a possibility for mathematical analysis is not needed in the near future. Also, the current IT infrastructure will possibly not support mathematical process models. Next to that, the purpose of the models includes communicating the standard process and its deviations to contractors, new employees, etc.

➔   Criterion: Classification.

➔   Minimum requirement: Technique should be classified in diagrammatic models, perhaps in combination with a business process language in order to make an analysis for this research.

➔   Undesired aspects: A technique classified in mathematical models.

Modeling perspective

The type of modeling approach could also depend on the perspective of the model. Those perspectives distinguish representations of elements that include "what activities constitute the process, who performs these activities, when and where the activities are performed, how and why they are executed, and what data elements they manipulate" (Giaglis, 2001). Curtis, Kellner and Over (1992) present the following perspectives:

1. The *functional perspective* represents *what* process elements (activities) are being performed;

2. The *behavioral perspective* represents *when* activities are performed (for example, sequencing) as well as aspects of *how* they are performed through feedback loops, iteration, decision-making conditions, entry and exit criteria, and so on;

3. The *organizational perspective* represents *where* and *by whom* activities are performed, the physical communication mechanisms used to transfer entities, and the physical media and locations used to store entities;

4. The *informational perspective* represents the informational entities (*data*) produced or manipulated by a process and their interrelationships.

For DEKRA it is important to see what activities are being performed and which department participates in that activity. In this manner it is possible to detect inefficiencies in the process.

➜ Criterion: Modeling perspective.

➜ Minimum requirement: The technique should have a functional perspective. An additional organizational perspective is preferred.

➜ Undesired aspects: A behavioral perspective will go beyond the purpose of the models, and is therefore undesirable. The informational perspective is probably too much focused on data and will not be sufficient for this research.

Orientation

Giaglis (2001) amongst others makes a distinction in the basis of the flow of the process diagrams, which could be e.g. activity-based or object-oriented. To keep a uniform terminology, this research uses the classification of business process architecture design approaches by Dijkman, Vanderfeesten and Reijers (2011). The authors made this classification based on the literature and are briefly explained below.

▪ Goal-based approach. The business process architecture is derived from a goal structure, consisting of business goals and relations between those goals.

▪ Action-based approach. Has an action structure, consisting of business actions and their relations. The business action is a loop of activity in which a provider completes some work.

▪ Object-based approach. The business process architecture consists of a business object model with business objects that exist in the organization, as well as their inter-relations.

▪ Reference model based approach. Here, an existing business process architecture (the reference model) is re-used and adapted to design a new business process architecture.

▪ Function-based approach. The business process architecture consists of a function hierarchy, and includes business functions such as procurement or production.

The Business Development Manager states that action-based and function-based will probably the most clear options within DEKRA. In the current procedures of SC, actions are described step by step and different functions (business roles) are already stated. It is preferred that the procedures of PC would be similar to those of SC. Furthermore, a reference model based approach would be useful in the sense that different processes can be based on a re-usable model.

➜ Criterion: Orientation.

➜ Minimum requirement: Action-based approach and function-based approach. The reference model based approach is additional.

➜ Undesired aspects: The goal-based and object-based approaches are irrelevant to the purpose of the models.

Degree of completeness

According to Recker et al. (2009), a limited scope of coverage of the modeling technique will decrease the relative clarity. Due to the fact that the current process models of SC lacks structure and clarity, there is need for an approach that provides clear descriptions of the modeled domain. A useful criteria used by Recker et al. (2009) is the degree of completeness, which is the extent to which process modeling techniques are able to provide complete descriptions of a real-world domain. It is preferred that the degree of completeness is as high as possible, but also depends on the next criterion; the level of detail.

➜ Criterion: Degree of completeness.

➔ Minimum requirement: An average degree of completeness, relative to the other techniques. It is preferred that the degree of completeness is as high as possible.
➔ Undesired aspects: A low degree of completeness, relative to the other techniques.

Level of detail

The degree of completeness is not available for every approach under research. Therefore, another criterion is the level of detail and will be evaluated together with the degree of completeness. The Business Development Manager believes that the process models must be in such a detail that every obligatory step according to the ISO rules and regulations is modeled. Next to that, steps that require attention in order to reach more efficiency must be modeled in more detail as well. The techniques are classified in "low", "moderate", and/or "high", which is based on findings in the literature.

➔ Criterion: Level of detail.
➔ Minimum requirement: A moderate level of detail. A higher level of detail is preferred.
➔ Undesired aspects: A low level of detail.

Area of use

To align the purpose of modeling the processes at DEKRA with an appropriate modeling technique, the criterion *area of use* is focused on the goals of the techniques, partly based on the framework of Giaglis (2001). Mainly communication, modeling analysis and process improvement will be relevant for DEKRA.

➔ Criterion: Area of use.
➔ Minimum requirement: Communication is a minimum requirement, because this is the main purpose for DEKRA. Modeling analysis and process improvement will be preferred in order to reach the goals of this research.
➔ Undesired aspects: Simulation is unnecessary. Due to the fact that simulation requires different approaches, this aspect is not desirable.

Cultural aspect

A last, more soft, criterion is the cultural aspect of the modeling approach. The representations of the processes must be easily understandable, simple, clear and structured. This gives a low barrier for employees to refer back to the process descriptions. Furthermore, this leads to a more accessible method of improving business processes, as managers can detect inefficiencies in the processes in the future as well. Findings are deducted from literature, such as Recker et al. (2009) and Giaglis (2001).

➔ Criterion: Cultural aspect.
➔ Minimum requirement: Understandable and simple process models.
➔ Undesired aspects: Process models that will be difficult for the employees to understand.

These criteria are evaluated for modeling techniques Flowcharts, IDEF, RADs, BPMN, BPEL, EPC, UML and Petri-nets. The selection criteria matrix can be found in appendix II. The last row shows positive and negative signs for that specific modeling technique. It can be seen that IDEF and Petri-nets score very low, due to a different focus (simulation) and no relation with the culture that demands simple and understanding representations. Techniques as Flowcharts and BPEL are excluded due to a low level of detail. RADs, EPC and UML are all useful techniques, but have a few negative points. RADs are more organizational and very function-based diagrams. EPC has a low degree of completeness and is, according to Recker et al. (2009) intended for a restricted set of modeling purposes. Further on, UML is object-based and could provoke difficulties for the communication purpose of DEKRA. The final approach, BPMN, suits every evaluated criterion. This technique has a high degree of completeness and possibilities of model processes in detail. Furthermore, the Business Development Manager agreed on the understandability of a BPMN example model. However, although BPMN can

be expected to lead to quite complete representations of real-world domains, Recker et al. (2009) advocates that process models could potentially become unclear and ambiguous. It is, therefore, suggested that the possibility of making extra efforts to bring knowledge external to the BPMN models, need to be held in mind.

Concluding, an appropriate process modeling technique, which will facilitate in modeling useful, structured, complete and understandable process models, is BPMN. The next section is focused on conducting interviews to model the processes according to BPMN.

4.2 Interviews on process modeling

The conducted interviews for modeling the current situation of SC and PC are based on a basic representation of a process, which is shown in figure 9 (based on Giaglis, 2001). Although this is an IDEF0 notation, it defines a process in a general way; a process has a specific input and output, needs mechanisms and has controls that constrain and direct activities. Based on this model, a semi-structured interview is developed and conducted to six employees working within the main processes. Several Lead Auditors and Product Experts from different clusters were asked for this interview. The open questions of this interview can be found in Appendix III.
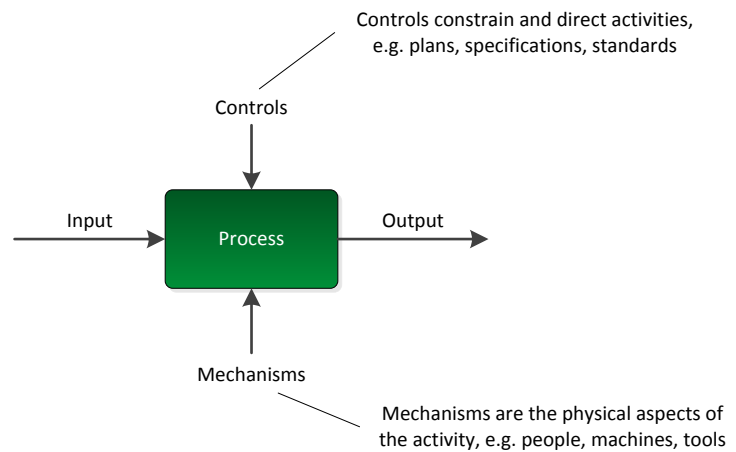
Figure 9. Basic representation of a process

4.3 Representation of processes

To model the business processes, the modeling technique BPMN is used (as from evaluation of techniques described in section 4.1). This will be done in ARIS Express, a modeling software for Business Process Management. Some important criteria were that the models should be as detailed and complete as possible, but still easily understandable for every employee working within the processes. As found in the literature, BPMN can be expected to lead to quite complete representations of real-world domains, but process models could potentially become unclear and ambiguous (Recker et al., 2009). One essential aspect dealing with this problem is the number of elements used in the process model. BPMN 2.0 uses numerous elements which are not necessary for modeling the processes of SC and PC. Therefore, the basic elements in figure 10 will be used, to keep the models structured, simple, clear and easily understandable, which is more in line with the purpose of the models.

Start Event. Acts as a process trigger. Indicates at which party the process starts.	**Message.** To show communication between two parties. This could be an Audit Package, Approval documents, etc.
Task. Represents a single unit of work that is not or cannot be broken down to a further level of business process detail.	**Data object.** To show which activity needs data. This could be a format document, a checklists, a work instruction, etc.
Exclusive Gateway. Used to create alternative flows in a process: only one of the paths can be taken.	**Data Storage.** Represents a database where data is stored, such as the ITEM Bank.
Parallel Gateway. Used to create parallel paths without evaluating any conditions.	**End Event.** Represents the result of a process. Indicates at which party the process ends.

Figure 10. Basic elements of BPMN used in the process models of SC and PC

Another aspect of BPMN is that this technique is function-based, which is relevant for DEKRA. Namely, different roles can be involved in the same process. For example, in the process of performing an audit, the project office delivers an audit package, the customer is involved in the discussion on nonconformities and the auditor performs a stage 2 audit. Every role has its contribution in the process. This gives reason to model the relevant involved roles in the BPMN process models. These roles are described in section 2.2.2.

Due to the fact that the case study is done according to participatory action research (as explained in section 3), the process models have been developed in a similar way. This started with desk-research, in which relevant documents have been studied. For SC, mainly the procedures from QMS (document names starting with 'FLOW-S') served as a basis for the process models. For PC, other procedures and work instructions (document names starting with 'QUA/ACO-P' and 'MEAN-H') have been consulted. This desk-research ensured that the researcher had more insights in the processes of SC and PC, which appeared to be useful when conducting the interviews. Due to the fact that the interviews were conducted over a period of two weeks, it was possible to constantly develop, verify and redesign the process models where necessary. For example, a process model could be developed on the basis of desk-research, verified by an auditor, adjusted where necessary and again be verified by a different auditor. This has led to multiple checks on the process models and verifications by different employees in the organization.

Three examples of the process models of SC can be found in Appendix IV, starting with an overview of the modeled processes, followed by the main process and two examples of the supporting

processes of SC. Appendix V includes also an overview of the modeled processes and three examples of the current processes of PC; the main process and two supporting processes.

4.4 Differences and similarities

This paragraph describes the results of analyzing the processes that were modeled in the previous section. Figure 11 visualizes how the processes of SC and PC relate to each other. This section is divided on the basis of this illustration. The left side illustrates that the processes can be divided into a part for elements of SC only, and a part for elements that are only present in the processes of PC and not in SC. These two separate parts describe the differences between the processes of SC and PC, and will be discussed first. The right side of figure 11 shows the intersect between the processes. Here, the focus is on the similarities in processes of SC and PC and will be discussed in the second paragraph.
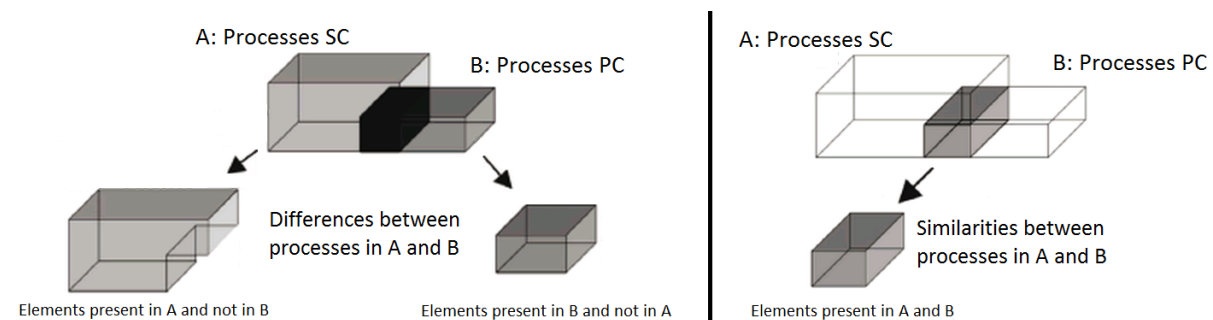
Figure 11. Differences and similarities in processes of SC and PC (basics adopted from Pardo et al., 2012)

4.4.1 Differences between processes of SC and PC

As earlier stated in this report, one of the greater differences between SC and PC is the end-customer. For SC, the customer is directly related to DEKRA; a company asking for certification of their management system. However, the end-customer for PC is the person who wants to be certified, but the examination of this person is being outsourced to different Examination Institutes. Therefore, the processes differ between SC and PC due to the activities that needs to be done.

Activities that are required in the processes of SC, but not in PC, are at least the following:
- Processing the audit package;
- Performing a special audit;
- Performing an assumption audit;
- Processing a decertification;
- Processing the Checklist Certification Manager.

On the other hand, there are activities required in the process of PC but not in SC, which are:
- Reviewing a location where examinations are being held;
- Reviewing an examiner;
- Reviewing theoretical exam questions and material for practical examinations;
- Attendance of an examination;
- Developing a certification scheme;
- Maintain a certification scheme;
- Selecting appropriate examination institutes;
- Evaluating examination results of candidates;
- Certifying candidates that proved to meet the requirements;
- Performing corrective actions on a certificate owner;
- Performing corrective actions on an Examination Institute;
- Analyzing the validity and reliability of certification.

4.4.2 Similarities between processes of SC and PC

Although processes of SC and PC differ in many ways, there are some similarities. On top-level in particular, processes regarding the audit of the ISO norms are quite similar. Both SC and PC are auditing an organization on ISO norms. Differences can only be found when going into more detail about which certification scheme is being audited, but how it is done is in terms of process the same. Therefore, similarities in processes are the following:

- Performing an initial ISO audit;
- Performing a surveillance ISO audit;
- Performing a recertification ISO audit.

Concluding, after the modeling and analyzing the business processes of SC and PC, it is discovered that there are a number of differences that are due to the fact that different activities have to be done for a different type of end-customer. Especially, the details of activities are based on different types of certification schemes. However, on a more general level, both SC and PC are performing audits regarding the ISO norms. These activities are similar, but the existing process descriptions are different between SC and PC.

In section 6, these differences and similarities will be input for optimizing the processes. Namely, eliminating and adjusting these differences is one of the aspects in harmonizing the business processes. First, in the next section, the focus is on identifying the factors that influence the level of harmonization of the business processes at SC and PC.

5 Influencing harmonization factors

As explained in the research design, one part of this research is to identify and specify the factors that influence the level of harmonization at DEKRA. Romero et al. (2012c) present a conceptual framework and state:

> It can be used from a practical perspective to get an overview of the factors that must be taken into account when engaging in a process harmonization project and the effect that those factors have on the success of that project and the subsequent potential to gain performance benefits. (p. 3)

This section applies the framework with the aim of getting an overview of the factors that influence the business processes at DEKRA. The first step in getting this overview is to operationalize the factors found by Romero et al. (2012c). This will be done according to an interview conducted with the researcher H. Romero. This is necessary, because the factors stated in their research are quite abstract. The factors and their measurement method are described in the first paragraph. Section 5.2 describes the method of information gathering, which consists of desk-research, notes from previous interviews and a new conducted questionnaire among 4 different employees. The results are described afterwards. The last section, 5.4, describes how the factors that are present at DEKRA influence the level of harmonization. This is done by using the relationships defined in the framework of Romero et al. (2012c). The factors that appear to have a negative influence on the level of harmonization of the processes of SC and PC will form the areas of focus, which will be used in the improvement of the business processes in the next chapter.

5.1 Operationalization

The factors described by Romero et al. (2012c) are fairly conceptual. The model that is used has been introduced in section 3.1. To operationalize the factors, a deeper investigation is done on the literature relating to the conceptual model. Namely, every factor is identified in the literature and could have qualitative or quantitative measurements. Romero et al. (n.d.) included the measurements in a questionnaire which is, therefore, useful for identifying influencing factors at DEKRA. To ensure that the questions in the questionnaire are well understood and that they measure what this case study wants to measure, an interview is conducted with the researcher H. Romero. As a pilot, the questionnaire is conducted with the Business Development Manager of DEKRA, and reviewed with H. Romero. With the information from the interview with the researcher, the descriptions of the factors and the measurement questions relating to them are given next. For every factor, the indicating measurement question(s) that relates to the factor can be found in the questionnaire that is included in Appendix VI.

5.1.1 Influencing factors

Legal regulations

This external factor consists of requirements from outside the organization, such as financial regulations, taxation regimes, import/export regulations and employment practices. Processes must be designed in such a way, that they meet the requirements. This could lead to a lower level of harmonization.

- Question O8 asks about the relevant requirements and regulations for the organization.

National / Regional culture

This external factor evaluates two criteria; Standardization versus adaptation. Standardization is used as a common approach in organizations throughout the world, while adaptation requires a different approach in each market, due to differences in culture. When there is a great difference in culture, standardization of processes will be more difficult than in an organization within the same culture. It is also stated that knowledge transfer becomes difficult across diverse cultures.

- One question in the original questionnaire (see next paragraph) indicates in which countries the organization operates, and can be evaluated by a classification of national culture.

Relationship characteristics

This external factor is an aspect of organizational differentiation and includes various factors such as power inequality, partners' financial and legal independence, and operational and cultural diversity. In this case, only power inequality is observed to lead to lower levels of harmonization when the power inequality is high.

- No specific question deals with the relationship characteristics, but can be answered through desk-research or previous done interviews.

Domain inherent expertise

This external factor involves the level of expertise and knowledge in a specific domain. In order for a harmonization project to be successful, there must be a high domain expertise and knowledge of particular issues of the organizational environment.

- No specific question is formulated regarding the domain inherent expertise, but can be answered by desk-research or previous done interviews.

IT-related factors

This internal factor focuses on the IT landscape and the management of this. In harmonizing business processes, a centralized IT governance is preferred over a decentralized governance. Also, fewer legacy systems, a centralized IT decision making unit and the same systems for similar processes will have a positive effect on the level of harmonization.

- Questions U5 and U6 discover the IT-related factors.

Organizational structure and corporate governance

This internal factor analyzes how a hierarchical network based on both vertical and horizontal relationships facilitate the centralization of decisions. The operationalization is based on two concepts: Centralization, which is about decision making, and formalization, which is the extent to which work roles are structured and activities are governed by procedures. A stronger hierarchical network and a higher extent of formalization will lead to a higher level of harmonization.

- Question O9 consists of multiple sub-questions to explore the extent of both concepts quantitatively.

Managerial practices

This internal factor is about increasing process variants when an organization deals with mergers, acquisitions and outsourced business processes. More of these managerial practices will lead to a lower level of harmonization.

- Question O7 verifies how many times the organization has been merged with or bought by another company.

Different locations

This internal factor examines different locations. An organization having multiple locations will have more difficulties in harmonizing business processes than an organization with just one location. This has partly to do with the cultural differences. Namely, personal differences are shaped by the cultural background.

- One question in the original questionnaire (omitted; see next paragraph) is about the number of locations and can be useful to compare results of different countries.

Different products / services

This internal factor explores the number of different products or services that an organization produces. More different products / services (e.g. due to mergers between organizations) will create more variations in the supporting processes, and thus a lower level of harmonization is reached.

- Question U1 and U4 are about the implications of producing different products or services.

Personal differences

This internal factor, also classified as immediate factor due to the fact that it is directly related to the process under study, explores whether personal differences like tacit knowledge makes it more difficult to harmonize processes. More employees with the same (low) experience with explicit and high procedural knowledge will lead to a higher level of harmonization.

- Questions U2 and U3 investigate whether different roles are needed for different products/services. The personal difference per process variant is not analyzed (explained in the next paragraph).

Process type

This internal factor, also classified as immediate factor due to the fact that it is directly related to the process under study, defines the nature and the characteristics of the process. A process can be primary or a supporting process. It also defines the level of routine and distinguishes between repetitive or unique processes. Non-routine processes are expected to lead to a lower level of harmonization.

Further on, the maturity level of processes appeared to have a correlation with the level of harmonization. Organizations which performed better on standardization initiatives, have at least a moderate level of process maturity.

- Due to the fact that the third part of the original questionnaire is omitted, no questions regarding the type of processes (routine, non-routine, primary, supporting, etc.) are asked. However, this can be answered using desk-research or previous done interviews.
- Furthermore, question U7 consists of sub-questions to measure the level of maturity.

5.1.2 Unit of analysis

In the conceptual model, a distinction is made between external, internal and immediate factors. For uniform descriptions of the influencing factors, it needs to be clear what the unit of analysis is. The unit of analysis, as defined earlier in this report, is the major entity that is being analyzed in a study, and is used by Romero et al. (n.d.) to split the questionnaire into three parts; (1) organizational level; (2) organizational unit, and (3) process level. In this way, it is possible to ask questions regarding the factors that influence a specific level in the organization. It is decided to analyze the Business Line Systems Certification and thus to choose this as unit of analysis. This has several reasons. First, Personnel Certification is a cluster within SC. Therefore, the factors could apply to PC or to the processes of SC. Secondly, the internal factors relate to the Business Line, which makes it easier to compare these factors with other Business Lines. As a third reason, the external factors will now apply to DEKRA Certification B.V., which is an organization by itself. This means that there will be a possibility for comparison with other organizations on external factors. These comparisons can be important when presenting a structured method for the harmonization of business processes; it will only be valuable if this model can be used in other Business Lines or organizations, and therefore, comparison must be possible. However, for more insight in the SC, also external factors for this Business Line will be evaluated.

Omitting factors

Based on the unit of analysis, it is discovered that not all factors will be relevant. Both *National / Regional culture* and *Different locations* are of importance when the organization operates on a global scale. This case study only takes DEKRA Certification B.V. into account (and is even more focused on lower level processes), which is only located in The Netherlands. Next to that, the aim of this case study is not to compare organizations on an international scale. Concluding, both factors are out of scope. The questions regarding these factors are deleted from the original questionnaire.

Adaptations of the original questionnaire

Next to omitting the questions regarding two irrelevant factors, other changes have been made to the original questionnaire. Some questions have been rearranged to have an improved sequential

interview, which is easier for the interviewee to understand. Furthermore, the questions are formulated to be applied for SC, as it was for a procurement department originally. The content and meaning of the questions is not changed. Finally, the last part of the original questionnaire has been omitted, due to the fact that this was focused on specific variants on process level, whereas for this case study, it is not necessary and not possible in terms of time to evaluate details of influencing factors for variants of specific processes.

The final version of the questionnaire used in this case study can be found in Appendix VI.

5.2   Gathering information

To gather information, results from previous interviews and desk-research is used, such as interview notes, company presentations and financial figures. This is done for questions on organization size, IT related questions and different products/services. For questions on the organizational structure (centralization and formalization) and the maturity level of processes, in total 4 questionnaires have been conducted. To have a hierarchical balance in results, 2 managers and 2 sales employees have been approached for this questionnaire. The results are discussed in the next paragraph.

5.3   Results

This paragraph describes the results of the questionnaire and the desk-research on the influencing factors on the level of harmonization at the Business Line SC of DEKRA.

The size of SC can be classified as medium. Answers on Q3, Q4 en Q5 result in a medium organization. The Business Line has employed just over 50 FTE, a turnover of 10,2 million euro but a total annual balance sheet of under 5 million. Looking at the answers for DEKRA Certification, this can be classified as a large organization. The *legal regulations*, such as financial requirements, taxation regimes and employment practices, are the same as for other Business Lines. However, for every Business Line several different requirements are appointed by the government of different ministries. Next to that, SC is ISO certified, which comes with requirements on systems and numerous quality management procedures. Looking at the *relationship characteristics*, there exist power inequality between SC and their customers, what could have an effect on the processes. An explanation is that the customer wants to get ISO certified by DEKRA, but can state their own deadlines. Namely, a company could take more time to get ready for an initial audit. The planning of SC is therefore subject to change, out of SC's control. This has a result on the processes, as procedures could not be followed as they should be. However, other aspects that characterize the relationship are partners' financial and legal independence, and operational and cultural diversity (Romero et al., 2012c). It appeared not significant that these aspects would have an influence on the processes of DEKRA. The last external factor is *domain inherent expertise*, and is for SC probably medium. There is enough expertise regarding the specific domains and it is expected that this will not influence the level of harmonization in a positive or negative way.

The organization has been merged; formerly it was KEMA Quality. This could indicate that more different process variants exist. Looking at the IT landscape, it can be stated that it consists of numerous individual systems which are sometimes unusable for similar business processes. Although the management of IT and decisions regarding higher-level IT is centralized, the high number of different systems will have a negative effect on the level of harmonization. The factor *different products/services* will also affect the level of harmonization at DEKRA. SC has about 50 different services for their customers in various market segments. Consequently, several different roles are needed for the different services. This is because the difference in knowledge, experience, qualifications and capabilities of the employee, which relate directly to the factor *personal differences.* The different services need dedicated auditors and product experts qualified for that specific service. The same applies to PC, where about 60 different services exist.

Furthermore, the conducted questionnaire contained 11 sub-questions on centralization and 14 sub-questions on formalization, both assessing the factor *organizational structure and corporate governance*. Due to the fact that a 5-point Likert scale and a 4-point Likert scale are used simultaneously, the values are normalized. The score for centralization is 0,47, which is a moderate score. It means that there is no extreme hierarchical network that would increase the level of harmonization. On the other hand, this moderate score indicates no negative effect on the level of harmonization. Looking at the score for formalization, 0,59, it could be classified as above moderate. Employees state that their Business Line is fairly formalized and that procedures exist. However, these procedures are not always followed. This is also noticed in the scores for the maturity level. A maturity level of 3 is reached, where after the scores decrease again. This indicates a defined process, with standardized procedures and a proactive organization. The decreasing scores for level 4 and 5 indicate that no real performance measurements are used to gain benefits from the standardized process. An overview of the calculation sheet is included in the Appendices (Appendix VII). A note should be made that these are scores regarding SC. Comparing this to the processes of PC, it can be stated that only level 1 or 2 of process maturity will be reached. This is because the process is unpredictable, but has repeatable practices. It is managed, but processes are ad-hoc and their outcomes are not always consistent.

The last influencing factor is *process type*. This has, like organization structure, a relation with the maturity level of processes. The level of maturity is defined/standardized for SC. Most of the processes are routine work. There exist a main process for SC and is supported by several repetitive processes. Ad-hoc processes are defined, but treated in their own way depending on the employee, which makes this part unpredictable.

5.4 Effect on level of harmonization

The results of the previous paragraph are briefly summarized in table 1. It describes for every factor, the influencing effect that it has on the harmonization of processes, both for SC and PC. This is obtained by reviewing the results of the previous section and by using the table provided in Romero et al. (2012c), which indicates the relationship between the factors and the level of harmonization. It defines aspects of low harmonization level processes and aspects of high harmonization level processes for every factor, based on findings in the literature. Further on, the framework of Romero et al. (2012c) indicates the type of relationship, i.e. a positive or a negative effect. The effects are shown in the table below. Next to positive and negative, the factor could also have a negligible effect on the harmonization, indicated as 'none'. Based on the relationships, the influencing factors that have a negative (decreasing) effect on the level of harmonization are described afterwards. Most influencing factors apply also to PC and, therefore, an expectation of the effect on the processes of PC is also given.

Table 1. Effect of influencing factors on the processes of SC and PC.

Influencing factor	Effect on harmonization level SC	Effect on harmonization level PC
Legal regulations	Negative; requirements of ministries and ISO norm	Negative; requirements of ministries and ISO norm
Relationship characteristics	None; only initial planning depends on customer	None; only initial planning depends on customer
Domain inherent expertise	None; expertise is inherent on domain	None; expertise is inherent on domain
IT-related factors	Negative; high number of different systems	Negative; high number of different systems
Org. structure / governance	Positive; medium centralization, above medium formalization	Unknown, due to questions that only applied to SC
Managerial practices	Positive; low number of mergers	Positive; low number of mergers
Different products / services	Negative; high number of different services	Negative; high number of different services
Personal differences	Negative; differences in knowledge, expertise and qualifications	Negative; differences in knowl., exp. and qualifications
Process type	Positive; moderate level of maturity and routine processes	Negative; low level of maturity and ad-hoc processes

Concluding from table 1, factors that have a negative influence on the level of harmonization of the processes are:

- Legal regulations. Next to requirements that apply to other Business Lines, SC and PC must meet the requirements that are specified by government of ministries and the Dutch Council for Accreditation. For example, the processes of PC must meet the requirements defined in ISO/IEC 17024:2003 (the new norm, ISO/IEC 17024:2012 becomes effective in 2015), in order to be certified as a body for the certification of persons. The different requirements for SC and PC lead to difficulties in the harmonization of processes;
- IT-related factors. The IT-landscape of SC consists of multiple individual systems that are not being used for similar processes of PC. This leads to a low level of harmonization between the processes of SC and PC;
- Different services. Both SC and PC deal with a high number of different services. Different services deviate from each other, which makes it difficult to define a harmonized process for every service;
- Personal differences. This relates to the previous factor, which also influence the harmonization of processes. The different services require personal differences in knowledge, expertise and capabilities. DEKRA assigned qualified auditors, product experts and certification managers to the different services;
- Process type. Especially for PC this has a negative effect on the level of harmonization. The level of maturity is low and processes are non-routine. Although the level of maturity is higher at SC, this influencing factor is important to this case study. Namely, the focus is on harmonization of processes within *and between* SC and PC. Giving attention to the process type of both SC and PC, the level of harmonization could be improved.

Previous described influencing factors force variation in the processes of SC and PC. This causes the processes to have differences. Looking back at the definition of harmonization, differences in processes need to be eliminated or adjusted on the basis of a strategy that fits the organization goals. This also means that the level of harmonization does not have to be increased; for some cases at DEKRA, a highly harmonized process would be inefficient or not in line with the organization goals. The following factors have no reason to harmonize the processes completely.

The influencing factor *legal regulations* decreases the level of harmonization due to differences in requirements from the government of ministries and the Dutch Council for Accreditation. The ISO requirements for PC do not apply to SC, and logically, DEKRA does not want to apply these requirements to SC. Therefore, the differences in processes caused by these requirements must not be eliminated. However, to gain more efficiency, the next section will describe the actions for PC, in order to meet the requirements of ISO/IEC 17024:2012, *general requirements for bodies operating certification of persons*.

The influencing factor *different services* and the factor relating to that, *personal differences,* decrease the level of harmonization due to differences in services. SC has services focused on management systems and PC has services focused on persons. This relates also to the difference in end-customer, found earlier in this report. Several processes, such as reviewing the examination location, are therefore specific for PC. They also require personal differences in knowledge, expertise and capabilities. These differences must not be eliminated. Hence, the level of harmonization must not be increased regarding these factors.

Factors that influence the processes and have no reason to not harmonize them, are the *IT-related factors* and *process type*. It relates to the aim of this study to find a focus in a BPR project, by using a harmonization approach. By investigating in the influencing factors and linking them to the organization goals, this focus is now found and a better view is gained in order to know where to start redesigning the business processes. Therefore, the two factors found in this section form the areas of focus in the improvement and redesign of business processes in the next section.

6 Improvement of business processes

Section 4 discovered differences and similarities of the processes of SC and PC. The previous section revealed areas of focus by investigating in the factors that influence the level of harmonization of the processes under study. This information is being used to analyze, improve and redesign the business processes of SC and PC, and is described in this section. The method of improvement is defined in the first part. Section 6.2 and 6.3 describe the improvements that have been done during this research or that need to be done, regarding the processes of SC and PC, respectively. These improvements are based on the areas of focus defined in the previous section; *IT-related factors* and *process type*. How the improvements will affect the level of harmonization is described in section 6.4. The last part is focused on additional improvements specially for PC, due to the fact that the new processes must meet the requirements of ISO 17024:2012.

6.1 Method of improvement

Reijers and Liman Mansar (2005) developed a framework for redesign of business processes. They discuss several best practices in order to improve processes, including task elimination, task composition, extra resources, specialist-generalist and task automation. Some of these best practices are used in the analysis of improving the business processes. Also, Covert (1997) provides in his phases for Business Process Reengineering some useful activities and principles that could help to improve the processes. Phase 4 for example, understand the existing process, has already been done in this research, performing the steps such as *model the current process*, *understand how information is currently used* and *understand the current organization structure*. In phase 5, the process is reengineered using principles as *several jobs are combined into one* and *work is performed where it makes the most sense*. Phase 6 consists of activities like *define the new flow of work* and *model the new process steps*. Several steps can be used in the improvement of the business processes. However, this is more focused on BPR. Looking to the definition of harmonization, it is necessary to eliminate and adjust differences in order to harmonize the business processes. Just like Romero et al. (2012c) state, "Process harmonization is the elimination of differences between processes that share the same goal in order to make them more uniform or compatible". Therefore, the information gathered in the previous sections will be analyzed; for the differences found in the processes, it is checked what can be done in order to eliminate the difference. An action plan will be created for DEKRA, and is based on the previous described best practices (Reijers & Liman Mansar, 2005), principles (Covert, 1997) or on empirical work of the researcher. DEKRA can use this action plan in order to eliminate differences and harmonize the business processes of SC and PC. Furthermore, a reference is made to the areas of focus found in the previous section, as they undesirably decrease the level of harmonization.

During the development of new process models for PC, the seven process modeling guidelines (7PMG's) will be consulted. Mendling, Reijers and van der Aalst (2010) came up with seven process modeling guidelines, which are built on empirical evidence and formulated to serve as knowledge transfer from academia to practitioners. The seven process modeling guidelines are as follows (adopted from Mendling et al., 2010):
  G1: Use as few elements in the model as possible.
  G2: Minimize the routing paths per element.
  G3: Use one start and one end event.
  G4: Model as structured as possible.
  G5: Avoid OR routing elements.
  G6: Use verb-object activity labels.
  G7: Decompose the model if it has more than 50 elements.

Next to the conducted interviews and desk-research that is already done, empirical evidence is gathered by on-site observation; joining an audit for examination attendance. Furthermore, to

receive feedback from employees working in the processes of PC, a presentation is given to let the relevant employees participate in the suggestions for improvements. This is also one of the important aspects in changing an organization, as stated by Kotter and Schlesinger (2008); "one of the most common ways to overcome resistance to change is to educate people about it beforehand. Communication of ideas helps people see the need for and the logic of change". Although the change in processes will not be as significant like an organizational change, the presentation and discussion session with the employees working in PC will be useful in providing DEKRA with a meaningful action plan.

6.2 Improvements within SC

The case study at DEKRA discovered a few problems regarding the processes of SC. This section covers the problems regarding the QMS and describes which improvements are suggested for DEKRA. Since the initial project assignment was intended for PC, more detailed improvements are evaluated for PC in the next section.

As discovered several times during the case study, the QMS appears to have numerous inefficiencies, including the following:

- The main process is unreadable. A screenshot is included in Appendix VIII;
- The cluster Inspections is not taken into account on the main screen;
- In only three steps, the second layer will show another flowchart. In the other 36 process steps, no flowchart is visualized;
- A specific referring document is inconsistent with the process flowchart;
- A specific step has an exact duplicate;
- A specific document refers to other steps in the process, but this is not shown in the process flow;
- A specific process has a loop, but is not modeled, which makes the process unclear.

Concluding, procedures are defined, but no structured overview exists. A high-level process is depicted, but is unreadable, inconsistent with the processes and misses some elements. In order to improve these inefficiencies, new process models have been modeled. Next to the models that have been made while modeling the current situation (section 4), an improved version of the main process of SC is modeled. This is done according to the 7PMG's from Mendling et al. (2010); duplicate steps are deleted and a loop is created in order to model as few elements as possible (G1), a clear start and end is included (G3) and, to increase the readability, the model is more structured (G4). Further on, the model has no OR routing elements, only exclusives OR elements (G5), it consists of elements with only one or two routing paths (G2), has mostly verb-object activity labels (G6) and has less than 50 elements (G7). The new modeled main process of SC can be found in Appendix IX. DEKRA should use this model in QMS to improve the structure, consistency, readability and understandability of the depicted processes.

6.3 Improvements within PC

Here, improvements are described for PC. This section is divided in the parts information technology, planning, QMS, standard process and other improvements.

Information Technology

In the current situation of PC, the flow of documents appears to be inefficient. It is noticed from interviews, that employees working in PC are struggling with different versions of documents and that they need to search for relevant documents required during an audit. Looking at the processes of SC, this is structured with an Audit Package sent by the Project Office, with all the relevant documents for the upcoming audit. An improvement for PC is therefore, that the processes should include Audit Packages. For every Examination Institute there should exist a Client File with documents such as the report of the previous audit, certification schemes, examiner information,

location approvals, non-conformities of previous audits, etc. From here, an Audit Package can be established for the relevant upcoming audit and can be send to the auditor performing the audit. One major aspect regarding this issue, is that PC needs a dedicated Project Office. The current Project Office of PC only performs the evaluation and certification of persons. A part of the planning is performed by a Project Office of SC. Looking at the best practices found in literature, extra resources are needed, which might increase cost, but as well increase flexibility and decrease time (Reijers and Liman Mansar, 2005). This has also to do with the best practice specialist-generalist. If the Project Office of PC will take care of the relevant documents (generalist), then the auditor (specialist) is able to focus on what he is employed for; performing the audit.

Planning

Currently, the planning of the ISO audits is done by a Project Office from SC and planning of other audits from PC is done by one of the Lead Auditors. Two of the principles discussed by Covert (1997), are *several jobs are combined into one* and *work is performed where it makes the most sense*. These apply to the suggested improvement about establishing a dedicated Project Office for PC. In that case not only processing the Audit Packages, but as well as every aspect of the planning will be performed by one Project Office, particularly for PC.

It is suggested that the Examination Attendance Audits and the Review Location Audit should be planned by the Project Office, due to the fact that the Examination Institutes are involved. For the Review Examination Material and Review Examiner, which can be done without direct involvement of an Examination Institute, are planned by the auditor itself. It is important that the Project Office plans hours for these activities. With a shared outlook location, the auditors can choose activities that need to be done, such as the review of an examiner, and perform that in the dedicated hours reserved by the Project Office. This idea of improvement is copied from SC, where some activities are performed this way, with a shared outlook location.

QMS

The fact that no structured process is visualized in QMS, has given reason to model the processes of PC. In section 4, the current situation is modeled with a main process and supporting processes. However, to incorporate the previous suggested improvements about the Audit Package and the planning performed by a Project Office, the process models have been improved. Again, this is done according to the 7PMG's. One remarkable change is that the procedure 'Inspection and Auditing of EI's', which violated guidelines G1, G2 and G4, is decomposed into the different audits and have been modeled separately. The new main process of PC is included in Appendix X. The new process models of the supporting processes are included in new, rewritten procedures for PC. The procedures are rewritten due to the fact that they appeared to be not up-to-date and different from the procedures at SC (more on this in the next section on harmonization). The format of the procedures from SC are used and completed on the basis of information gathered during the case study. The documents describing the process steps and process models per supporting process are verified by employees from PC; two Auditors / Product Experts and one Certification Manager. Their feedback has been processed, where after the final versions have been delivered to the Quality Assistant in order to include the documents in the QMS. An example of a procedure and its process model can be found in Appendix XI.

Standard process

The processes that have been modeled define the process of the domain 'STIPEL BASIS' within PC. This domain is chosen to serve as a standard process within PC, due to the fact that this is the only domain that is accredited by the Dutch Council for Accreditation. Next to that, DEKRA wants the domain 'STIPEL PCE' to be accredited as well, and is in most aspects similar to 'STIPEL BASIS'. It will therefore be easier to adjust the processes by describing additions and deviations from the standard process, in order to meet the requirements of ISO 17024:2012. Suggestions for improvement are

therefore, to design the process for other domains (STIPEL PCE, Cathodic Protection, Real Estate Agents and BTSW) on the basis of a description of the additions and deviations that are needed for that specific domain. These descriptions should be made by the appropriate auditor working in that domain. The steps in the standard process are described in a format used at SC and can be used in order to describe the additions and deviations per domain. This document is included in Appendix XII.

Other improvements

To improve the efficiency of PC, some more minor actions can be stated. These actions are incorporated in the action plan for DEKRA. A final version of this action plan is included in Appendix XIII. Next to the suggestion for improvements described earlier, minor actions include the following:

- Delete old procedures, which are now included in the new developed documents;
- Update or verify several work instructions and information in procedures;
- Communicate changes to employees of PC. This is partly done in an final presentation by the researcher;
- Clarify the appropriate location for documents of PC. Currently, different locations are being used, causing that employees use different versions of documents. It is suggested that only one location should be used to store the updated checklists, work instructions, etc.;
- Develop several required work instructions or checklists. This also relates to the requirements of ISO 17024:2012, and will be discussed in more detail in section 6.5.

6.4 Harmonization

Previous two sections described the improvements and suggestions for improvement on both processes of SC and PC. Here, the relation is made to the level of harmonization. It is described how the level of harmonization is or will be increased by the improvements.

Both the suggestions for improvement about the Audit Package and planning are related to the *IT-related factors* (an earlier stated area of focus). The Project Office at SC performs the planning of every audit and composes an Audit Package with the documents relevant for the audit. The auditors are supported by the Project Office and can focus on performing the audit. This information technology is available at SC but not used for similar processes of PC. By copying the way in which auditors are supported regarding these IT factors, the differences can be eliminated. This should be done by establishing a dedicated Project Office which has access to the planning system of DEKRA. The client files for composing the Audit Packages can be stored on the server of DEKRA (e.g. their 2connect application). By replicating both the planning and the Audit Packages to support the auditors of PC, the level of harmonization will increase.

The improvements regarding QMS are more semantic, but have been done during the case study at the company. The documents describing the process steps of PC were different from the documents that describe the process steps for SC in terms of lay-out, terminology and language. In order to harmonize this, the formats of SC have been used and completed to make uniform process descriptions. One of the aspects in harmonization is to make processes mutually compatible. This can only be done when descriptions of processes are similar, which was the reason for this improvement. Furthermore, the process descriptions of PC are now more structured, which makes the process more predictable and outcomes more consistent. Looking to the influencing factor *process type* (one of the areas of focus), this will increase the level of maturity and therefore, increase the level of harmonization.

One last improvement has also relations with the influencing factor *process type.* A standard process description is made for PC, similar to the format of SC. For this process, the relevant routine processes have been copied from SC. These are the processes regarding the ISO audit (Planning ISO Audit, Preparation ISO Audit, Perform ISO Audit Stage 1, Perform ISO Audit Stage 2, Process Audit

Package, Process CMC), processes regarding the planning and processes regarding the Audit Package. These routine processes have been reworded for application at PC. The fact that more processes will be routine, will increase the level of harmonization.

Effect on business performance

Although this research was not focused on the exact measure of the level of harmonization, an indication can be made of the effect of the increased level of harmonization on the business performance. The model of Romero et al., presented in section 3.1, shows relationships between the level of harmonization and the business performance. As stated by Romero at al. (2012c), their paper "presents relations that have been hypothesized or proven in other papers, it does not present empirical research into these relations. Therefore, the relations that are presented in this paper should be considered hypotheses, rather than proven relations". This means that the indications must come with the notification that the effect is merely hypothetical and not proven. However, is still gives a valuable overview of advantages that can convince management to support and approve activities in a harmonization project. The model divides business performance into three levels; strategic, tactical and operational. The first level describes the effect of an increase level of process harmonization on strategic performance, such as higher integration and outsourcing success and lower risk growth rate, but is only covered by a few studies. The effect on tactical level deals with costs. The direction of the effect depends on the trade-off that must be evaluated when deciding on the level of harmonization to be achieved. As explained in the paper of Romero et al. (2012c), there are some significant costs involved in the implementation and it is therefore "not straightforward that a higher level of harmonization will always produce a reduction in the operational costs". More effects can be found in the operational level. Here, the performance is directly affected by increased efficiency, increased quality, reduced time, increased responsiveness and increased effectiveness.

Relating this to the situation within DEKRA, their need for harmonization is satisfied by the following effects. First, by implementing the suggestions of improvements for assigning a Project Office for PC, the efficiency will increase. By harmonizing the same method as SC, planning of auditors and providing the audit packages are done by a supporting Project Office. This will also reduce the throughput time, as auditors can focus on their job. Further on, due to the harmonized format of process descriptions and accompanying actions for improvements, the quality of outcomes will be more consistent. Outdated and irrelevant procedures are deleted and the new format will give the employees more uniformity, structure and clarity on the processes. Next to that, it is expected that this comes with advantages for management such as more control on the processes and the ability to detect and react on inefficiencies more quickly.

6.5 Further improvements of processes of PC

The previous sections focused on improving the internal efficiency by harmonization of the processes of SC and PC. This last section takes a closer look to one of the external factors that influence the level of harmonization; the *legal requirements*. As mentioned before, the processes of PC must meet the requirements of ISO 17024:2012, *general requirements for bodies operating certification of persons*. In order to evaluate the processes of PC on conformation with the new requirements of ISO, the following has been done. First, the ISO 17024:2012 requirements have been read to get a better understanding of the rules. Second, the presentation on the major changes in the new revision of ISO 17024 (Convenor of ISO CASCO WG 30, n.d.) has been studied. This is done because it was expected that the processes already met the requirements of the existing norm, ISO 17024:2003. In this case, only the changes that have been made in the new revision of the norm have to be evaluated. However, by using a transition plan as a cross reference model, also existing norms have been evaluated. This cross reference model will be useful for DEKRA when the processes are being audited by the Dutch Council of Accreditation; requirements can be found easily in the

new procedures by checking the cross reference model. For every clause in ISO 17024:2012, a reference with explanation is stated. For clauses where the researcher was not clear of, or clauses that DEKRA does not satisfy with, actions have been stated for DEKRA. Next to that, the actions are dedicated to employees that have knowledge, capabilities and/or qualifications to deal with the clause. This cross reference list with actions has been delivered to DEKRA and can be found in Appendix XIV.

The next section concludes the case study by specifying the structured method for the harmonization-based redesign of business processes.

7 Development of a structured method

This section deals with the specification of a method which can be used in order to systematically redesign business processes, by gaining focus through harmonization. The development of the method has been done by gathering information throughout the case study at DEKRA. The participative study provided a constant interaction of information usage from the case study and a reaction on that during the case study. In this section, the results of this are briefly described, and are used for the specification of the method. The method is explained in section 7.2. The last section describes how the method is validated.

7.1 Results of the case study

The case study at DEKRA has revealed important actions that are essential in a process harmonization project. These actions are described next, including the reasoning on the necessity of those steps.

Model the current situation

After gaining a general insight of the organization, which can be seen as a prerequisite for the harmonization project, the current business processes under study have been modeled in more detail. This made it possible to visual analyze the processes on differences and similarities. Next to that, gathering information from interviews and desk-research needed to model the processes was uttermost useful in defining differences and similarities. One requirement for analyzing the current situation is that the descriptions and process models must exist in the same format, language and terminology. In this way, comparing the processes will be more clearly. In the case study at DEKRA, the process description were different in many aspects. Hence, an essential step was to model both processes under study by using a singular, appropriate modeling approach. When selecting a modeling approach, not only the research goal, but as well as criteria that satisfy the needs of the organization (e.g. purpose, level of detail or cultural aspect) could be held in mind. In the case study, this was necessary because the process models would be used for the process descriptions and as a communication to e.g. customers or new employees. The main step to gain a clear overview was to describe the differences and similarities of the processes under study.

Evaluate influencing factors

The aim of identifying the factors that influence the business processes under study is to gain insight in the explanations of the differences in the processes. By using the model presented by Romero et al. (2012c), influencing factors that were found in the literature were identified at the company. The actual operationalization is done with a questionnaire that is conducted at the organization. The questionnaire is adapted by omitting irrelevant factors, rearranging the sequence of questions, adjusting the terminology for application within DEKRA and omitting the last part of the questionnaire, which was focused on variants of specific processes. This step was necessary for this case study, but is not always needed in the method. Namely, the adjusted questionnaire will be presented as a tool for identifying the influencing factors at an organization, and more questions on factors that are relevant to the process under study could be included by conducting the original questionnaire from Romero et al. After describing the results of the questionnaire, which was a description of the factors and to which extent they influence the processes under study, a link is made to the organization goals. It appeared to be important to have areas of focus with factors that have a negative, unwanted effect on the level of harmonization. Some factors force variation in the processes, but is in line with the strategy of the organization. It must not be the case that business processes are harmonized by not taking into account the goals of e.g. providing different types of services or satisfy legal regulations such as ISO requirements. Therefore, an important step in harmonization is to define the areas of focus, which are the influencing factors that force variation in the processes under study and are not caused by differences due to the organization goals.

Improve and harmonize

The gathered information on differences, similarities and areas of focus were the input for (suggestions for) improvements and harmonization. The areas of focus appeared to be useful in directing the analysis to improvements that not only would increase the efficiency, but as well as increase the level of harmonization. Improvements of business processes are made according to improvement practices found in the literature (Reijers & Liman Mansar, 2005; Covert, 1997) and empirical experience during the case study. Also, eliminating differences is an important manner for harmonization. How this is done depends on what the difference is and what the area of focus is. An example from the case study is that the difference in process descriptions led to an improvement of rewriting the procedures into the same format, language and terminology. The area of focus relating to this was *process type,* where the maturity level of processes appeared to be low with non-routine, ad-hoc processes with unpredictable outputs. The improvements led to more standardized process descriptions in the same format for SC and PC. The improvements of processes and the elimination of differences will increase the level of harmonization.

With previous described necessary steps from the case study, the next section will focus on the specification of the structured method for the harmonization of business processes.

7.2 Presentation of the method

This section illustrates and explains the structured method for the harmonization of business processes. The method is depicted in figure 12. The steps are based on the essential activities that are done in the case study, as explained in the previous paragraph. In clear, brief bullet points, these steps are described as a framework for the method.

STEP ONE. ANALYZE THE CURRENT SITUATION
- Pre-requirements of the harmonization project:
  - A general overview of the processes and the problems relating to that should be known by the executer of the project;
  - Documented processes must be similar in terms of terminology, language, lay-out etc. in order to be able to compare them. If not, modeling should be a step in the harmonization process (see next two activities).
- Select an appropriate modeling approach based on criteria that are in line with the organization goals. BPMN appeared sufficient in analyzing process models on differences and similarities. It is therefore suggested that, if the process models are merely used in analyzing it on differences and similarities (and not for mathematical, behavioral or simulation purposes), BPMN should be used.
- Model the current situation by using semi-structured interviews (question the input, process and output of each process step) and desk-research.
- Analyze the processes on differences and similarities by performing visual checks on the process models and using additional information from the interviews and desk-research.

STEP TWO. EVALUATE INFLUENCING FACTORS AND IDENTIFY THE AREAS OF FOCUS
- Conduct the questionnaire, with questions relevant to the unit of analysis, to several employees relating to the processes under study.
- Classify the influencing factors on a positive or negative influence on the level of harmonization of the processes under study, based on the relationships defined by Romero et al. (2012c).
- Relate the negative influencing factors to the organization goals and define which factors force variation in the processes, but are not in line with the organization goals. These undesirable influencing factors become the areas of focus.

STEP THREE. IMPROVE AND HARMONIZE
- ▪ Create an action plan by using the differences in the processes and the areas of focus.
  For improvements, next to empirical experience, the following can be used:
  - o Best practices in business process redesign (Reijers & Liman Mansar, 2005);
  - o Redesign principles (Covert, 1997);
  - o The Seven Process Modeling Guidelines to improve current business process models (Mendling, Reijers & van der Aalst, 2010).

  For harmonization, the differences between the processes should be eliminated as far as possible. It could be useful to decide to copy part of the processes and use it for another part. In this case it should be clear which part is more efficient, in order to increase the total efficiency.
- ▪ Carry out the action plan.

If successfully executed, the method will help redesign the business processes in a harmonized manner and enhance the efficiency within the organization.
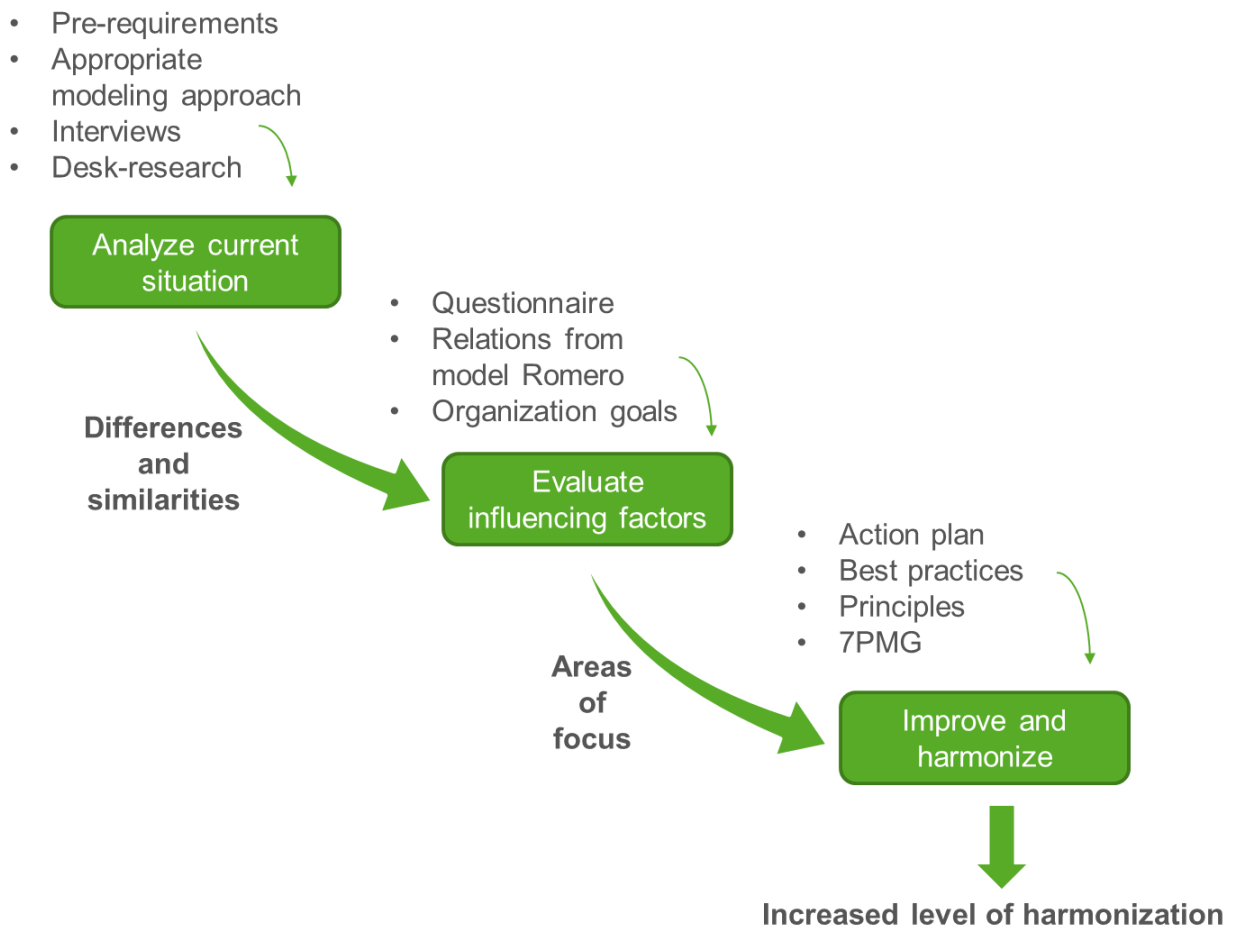
Figure 12. Structured method for the harmonization-based redesign of business processes

7.3   Validation

To ensure that the previous described method fulfills its intended purpose, it should be validated. Due to time limitations, a full case study at another business line or organization will not be possible. However, insights in the processes of a different business line at DEKRA can be collected, on which an analysis can be done to the extent to which the method will be successful. It is chosen to focus the validation on the Business Line Explosion & Safety (E&S). The reason for this is that this is the only business line that deals with certification of persons as well, but merely aimed at safety at work.

The harmonization project in this case would be the harmonization of business processes between the two business lines. To make comparison with SC possible, a similar method is used for gaining insight in the factors that influence the business processes at E&S. The same questionnaire is conducted with two employees working at E&S; a Certification Manager and the Business Development Manager. The next paragraph describes the current situation. After that, this situation is evaluated on the extent to which the method will be useful.

7.3.1 Situation at Explosion & Safety

The size of E&S is smaller than SC, but cannot be classified as very small. The number of employees and the turnover turned out to be lower than SC, but the answers on Q3 and Q4 were not the lowest possible. Therefore, this business line is classified as small. Just like other business lines, E&S has *legal regulations*, such as financial requirements, taxation regimes and employment practices. Next to that, the government and the Dutch Council of Accreditation impose requirements, European guidelines come from ATEX (guidelines for explosion safety), and norms such as NEN 45011 and ISO 17024 apply to this business line.

Looking at the *relationship characteristics*, the same type of power inequality exists between E&S and their customers, what could have an effect on the processes. The business line is dependent on the planning of their customers, and changing that is beyond E&S' control. For the last external factor *domain inherent expertise*, it is expected that this will not influence the level of harmonization in a positive or negative way, for the same reason as for SC.

E&S experienced the same merge as SC. The two conducted questionnaires also showed that a similar IT landscape exists, including different individual systems such as a certification database, OMS for quotations, JobInfo and WOWOS for the project administration. The management of IT and decisions regarding higher-level IT is centralized. However, as the case study at SC has shown, the high number of different systems will have a negative effect on the level of harmonization. The factor *different products/services* will also affect the level of harmonization, but to a lesser extent. E&S has about 10 different services, which is much less than the 50 for SC and 60 for PC. However, due to the difference in knowledge, experience, qualifications and capabilities of the employees, several different roles are needed for the different services, including project leaders, reviewers, certification managers and auditors. Also, the *personal differences* differ within E&S, especially between the certification of products and the certification of persons.

The score for centralization is 0,27, lower than SC's moderate score of 0,47. The score of 0,61 for formalization is not significantly different from the score of 0,59 from SC. Looking at the scores for the maturity level, the processes of E&S can be defined as standardized. Similar to SC, the processes are standardized and defined, but are not always followed by the employees. The scores for maturity levels 4 and 5 are extreme low, indicating no performance measurements and no process improvement practices. Notice that the scores for the situation within E&S are gathered from only two questionnaires and are therefore not highly reliable. However, it is possible to indicate that most of the processes are routine work, which is an aspect of the last influencing factor *process type*.

During the questionnaire, the interviewees explained the possibilities of harmonization of processes of E&S to the standard processes at SC. Although other norms apply and different certification schemes are used, the processes at top level are comparable. However, in more detail like supporting processes, the number of deviations become too high in order to be efficient. Procedures with additional descriptions about how it differs from the general process will become unstructured and difficult to understand.

Concluding, there are several factors that influence the level of harmonization at E&S. Generally, these are the same as for SC. *Legal regulations* influence the harmonization by requirements from

ministries and government, ATEX and the Dutch Council of Accreditation. The *IT-related factors* influence the processes due to the high number of individual systems. The number of different services are lower, but force variation in the processes regarding the *personal differences* of employees. Also, these services are different from the services at SC, which cause an important difference in the processes of the two business lines. Consequently, the level of harmonization is decreased due to these factors. However, some of these factors cause differences that are in line with the organization goals. The business line E&S is different from SC due to the different services and the personal differences and requirements that relate to them. One area of focus would therefore be the IT-related factors. This input for the phase of 'improve and harmonize' will determine the method of improvement, which has probably a relation with the best practice Information Technology that includes task automation and integral business process technology (Reijers & Liman Mansar, 2005).

7.3.2 Applicability of the structured method

So, is the method applicable to other business lines? The validation at E&S emphasizes that identify differences and relate the factors that force variation in the processes to the organization goals are important steps in a harmonization project. How the processes are then harmonized completely depends on the areas of focus. For example, if the major area of focus is IT-related, the harmonization project would lead to an IT project (database management, workflow management, enterprise resource management, etc.). If the areas of focus are more related to personal differences and organizational governance, the project could also include human resource management. And even this could be insufficient to improve and harmonize the processes on this area. As a direction for redesigning processes, the earlier provided literature could be applied. However, an exact method for improving the processes can only be formulated after an extensive analysis of the differences between the processes under study and the areas of focus that indicate the force of variations that is not in line with the organization goals.

The previous shows that the general steps in the developed method are useful as a guideline in a harmonization-based redesign project. Not only for processes within the business lines of DEKRA, but the method is also generalizable to other organizations. For every organization, regardless of their industry, size or location, an analysis on the differences and the factors that influence the level of harmonization is possible. This will be useful in gaining focus in a BPR project.

8   Conclusions and recommendations

This part concludes this master thesis report. Section 8.1 describes the conclusions of the case study and the method that is developed. Section 8.2 deals with the recommendations and is divided in recommendations for DEKRA and directions for further research. The last section also describes limitations of this research.

8.1   Conclusions

To conclude this research, this section refers to the research questions defined in chapter 3 and gives briefly answers to it.

The first research question was as follows. *What significant differences and similarities can be detected when analyzing the business processes by using an appropriate process modeling technique?* With appropriate criteria, keeping the needs of the organization in mind, the modeling approach BPMN is used. The processes of SC and PC have been modeled using desk-research and semi-structured interviews guided by a simplified input-output model of a business process. The major differences and inefficiencies are the end-customer, the type of audits and reviews, the format, language and terminology of process descriptions, no specific planning for audits of PC and no supporting Project Office for handling an Audit Package. Similarities include the processes regarding the ISO audits.

The second RQ went into detail about the factors that force these differences; *to which extent are the influencing factors of harmonization (from the conceptual framework of Romero et al., 2012c) present at DEKRA Certification and how could these factors give focus to the redesign of the business processes?*
By using a questionnaire from Romero et al. (n.d.), the factors presented in the model were identified at the organization. The factors that have a negative influence the level of harmonization of the processes of SC and PC include *legal regulations, IT-related factors, different services, personal differences* and *process type*. However, the organization goals require that some differences exist. The factors that undesirably influence the level of harmonization in a negative way formed the areas of focus, which were *IT-related factors* and *process type.* These areas of focus resulted in a better understanding of the direction for the redesign of the business processes.

The third RQ, w*hat actions should be taken in order to eliminate differences, harmonize the business processes and optimize the organization of DEKRA Certification, and what is the effect of these actions on the level of harmonization?* used the information from previous questions to improve and harmonize the processes of SC and PC. Actions are defined according to improvement practices found in the literature (Reijers & Liman Mansar, 2005; Covert, 1997) and empirical experience during the case study. The action list is included in Appendix XIII and consist also of actions for dealing with the new clauses of ISO 17024:2012.

In the end, an answer could be given to the main research question: *What kind of framework (such as a model, a stepwise approach or practical guidelines) could provide a structured method in a harmonization-based redesign of different business processes?* The case study provided information and evidence to answer this question. A structured method has been developed and presented in section 7.2. The necessary steps done in the case study have been generalized into steps that other business lines or other organizations could use. During a validation, where a different business line is analyzed, it appeared that the method could help in a harmonization-based redesign project in a different setting.

The goal was formulated as follows:
The goal of this research is to provide organizations struggling with alignment of business processes with a structured method to redesign different business processes in a harmonized manner.

By answering the main research question, the goal of this research has been achieved. The development of a structured method was possible with the information from the case study. The case study has shown that the harmonization approach of Romero et al. (2012c) is useful in a BPR project; using it to gain insights in areas of focus (negative, undesirable influencing factors) helps in providing a focus on where to start redesigning the business processes and where not. Next to that, the case study provided DEKRA with practical improvements and suggestions for improvements that increased the level of harmonization in the processes of SC and PC. Furthermore, a validation of the method has been done at a different business line and made clear that the developed method consists of steps that are essential in a harmonization-based redesign project. Therefore, both sub-goals have been achieved as well.

To conclude and refer to the definition of harmonization, that was defined as a provisional definition based on other definitions in the literature, it can be stated that it does not have to be revised. It appeared to have essential elements that were suitable in this research:

- *The adjustment of differences and inconsistencies...* This refers to 'how' harmonization must be done. In the case study at DEKRA, the differences and inconsistencies are first identified, where after an action plan is created;
- *...among different processes...* This refers to the processes under study. In this case, the processes of SC and PC;
- *...to make them uniform or mutually compatible...* This is mainly the aim of harmonization. For DEKRA, the improvements made more uniform processes which are therefore, more comparable;
- *...and in line with the business strategy and organization goals.* One of the essential steps is to relate the influencing factors to the goals of the organization. From here, areas of focus were designed and appeared useful input for improving and harmonizing the processes.

8.2 Recommendations

In this last section, recommendations for DEKRA, limitations of this research and directions for further research will be described.

8.2.1 Recommendations for DEKRA Certification

Recommendations for DEKRA are divided into Project Office, continuous improvement, the structured method and Workflow Management.

Assign a dedicated Project Office to Personnel Certification
Two major inefficiencies regarding the processes of PC concern the planning and the audit package. Next to the ISO audit that is planned by a Project Office from SC, other audits of PC are planned manually (at least not in the planning system from DEKRA) by a Lead Auditor or planned by the Auditor itself. An Audit Package for PC doesn't exist, which causes Auditors to search for relevant documents needed for their audit. At SC, both planning and audit packages are supported by a Project Office. This is the main reason to harmonize this part of the processes.

Regarding the Audit Package, it is recommended that DEKRA should maintain a Client File for every Examination Institute consisting of documents such as formats, the report of the previous audit, certification schemes, examiner information, location approvals, non-conformities of previous audits, etc. From here, an Audit Package can be established for the relevant upcoming audit. The system of

SC provides the Project Office automatically with relevant documents when the information of the audit is entered. This should be possible for PC as well. In this case, the Project Office can select the relevant documents and send it to the auditor performing the audit. After the audit, the auditor processes the documents and sends it back to the Project Office. These documents are then processed according to the procedures and can be stored in the Client File. The Client Files should be stored somewhere accessible by every auditor, such as DEKRA's SharePoint 2connect.

For the planning, also a part of the method from SC should be copied. It is suggested that the Examination Attendance Audit and the Examination Location Review are planned by a Project Office. The communication with the customer is therefore maintained by the Project Office. Together with the communication to the customer about the approved documents, the Project Office will be the main point of contact for the customer. The planning for reviewing the Examiner and reviewing the Examination Material can be done by planning dedicated hours for PC, in which the auditor can decide which review to do. The Project Office should maintain a shared outlook location where the activities can be stored. When the Project Office receives orders from Examination Institutes or notices that e.g. Examination Material must be revised (due to the requirement of the Certification Scheme), dedicated hours for PC can be planned.

By implementing the suggestions for improvements on assigning a Project Office for PC that takes care of the planning and the Audit Packages, the efficiency will increase. Harmonizing the same method as SC will also reduce the throughput time, as auditors are supported by a Project Office and can focus on their job.

Improve continuously
Harmonizing the format of process descriptions and providing DEKRA with actions for improvements has been the first step in a harmonized and a more standardized way of defining the business processes. This will increase the consistency of the quality of outcomes and give the employees more uniformity, structure and clarity on the processes. Besides that, it is expected that this comes with advantages for management such as more control on the processes and the ability to detect and react on inefficiencies more quickly. However, analyzing inefficiencies, improving business processes and updating documents, procedures and work instructions must be done on a constant basis. As an example, Deming's Plan-Do-Check-Act circle can be applied. Figure 13 illustrates that a new standard will increase the quality improvement and will keep the improvements from decreasing again. For DEKRA, new procedures define this new standard (also with the additional requirements of ISO 17024:2012) and old procedures are deleted. The latter action will prevent the improvements from falling back to the inefficient situation. It is recommended that all processes and accompanying documents are constantly improved in order to reach a higher quality improvement of processes.
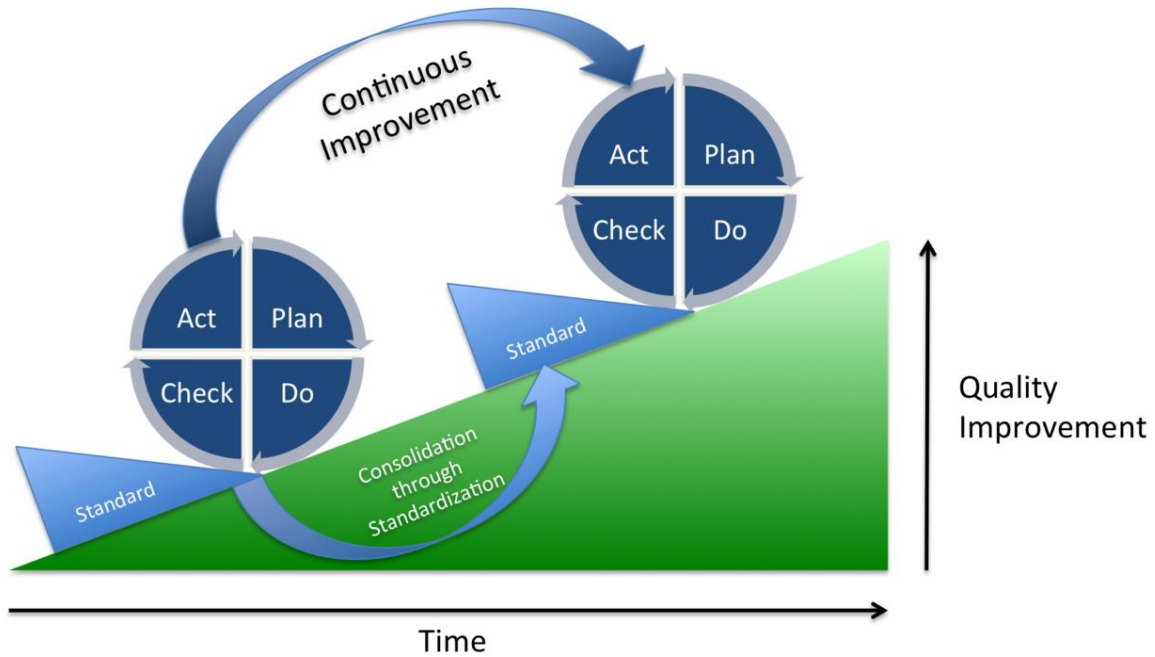
Harmonize by using the structured method

The method that is developed in this research can be used in other harmonization-based projects. The general steps and tools like the questionnaire can be used to gather information on e.g. the factors that influence the level of harmonization between different business lines of DEKRA. The essential step of linking the factors to the organization goals will give insights in the areas of focus which will be useful to obtain focus on harmonization in a redesign project.

Use process models of this research for Workflow Management

As a last recommendation for DEKRA, it must be mentioned that the process models of SC and PC, that now were only used for analysis in this research, could be used as a basis for Workflow Management. As stated by Georgakopoulos, Hornick and Sheth (1995):

> Workflow management (WFM) is a technology supporting the reengineering of business and information processes. It involves:
>
> 1. defining workflows, i.e., describing those aspects of a process that are relevant to controlling and coordinating the execution of its tasks (and possibly the skills of individuals or information systems required to perform each task), and
>
> 2. providing for fast (re)design and (re)implementation of the processes as business needs and information systems change. (p. 120)

The first step is partly done in this research and therefore, all process models have been delivered to the company. Workflow Management has some useful benefits that are similar to harmonization, including the following (as summarized in Xu and Ramesh, 2002):

- Improved efficiency: automation of many business processes results in the elimination of many unnecessary steps;
- Better process control: improved management of business processes achieved through standardizing working methods and the availability of audit trails;
- Improved customer service: consistency in the processes leads to greater predictability in customer response levels;
- Flexibility: software control over processes enables their redesign in line with changing business needs;

- Business process improvement: focus on business processes leads to their streamlining and simplification.

8.2.2 Limitations and directions for further research

This final paragraph discusses the limitations of the research and provides directions for further research.

One limitation of this research is that it is partly based on the model of Romero et al. (2012c), in which hypothetical relations are used which are not all proven by empirical research. The indications that are given on the effect on business performance are therefore merely expectations. Also, the areas of focus are based on the factors with a negative influence on the level of harmonization. Although this analysis is done according to the relationships that Romero et al. (2012c) identify in the literature, it should be considered hypothetical. However, also empirical evidence convinced the researcher that the relationships are correct and that indeed some of the factors have a negative influence on the level of harmonization. Another limitation relating to the model of Romero et al. (2012c) is the fact that only the first part is used in this research. An exact measurement of the level of harmonization is not performed, due to time limitations. Therefore, it is not validated quantitatively that the level of harmonization is increased.

A direction for further research is to validate the developed method in an organization within a different industry. The validation in this research is done according to conducting the questionnaire to a different business line and evaluating to which extent the method would be successful. This validation should be extended to other organizations.

Although the steps on improving and harmonizing the business processes suggest some useful literature, real practical guidelines are not provided. Another direction for further research is therefore to investigate in detailed activities belonging to the possible areas of focus. It should be more clear what an organization could do to harmonize their processes on specific influencing factors. This is also an aspect that is missing in the model of Romero et al. (2012c). It lacks a clear link from the identified factors to actions and how exactly should be harmonized. Another facet that is not clearly covered in Romero's literature, is the desirable level of harmonization according to the organization. The strategy and organization goals define whether a variation in processes is desirable. Some processes need no high level of harmonization. The last reflection on the literature of Romero et al. is that the questionnaire used for identification of the influencing factors is fairly unstructured and not logical sequentially, which makes it sometimes difficult to understand for the interviewer and interviewee. For instance, the difference between the options 'False' and 'Definitely false' is vague. Also, some answers depend on the meaning of the content of the question. An example is the question of having a problem, and going to the same person for an answer, which really depends on the type of the problem. The last thing to mention about the questionnaire is that it starts immediately with a difficult question, whereas easy questions such as the number of employees would act as a sort of introduction to the interview.

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Appendices

Appendix I. Interview for general insights of the company

- What is your function within the organization?
  - What are your daily activities?
  - What are your responsibilities within DEKRA?
  - Which departments do you relate to? And with which employees do communicate often?
  - For which processes is your work important? What is your share in the company?

- Which information / data is being used in your function?

- Where does this information come from?

- Can you tell something about the systems that are used within DEKRA? And which apply to your job?

- How do you work as a manager?
  - Are you attainable? Are you visible for other employees?
  - Do you have clear management tasks?
  - What is you management style? (Directive, participative, people-oriented, task-oriented)

- Does a clear structure of tasks, responsibilities and competences exists within DEKRA, and is this a logical structure?

- Do you work with a quality management system? How do you ensure that the quality is guaranteed?

- To which extent do you work according to the procedures and work instructions?

- What are, according to you, the most important problems regarding you function?
  - Efficiency
  - Unnecessary actions

- Can you tell something about the problems regarding the processes within Personnel Certification?

- To which extent are the processes of Systems Certification comparable with those of Personnel Certification?

Appendix II. Selection Criteria Matrix for process modeling techniques

			Process Modeling Techniques							
			Flowcharts	IDEF	RADs	BPMN	BPEL	EPC	UML	Petri-nets
Criteria	Basis	Classification (Vergidis et al., 2008)	Diagrammatic	Diagrammatic	Diagrammatic	Diagrammatic / Business Process Language	Business Process Language	Diagrammatic / Business Process Language	Diagrammatic / Business Process Language	Diagrammatic / Mathematical
		Modeling Perspective (Curtis et al. 1992; Giaglis, 2001)	Functional	Functional (depending on IDEF0 or IDEF3)	Organizational	Functional, Organizational	Functional	Functional	Functional, Informational	Functional, Behavioral
		Orientation	Dataflow, action-based	Events, action-based	Function-based	Workflow of objects (actions and functions)	Tasks, functions (only language)	Event-driven, events and functions	Object-based, function-based	Execution of actions
	Scope	Degree of completeness (Recker et al., 2009)	6,9%	37,9% (IDEF3)	-	65,5%	51,7%	37,9%	-	41,4%
		Level of detail	Low	Low (IDEF0), Moderate (IDEF3)	Moderate	Moderate to high	Low	Moderate	Moderate to high	Moderate
		Area of use	Communication	Observational / Simulation	Modeling / Performance analysis	Communication, Process improvement	Complement other techniques / Modeling	Communication, Process improvement	Process improvement	Modeling / Simulation
	Rest	Cultural aspect	Ease of use, familiarity	Difficult	Understandable	Understandable	Difficult	Simple, intelligible	Difficult	Difficult
		Total review	++--++	++-+--	+-+-++	++++++	++-+--	++--++	++-++-	---+--

Appendix III.   Interview for modeling the current business processes

General
- Function, job description, which cluster(s)?
- Process description:
  - When does a 'new' order start for you?
  - What steps should be taking into account?
  - When is your job finished for this particular order?

Input
- Where does the information come from?
  - Internal; different process, department or organizational unit.
  - External; Examination Institute, customer, other organization.
- What is the quality of the received information?
  - In time?
  - Complete?
  - Reliable?
  - In the right form?
  - In the right place?
- How is the information provided?
  - Automated
  - Manually

- Which problems exist regarding the input?
- What changes would you make to the input of this activity?

Process / Activity
- How is the process / activity performed?
  - Automated support?
  - Manually?
  - Structured?
  - Ad-hoc?
  - Routine activities?
- How is the process / activity regulated?
  - Standards (in the form of rules, regulations, procedures, work instructions)?
  - Responsibilities / competences?
  - Measures of internal control?
- Which documents are relevant for this process / activity?
- What steps must be completed before the new activity can start?
- What steps can only be carried out after the activity is completed?

- Which problems exist regarding this process / activity?
- What changes would you make to this process / activity?

Output
- Where does the information go to?
  - Internal; different process, department or organizational unit.
  - External; Examination Institute, customer, other organization.
- Is this information conform the requirements of the 'customer'?
  - In time?
  - Complete?

- - Reliable?
    - In the right form?
    - In the right place?
  - How is the information provided?
    - Automated
    - Manually

  - Which problems exist regarding the output?
  - What changes would you make to the output of this activity?

Appendix IV. Examples of current business processes of SC

OVERVIEW OF THE MODELED PROCESSES OF SC

	Process step	Referring Documents DEKRA	Name Modeled Process
	MAIN PROCESS	No existing document	SC Main Process
Initial Certification	PREPARATION ORDER	FLOW-S-W-W2	FLOW-S-W-W2_Preparation Order
	PREPARATION AUDIT	FLOW-S-W-W3	FLOW-S-W-W3_Preparation Audit
	PERFORM STAGE 1 AUDIT	FLOW-S-R-W4	FLOW-S-R-W4_Perform Stage 1 Audit
	PERFORM STAGE 2 AUDIT	FLOW-S-R-W5	FLOW-S-R-W5_Perform Stage 2 Audit
	AUDIT PACKAGE INITIAL CERTIFICATION	FLOW-S-R-W6	FLOW-S-R-W6_Audit Package Initial Certification
	CERTIFICATION DECISION	FLOW-S-R-W7	FLOW-S-R-W7_Certification Decision
	PROCESS CMC	FLOW-S-R-W8	FLOW-S-R-W8_Process CMC
Ongoing Surveillance Activities	PLANNING (LAST) SURVEILLANCE AUDIT	FLOW-S-W-W4	FLOW-S-W-W4_Planning (Last) Surveillance Audit
	PLANNING SPECIAL AUDIT	FLOW-S-W-W7	FLOW-S-W-W7_Planning Special Audit
	PREPARATION AUDIT1	FLOW-S-W-W3	FLOW-S-W-W3_Preparation Audit
	PREPARATION AUDIT2	FLOW-S-W-W3	FLOW-S-W-W3_Preparation Audit
	PERFORM STAGE 1 AUDIT1	FLOW-S-R-W4	FLOW-S-R-W4_Perform Stage 1 Audit
	PERFORM STAGE 1 AUDIT2	FLOW-S-R-W4	FLOW-S-R-W4_Perform Stage 1 Audit
	PERFORM SURVEILLANCE AUDIT	FLOW-S-R-W9	FLOW-S-R-W9_Perform Surveillance Audit
	PERFORM LAST SURVEILLANCE AUDIT	FLOW-S-R-W10	FLOW-S-R-W10_Perform Last Surveillance Audit
	PROCESS AUDIT PACKAGE SURVEILLANCE AUDIT	FLOW-S-R-W11	(Not modeled)
	PROCESS AUDIT PACKAGE LAST SURVEILLANCE AUDIT	FLOW-S-R-W12	FLOW-S-R-W12_Process Audit Package Last Surveillance Audit
Recertification	PLANNING RECERTIFICATION AUDIT	FLOW-S-W-W5	FLOW-S-W-W5_Planning Recertification Audit
	PREPARATION AUDIT3	FLOW-S-W-W3	FLOW-S-W-W3_Preparation Audit
	PERFORM STAGE 1 AUDIT3	FLOW-S-R-W4	FLOW-S-R-W4_Perform Stage 1 Audit
	PERFORM STAGE 2 AUDIT1	FLOW-S-R-W5	FLOW-S-R-W5_Perform Stage 2 Audit
	PROCESS AUDIT PACKAGE RECERTIFICATION	FLOW-S-R-W13	FLOW-S-R-W13_Process Audit Package Recertification
	CERTIFICATION DECISION1	FLOW-S-R-W7	FLOW-S-R-W7_Certification Decision
	PROCESS CMC1	FLOW-S-R-W8	FLOW-S-R-W8_Process CMC
Corrective Action Audit	PLANNING CORRECTIVE ACTION AT OFFICE OR AT CUSTOMER	FLOW-S-W-W6	(Not modeled)
	PREPARATION AUDIT	FLOW-S-W-W3	FLOW-S-W-W3_Preparation Audit
	PERFORM STAGE 1 AUDIT	FLOW-S-R-W4	FLOW-S-R-W4_Perform Stage 1 Audit
	PERFORM CORRECTIVE ACTION AT CUSTOMER	FLOW-S-R-W14	FLOW-S-R-W14_Perform Corrective Action at Customer
	PERFORM CORRECTIVE ACTION AT OFFICE	FLOW-S-R-W15	FLOW-S-R-W15_Perform Corrective Action at Office
Decertification	INFORM CERTIFICATION MANAGEMENT	FLOW-S-R-W17	(Not modeled, due to time limitations)
	ANALYSE INPUT AND DECIDE	FLOW-S-R-W16	(Not modeled, due to time limitations)
	INFORM CUSTOMER	FLOW-S-R-W18	(Not modeled, due to time limitations)
	CORRECTIVE ACTION BY CUSTOMER	FLOW-S-R-W19A	(Not modeled, due to time limitations)
	VERIFICATION OF CORRECTIVE ACTION PLAN	FLOW-S-R-W19A and B	(Not modeled, due to time limitations)
	INFORM CUSTOMER / THIRD PARTY	FLOW-S-R-W18	(Not modeled, due to time limitations)
	CORRECTIVE ACTION BY CUSTOMER	FLOW-S-R-W19A	(Not modeled, due to time limitations)
	VERIFICATION OF CORRECTIVE ACTION PLAN	FLOW-S-R-W19A and B	(Not modeled, due to time limitations)
	INFORM CUSTOMER	FLOW-S-R-W18	(Not modeled, due to time limitations)

CURRENT MAIN PROCESS SC

Name: SYS Main Process_ASIS

Type: BPMN Diagram

ARIS Platform

Initial Certification

Preparation Order (FLOW-S-W-W2) → Preparation Audit (FLOW-S-W-W3) → Perform Stage 1 Audit (FLOW-S-R-W4) → Perform Stage 2 Audit (FLOW-S-R-W5)

Audit Package Initial Certification (FLOW-S-R-W6) → Decision process (FLOW-S-R-W7) → Process CMC (FLOW-S-R-W8)

Ongoing Surveillance Activities

Planning (Last) Surveillance Audit (FLOW-S-W-W4) → Preparation Audit 1 (FLOW-S-W-W3) → Perform Stage 1 Audit 1 (FLOW-S-R-W4) → Perform Surveillance Audit (FLOW-S-R-W9) → Process Audit Package Surveillance Audit (FLOW-S-R-W11)

Planning (Last) Surveillance Audit (FLOW-S-W-W4) → Preparation Audit 2 (FLOW-S-W-W3) → Perform Stage 1 Audit 2 (FLOW-S-R-W4) → Perform Last Surveillance Audit (FLOW-S-R-W10) → Process Audit Package Last Surveillance Audit (FLOW-S-R-W12)

Recertification

Planning Recertification Audit (FLOW-S-W-W5) → Preparation Audit (FLOW-S-W-W3) → Perform Stage 1 Audit (FLOW-S-R-W4) → Perform Stage 2 Audit (FLOW-S-R-W5) → Process Audit Package Recertification (FLOW-S-R-W13) → Certification Decision (FLOW-S-R-W7)

Process CMC (FLOW-S-R-W8)

Corrective Action Audit

Planning Corrective Action (FLOW-S-W-W6) → Preparation Audit (FLOW-S-W-W3) → Perform Stage 1 Audit (FLOW-S-R-W4) → Perform Corrective Action at Customer (FLOW-S-R-W14)

Planning Corrective Action (FLOW-S-W-W6) → Perform Corrective Action at Office (FLOW-S-R-W15)

Decertification

Inform Certification Management (FLOW-S-R-W17) → Analyse Input and Decide (FLOW-S-R-W16) → Inform Customer / Third Party (FLOW-S-R-W18) → Corrective Action by Customer (FLOW-S-R-W-19a) → Verification of Corrective Action Plan (FLOW-S-R-W19b)

Inform Customer / Third Party (FLOW-S-R-W18) → Corrective Action by Customer (FLOW-S-R-W-19a) → Verification of Corrective Action Plan (FLOW-S-R-W19b) → Inform Customer / Third Party (FLOW-S-R-W18)

CURRENT PROCESS SC; PERFORM STAGE 2 AUDIT

Name: FLOW-S-R-W5_Perform Stage 2 Audit

Type: BPMN Diagram

ARIS
Platform

Customer

Fact Sheet

Project Office

Audit Package

Audit Package

Auditor

Opening Meeting

Perform Stage 2 Audit

Document Non-Conformities

Discuss Non-Conformities

Document NCF's to Client

Corrective Action (FLOW-S-W-W6)

Establish Audit Conclusions

Closing Meeting

Draw up Report

Inform Project Office

ISO/IEC 17021:2011 9.1.9.2

ISO/IEC 17021:2011 9.2.3.2

Certificate Scheme

ISO/IEC 17021:2011 9.1.9.8.1

Agenda Next Audit

CURRENT PROCESS SC; CERTIFICATION DECISION

Name: FLOW-S-R-W7_Certification Decision

Type: BPMN Diagram

ARIS
Platform
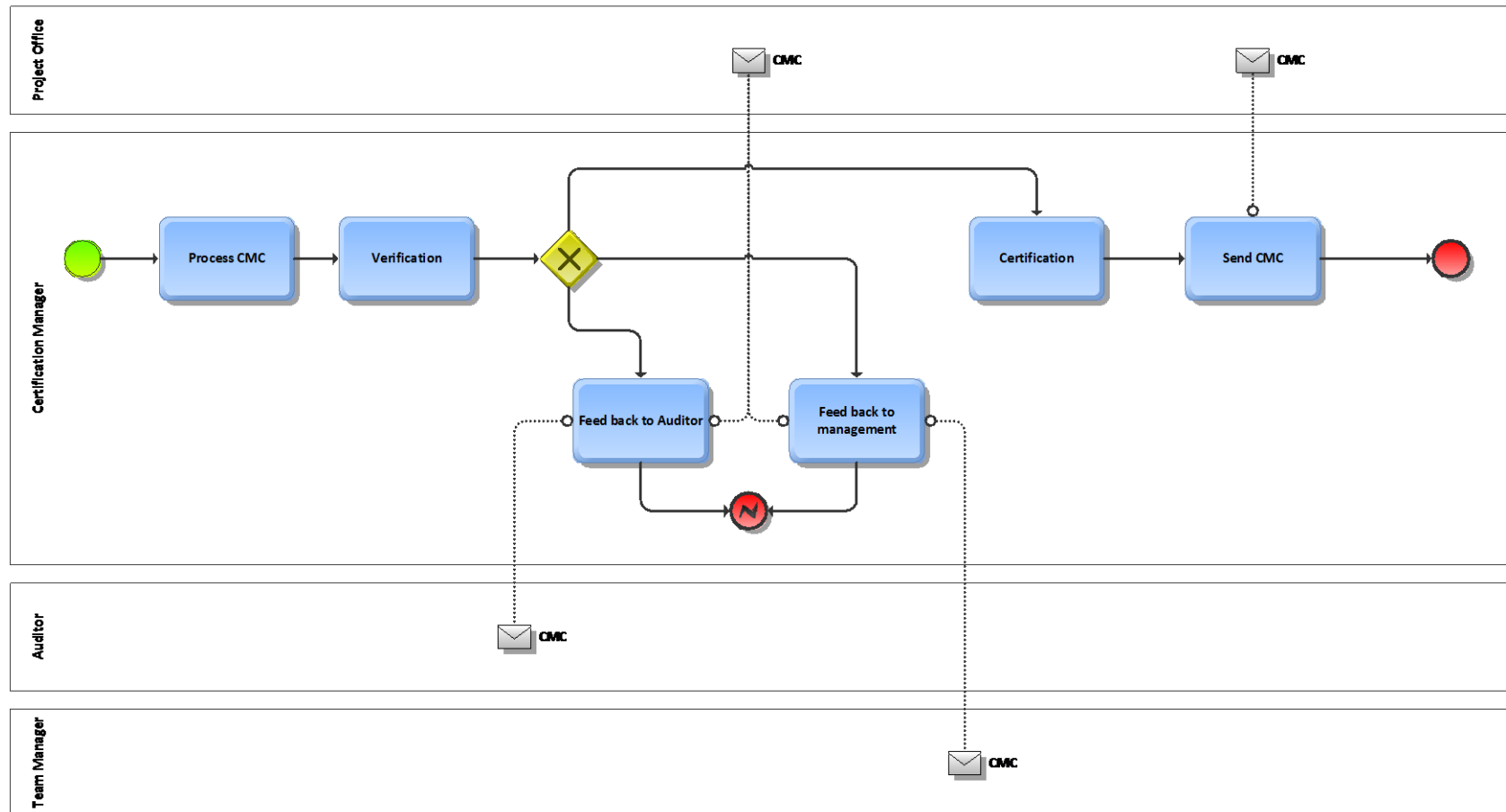
Appendix V.   Examples of current business processes of PC

OVERVIEW OF THE MODELED PROCESSES OF PC

	Process	Referring Document DEKRA	Name Modeled Process
	MAIN PROCESS	No existing document	PC_Main Process_ASIS
	DEVELOPMENT OF CERTIFICATION SCHEMES	QUA/ACO-P-010	PC_ACO-P-010_Development of Certification Schemes_ASIS
	SELECTION OF EXAMINATION INSTITUTES	QUA/ACO-P-011	PC_ACO-P-011_Selection of Examination Institutes_ASIS
	INSPECTION AND AUDITING OF EI'S	QUA/ACO-P-013	PC_ACO-P-013_Inspection and Auditing of EI's_ASIS
	EVALUATION AND CERTIFICATION OF PERSON	QUA/ACO-P-014	PC_ACO-P-014_Evaluation and Certification of Person_ASIS
	CORRECTIVE ACTION	QUA/ACO-P-016	PC_ACO-P-016_Corrective Action_ASIS
	QUALIFICATION OF PERSONNEL	QUA/ACO-P-017	PC_ACO-P-017_Qualification of Personnel_ASIS
	MAINTENANCE CERTIFICATION SCHEMES	QUA/ACO-P-018	PC_ACO-P-018_Maintainance Certification Schemes_ASIS
	ANALYSIS VALIDITY AND RELIABILITY CERTIFICATION	QUA/ACO-P-019	PC_ACO-P-019_Analysis Validity and Reliability Certification_ASIS
	REVIEW EXAM ATTENDANCE	No existing document	PC_Review Exam Attendance_ASIS
	REVIEW EXAM LOCATION	No existing document	PC_Review Exam Location_ASIS
	REVIEW EXAM QUESTIONS	No existing document	PC_Review Exam Questions_ASIS
	REVIEW EXAMINER	No existing document	PC_Review Examiner_ASIS

CURRENT MAIN PROCESS PC

Name: PC Main Process_ASIS

Type: BPMN Diagram

ARIS
Platform

Person
- Take examination
- Recieve certificate

Examination Institute
- Examine Person

DEKRA

Project Office
- Evaluation examresults and certification of person (ACO-P-014)

Auditor / Product Expert
- Development of certification schemes (ACO-P-010)
- Selection of Examination Institutes (ACO-P-011)
- Inspection and auditing of EI (ACO-P-013)
- Ongoing Surveillance Activities (ACO-P-015)

Certification Manager
- Supervise auditing
- Corrective Action (ACO-P-016)

CvD

CURRENT PROCESS PC; INSPECTION AND AUDITING OF EXAMINATION INSTITUTES

Name: PC_ACO-P-013_Inspection and Auditing of EI's_ASIS

Type: BPMN Diagram

ARIS
Platform
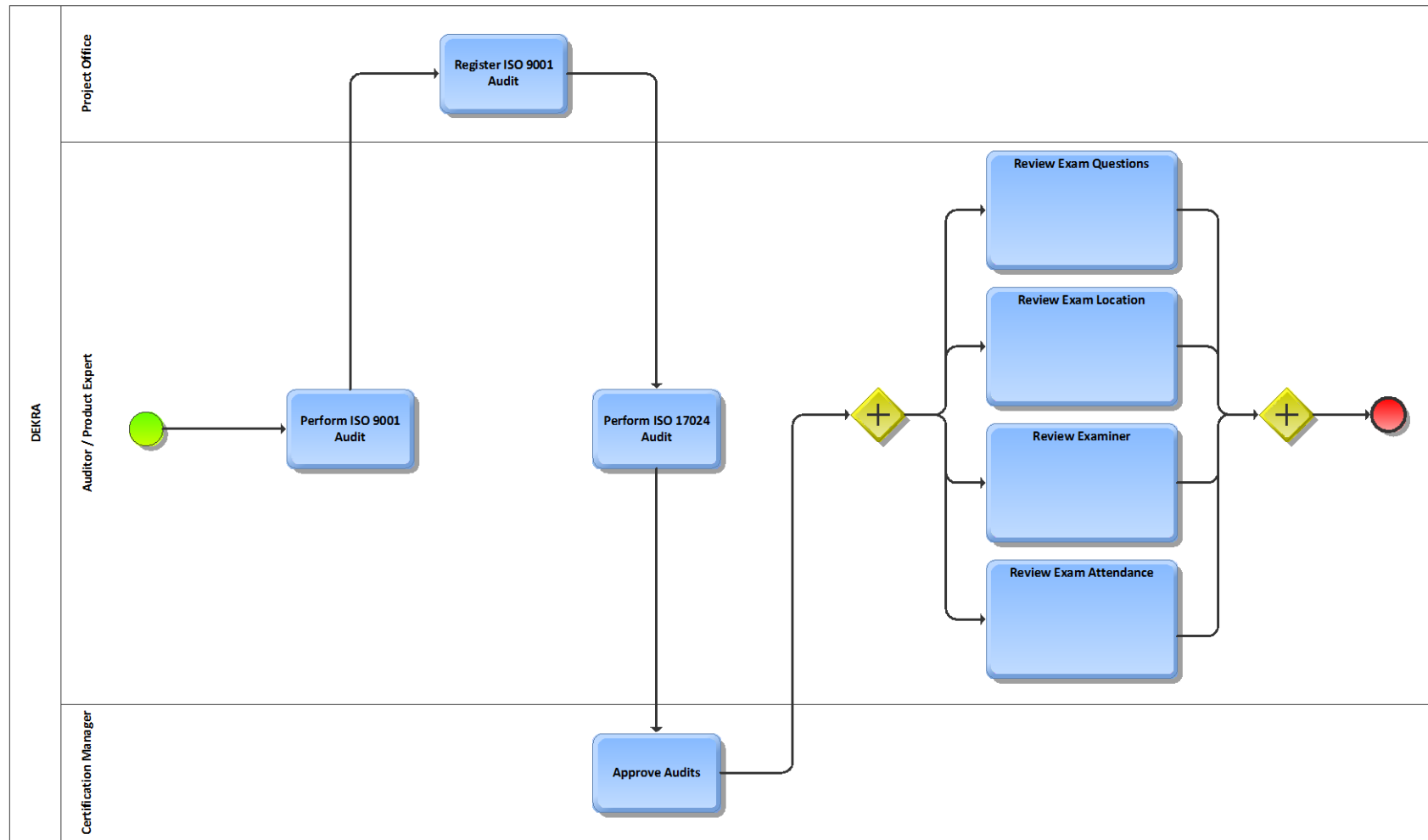
CURRENT PROCESS PC; EVALUATION AND CERTIFICATION OF PERSON

Name: PC_ACO-P-014_Evaluation and Certification of Person_ASIS

Type: BPMN Diagram

ARIS Platform

Examination Institute

Certificate

DEKRA

Project Office

Receive Exam Results → Verification Exam Results → Make Certification Decision → ⊗ → Print and Send Certificate → Register in Archive → ●

Store Insufficient Result in E-mail
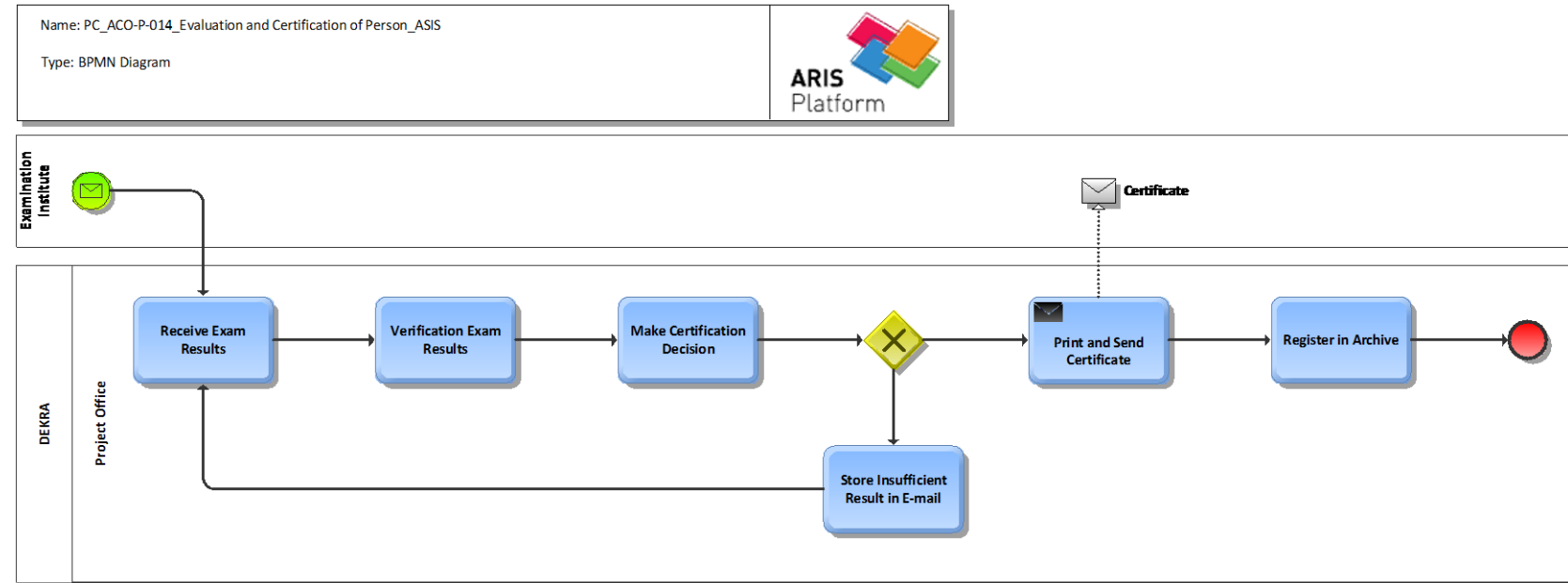
Questionnaire DEKRA Certification B.V.

At organizational level (O) – DEKRA Certification B.V.

O.1.   Company name: _____

O.2.   Industry type: _____

O.3.   How many employees does your organization count?
   a) 1-9
   b) 10-49
   c) 50-249
   d) 250-749
   e) More than 750

O.4.   How large was the turnover in the previous year (2012, in Euros)?
   a) Less than 2 million
   b) 2-10 million
   c) 10-50 million
   d) more than 50 million

O.5.   What is your annual balance-sheet total in the previous year (2012, in Euros)?
   a) Less than 5 million
   b) 5-27 million
   c) More than 27 million

Classification (Company size)

Very small	Small	Medium	Large
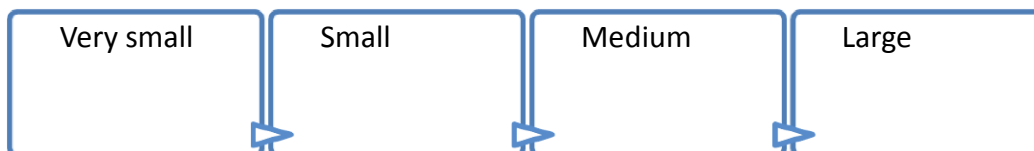
Age:

O.6.   How long does your organization exist?

O.7.   How many times has your organization been merged with or bought by another company, since its foundation?

O.8.   What are legal requirements (i.e. financial, taxation regimes and employment practices) relevant for your organization?

O.9.   Describe the organizational structure of the Systems Certification department
   9.1. **(Centralization)** Answer the following questions using the scale provided:

   • Index of participation in decision making:

	Never	Seldom	Sometimes	Often	Always
How frequently do you usually participate in the decision to hire new staff?	●	○	○	○	○

	Never	Seldom	Sometimes	Often	Always
How frequently do you usually participate in decisions on the promotion of any of the professional staff?	○	○	○	○	○
How frequently do you participate in decisions on the adoption of new policies?	○	○	○	○	○
How frequently do you participate in the decisions on the adoption of new programs?	○	○	○	○	○

- Index of hierarchy of authority:

	Definitely false	False	True		Definitely true
There can be little action taken here until a supervisor approves a decision.	○	○	○		○
A person who wants to make his own decisions would be quickly discouraged here.	○	○	○		○
Even small matters have to be referred to someone higher up for a final answer.	○	○	○		○
I have to ask my boss before I do almost anything.	○	○	○		○
Any decision I make has to have my boss's approval.	○		○	○	○

- Departmental participation in decision making:

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Neither agree/ disagree	Agree	Strongly agree
Employees participate in decisions involving your work.	○	○	○	○	○
Employees participate in decisions involving their work environment.	○	○	○	○	○

9.2. **(Formalization)** Answer the following questions using the scale provided:

- Index of Job codification:

	Definitely false	False	True	Definitely true
I feel that I am my own boss in most matters.	○	○	○	○
A person can make his own decisions without checking with anybody else.	○	○	○	○
How things are done here is left up to the person doing the work.	○	○	○	○
People here are allowed to do almost as they please.	○	○	○	○
People here make their own rules on the job.	○	○	○	○

- Index of rule observation:

	Definitely false	False	True	Definitely true
The employees are constantly being checked on for rule violations.	○	○	○	○
People here feel as though they are constantly being watched to see that they obey all the rules.	○	○	○	○

- Index of Specificity of job:

	Definitely false	False	True	Definitely true
Whatever situation arises, we have procedures to follow in dealing with it.	○	○	○	○
Everyone has a specific job to do.	○	○	○	○
Going through the proper channels is constantly stressed	○	○	○	○
The organization keeps a written record of everyone's job performance.	○	○	○	○

	Definitely false	False	True	Definitely true
We are to follow strict operating procedures at all times.	○	○	○	○
Whenever we have a problem, we are supposed to go to the same person for an answer.	◉	○	○	○

- Written communication:

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Neither agree/ disagree	Agree	Strongly Agree
The frequency of written communication in your organization is high.	○	○	○	○	○

At organizational unit level (U) – Systems Certification department

----

U.1.   Does your organization produce different types of products and/or services?
☐   Yes
☐   No, proceed to question U.5.

U.2.   Are there different roles responsible for the certification of the different types of products / services?
☐   Yes
☐   No, proceed to question U.5.

U.3.   Why are there different roles for the different products / services?

U.4.   What are the implications of processing different types of products / services in the same way / in a different way?

U.5.   How is the management of the IT governance in your organization (or only in the organizational unit: Systems Certification department)?
☐   Centralized
☐   Decentralized

U.6.   Who performs the function of IT? And who is responsible for the IT decisions?

U.7.   (Maturity level) To what extent do you agree that the following statements describe your organization? Use a Likert scale form 1 (completely disagree) - 5 (completely agree)

- Level 1 (Initial):
  - Formal procedures for the execution of processes do not exist in our organization
  - If procedures are defined, they are rarely followed

- o Everybody executes tasks in its own way, in other words: everybody has its own methods
- Level 2 (Managed):
  - o At the beginning of a project, we make agreements about which methods and technology we will use.
  - o If we make agreements about work methods, they will be documented such that they can be executed in the same way at another time.
  - o We use planning and management procedures to control our individual projects
- Level 3 (Standardized):
  - o Procedures are standardized for the whole organization
  - o Work procedures and objectives are well documented in our whole organization
  - o Processes are defined such that they will be in the same way by different work groups
- Level 4 (Predictable):
  - o Performance is managed statistically (e.g. by measuring KPIs) to understand performance and to control variation
  - o Processes/tasks are managed in such a way that they meet agreed-upon performance and quality goals
  - o If processes do not perform according to predefined standards, they are corrected to meet the quantitative goals
- Level 5 (Innovating):
  - o Our organization understands its critical business issues and areas of concern by using feedback from performance measurements
  - o Our organization sets quantitative improvement goals to constantly reorganize processes when perceived necessary
  - o We constantly pilot with new ideas and new technologies to improve our processes

Appendix VII.   Calculation sheet questionnaire

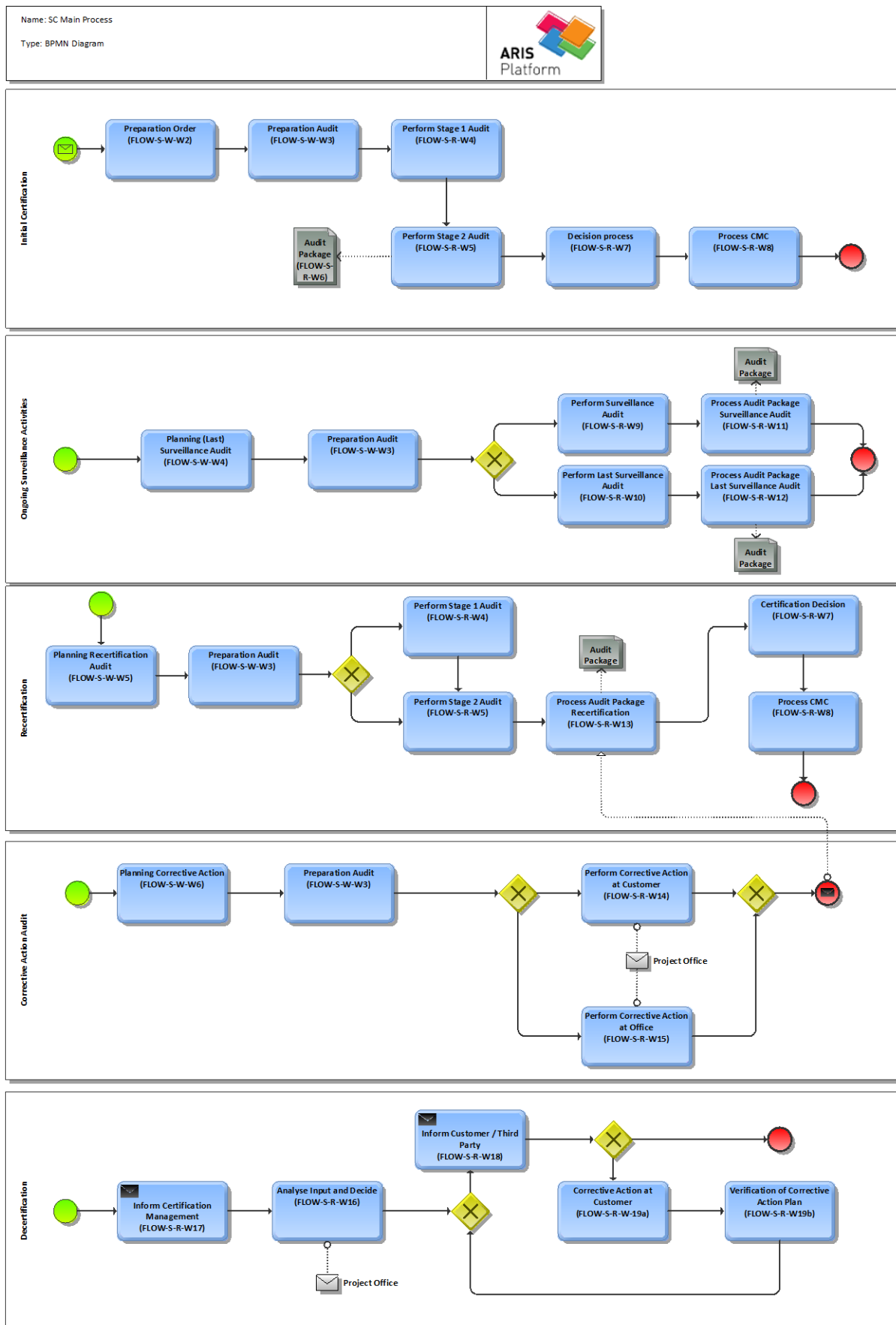| Centralization				Interviewee 1	Interviewee 2	Interviewee 3	Interviewee 4	Averages
Index of participation in decision making (5-point Likert-scale)								
How frequently do you usually participate in the decision to hire new staff?				0,50	1,00	0,00	0,25	0,44
How frequently do you usually participate in decisions on the promotion of any of the professional staff?				0,00	1,00	0,00	0,00	0,25
How frequently do you participate in decisions on the adoption of new policies?				0,25	0,75	0,50	0,75	0,56
How frequently do you participate in the decisions on the adoption of new programs?				0,75	0,50	0,00	0,25	0,38
								0,41
Index of hierarchy of authority (4-point Likert-scale)								
There can be little action taken here until a supervisor approves a decision.				0,67	0,67	0,67	0,33	0,58
A person who wants to make his own decisions would be quickly discouraged here.				0,67	0,33	0,33	0,33	0,42
Even small matters have to be referred to someone higher up for a final answer.				0,67	0,33	0,33	0,33	0,42
I have to ask my boss before I do almost anything.				0,33	0,00	0,33	0,33	0,25
Any decision I make has to have my boss's approval.				0,33	0,33	0,67	0,33	0,42
								0,42
Departmental participation in decision making (5-point Likert-scale)								
Employees participate in decisions involving your work.				0,75	0,25	0,75	0,50	0,56
Employees participate in decisions involving their work environment.				0,75	0,75	0,75	0,25	0,63
								0,59
Group average Centralization		**0,47**						
Formalization								
Index of Job codification (4-point Likert-scale)								
I feel that I am my own boss in most matters.				1,00	0,33	0,33	0,67	0,58
A person can make his own decisions without checking with anybody else.				0,33	0,67	0,00	0,67	0,42
How things are done here is left up to the person doing the work.				0,33	0,33	1,00	0,33	0,50
People here are allowed to do almost as they please.				0,33	0,33	0,67	0,33	0,42
People here make their own rules on the job.				0,00	0,67	0,67	0,33	0,42
								0,47
Index of rule observation (4-point Likert-scale)								
The employees are constantly being checked on for rule violations.				0,67	0,33	0,33	0,67	0,50
People here feel as though they are constantly being watched to see that they obey all the rules.				1,00	0,67	0,33	0,33	0,58
								0,54
Index of Specificity of job (4-point Likert-scale)								
Whatever situation arises, we have procedures to follow in dealing with it.				0,67	0,33	0,67	0,67	0,58
Everyone has a specific job to do.				0,67	0,67	0,67	0,67	0,67
Going through the proper channels is constantly stressed				1,00	0,67	0,67	0,67	0,75
The organization keeps a written record of everyone's job performance.				0,67	0,67	0,67	0,67	0,67
We are to follow strict operating procedures at all times.				0,67	0,67	0,67	0,67	0,67
Whenever we have a problem, we are supposed to go to the same person for an answer.				0,67	0,67	0,67	0,67	0,67
								0,67
Written communication (5-point Likert-scale)								
The frequency of written communication in your organization is high.				0,75	0,75	0,75	0,50	0,69
								0,69
Group average Formalization		**0,59**						
Maturity level (5-point Likert-scale)								
Level 1	Formal procedures for the execution of processes do not exist in our organization			0,00	0,00	0,25	0,25	0,13
	If procedures are defined, they are rarely followed			0,25	0,25	0,25	0,25	0,25
	Everybody executes tasks in its own way, in other words: everybody has its own methods			0,25	0,75	0,75	0,50	0,56
Level 2	At the beginning of a project, we make agreements about which methods and technology we will use			0,75	0,25	0,75	0,75	0,63
	If we make agreements about work methods, they will be documented such that they can be executed in the			0,75	0,25	0,75	0,50	0,56
	We use planning and management procedures to control our individual projects			0,75	0,00	0,25	0,75	0,44
Level 3	Procedures are standardized for the whole organization			0,75	0,25	0,75	0,75	0,63
	Work procedures and objectives are well documented in our whole organization			0,75	0,50	0,75	0,50	0,63
	Processes are defined such that they will be in the same way by different work groups			0,75	0,25	0,75	0,75	0,63
Level 4	Performance is managed statistically (e.g. by measuring KPIs) to understand performance and to control varia			0,75	0,75	0,75	0,75	0,75
	Processes/tasks are managed in such a way that they meet agreed-upon performance and quality goals			0,50	0,50	0,75	0,75	0,63
	If processes do not perform according to predefined standards, they are corrected to meet the quantitative go			0,75	0,25	0,25	0,50	0,44
Level 5	Our organization understands its critical business issues and areas of concern by using feedback from perform			0,75	0,25	0,25	0,25	0,38
	Our organization sets quantitative improvement goals to constantly reorganize processes when perceived nee			0,75	0,25	0,25	0,50	0,44
	We constantly pilot with new ideas and new technologies to improve our processes			0,75	0,25	0,25	0,50	0,44
								0,50
							Initial	0,31
							Managed	0,54
							Standardized	0,63
							Predictable	0,60
							Innovating	0,42

Appendix VIII.   Screenshot of the main process of SC in QMS
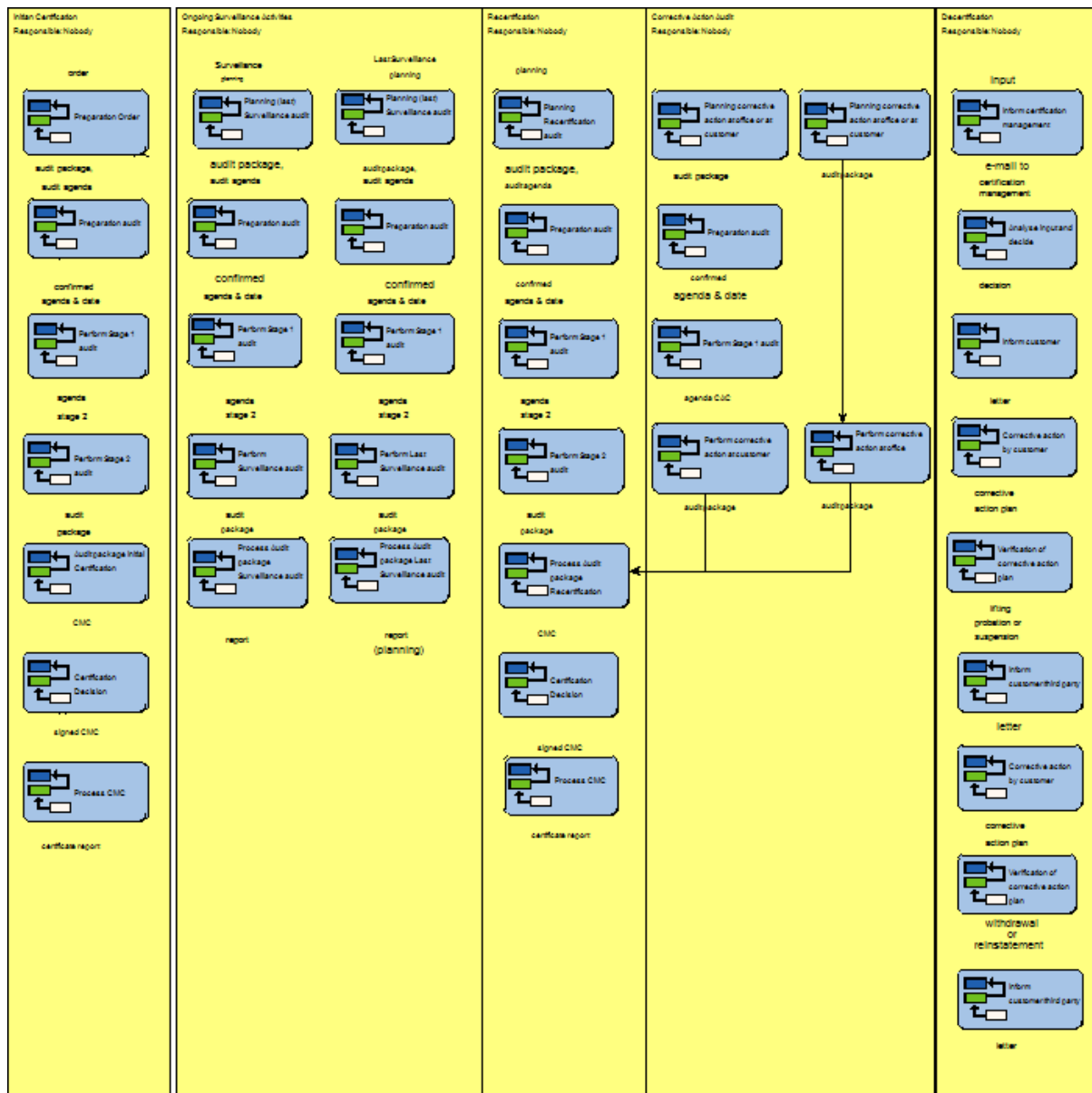
Appendix IX. New modeled main process of SC

Name: SC Main Process

Type: BPMN Diagram

ARIS Platform

Initial Certification

- Preparation Order (FLOW-S-W-W2)
- Preparation Audit (FLOW-S-W-W3)
- Perform Stage 1 Audit (FLOW-S-R-W4)
- Perform Stage 2 Audit (FLOW-S-R-W5)
- Audit Package (FLOW-S-R-W6)
- Decision process (FLOW-S-R-W7)
- Process CMC (FLOW-S-R-W8)

Ongoing Surveillance Activities

- Planning (Last) Surveillance Audit (FLOW-S-W-W4)
- Preparation Audit (FLOW-S-W-W3)
- Perform Surveillance Audit (FLOW-S-R-W9)
- Perform Last Surveillance Audit (FLOW-S-R-W10)
- Process Audit Package Surveillance Audit (FLOW-S-R-W11)
- Process Audit Package Last Surveillance Audit (FLOW-S-R-W12)
- Audit Package

Recertification

- Planning Recertification Audit (FLOW-S-W-W5)
- Preparation Audit (FLOW-S-W-W3)
- Perform Stage 1 Audit (FLOW-S-R-W4)
- Perform Stage 2 Audit (FLOW-S-R-W5)
- Process Audit Package Recertification (FLOW-S-R-W13)
- Audit Package
- Certification Decision (FLOW-S-R-W7)
- Process CMC (FLOW-S-R-W8)

Corrective Action Audit

- Planning Corrective Action (FLOW-S-W-W6)
- Preparation Audit (FLOW-S-W-W3)
- Perform Corrective Action at Customer (FLOW-S-R-W14)
- Project Office
- Perform Corrective Action at Office (FLOW-S-R-W15)

Decertification

- Inform Certification Management (FLOW-S-R-W17)
- Analyse Input and Decide (FLOW-S-R-W16)
- Project Office
- Inform Customer / Third Party (FLOW-S-R-W18)
- Corrective Action at Customer (FLOW-S-R-W-19a)
- Verification of Corrective Action Plan (FLOW-S-R-W19b)

Appendix X. New modeled main process of PC

Name: FLOW-PC-H1_PC Main Process

Type: BPMN Diagram
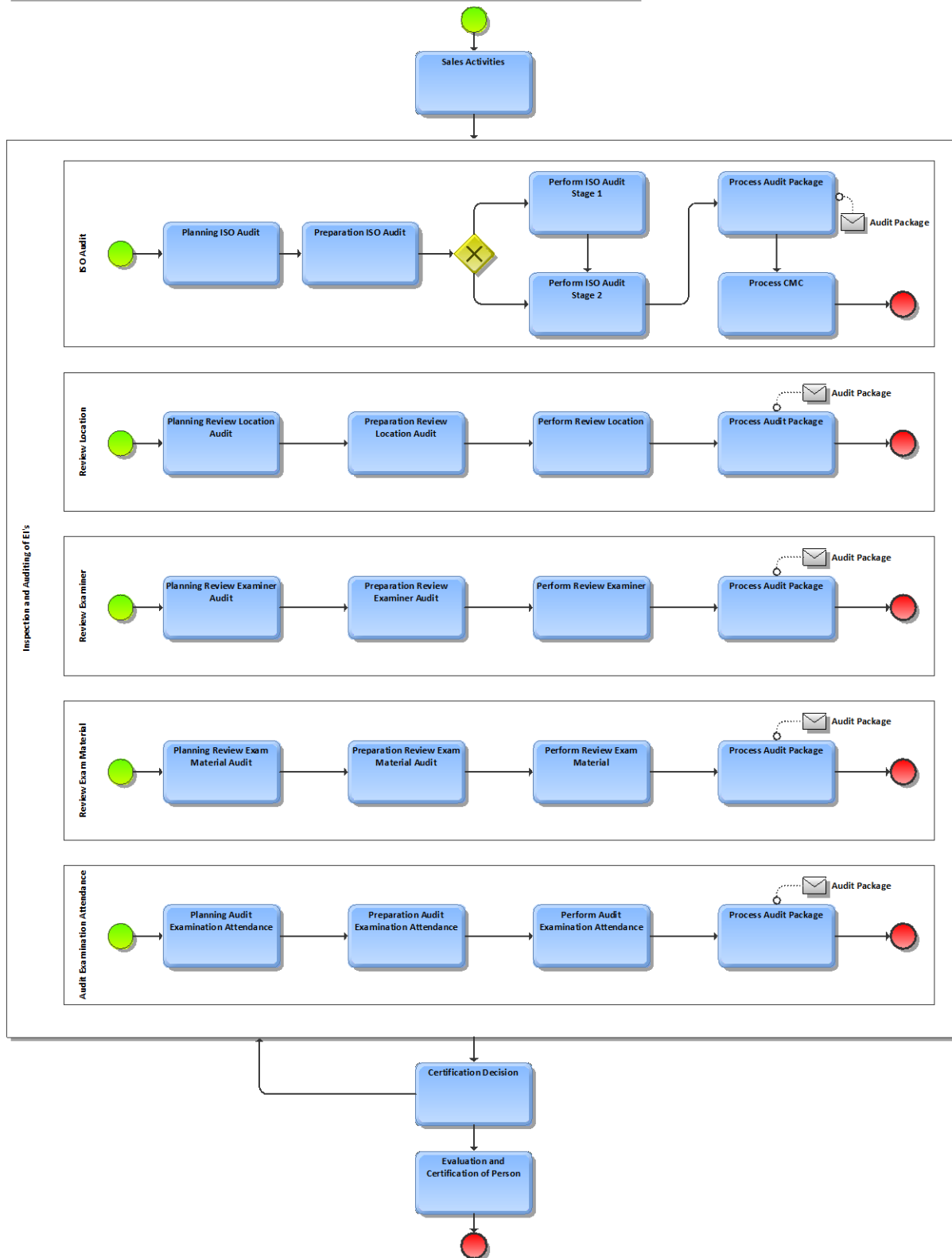
Appendix XI.   Example of a new procedure from PC and its process model

Executor: Auditor

INPUT	SOURCE	OUTPUT	DESTINATION
▪ Audit Package, including: - Date, time and location for attendance - Report of previous attendance - Format report Audit Examination Attendance	▪ Project Office	▪ Audit Examination Attendance Report ▪ Signed Approval	▪ Project Office → Examination Institute

Overview of activities

	Action	Clarification (principles)	Tools	References
1.	Opening Meeting	During the opening meeting, discuss the agenda and verify information such as number of candidates, appropriate certification scheme(s), etc.		
2.	Audit Examination Attendance	The Examination Attendance shall include, at least: - Identification of EI and number of candidates per certification scheme; - On-site location verification; - On-site examiner verification; - Available documents and its versions; - Security of exam documents (questions and answers); - Available time per certification scheme; - Process of the examination (theory and practical parts); - Non-conformities from previous attendance (if applicable); - New non-conformities (if applicable); - Additional issues, explicit indicated by the Certification Manager (if applicable); - Conclusion of the Examination Attendance.		- Format Report Audit Examination Attendance (MEAN-H-PER20): http://2connect.dekra.com/Systems/personcertification/Stipel/Forms/AllItems.aspx - Relevant Certification Scheme: www.stipel.nl
3.	Document Findings	Document the findings during the Examination Attendance. In case of NCF's, document NCF's in the report and classify them according to the		- Format Report Audit Examination Attendance (MEAN-H-PER20):

	Action	Clarification (principles)	Tools	References
		risk as major or minor: Major Nonconformance: The requirement has not been met. Minor Nonconformity: The requirement has not been fully met. Follow procedure FLOW-PC-W17 to review the Corrective Actions on EI. After completing this procedure, proceed to the next step.		http://2connect.dekra.com/Systems/personcertification/Stipel/Forms/AllItems.aspx **FLOW-PC-W17**
4.	Inform Project Office	Send the complete report to the Project Office, together with a signed letter of approval.	Outlook	

Name: FLOW-PC-W13_Audit Examination Attendance

Type: BPMN Diagram
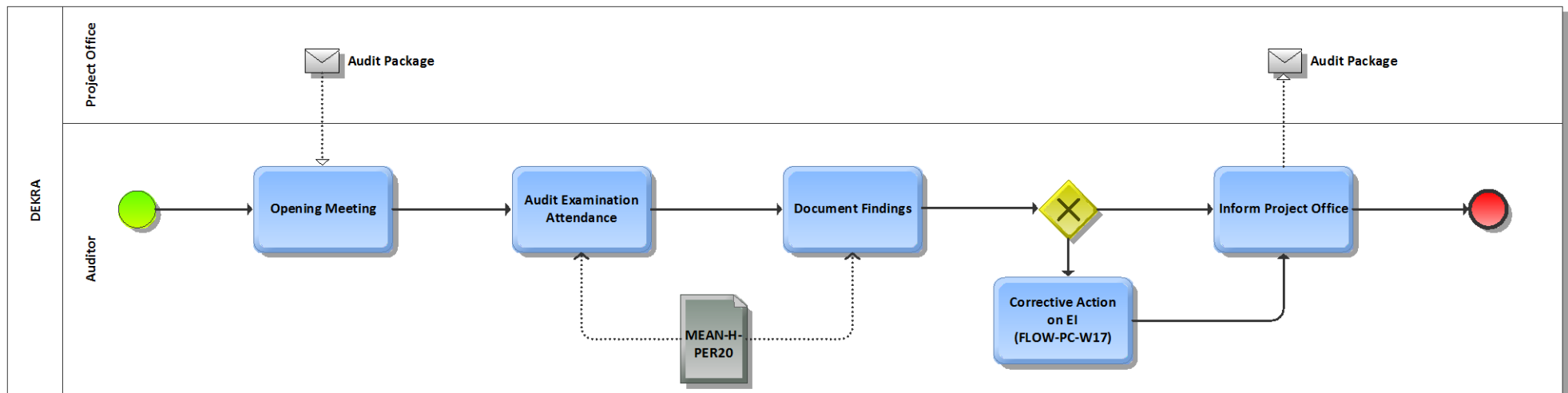
Appendix XII.   Standard process of PC; STIPEL BASIS

Purpose: To define the service and process variations to the standard process.

Use: This document describes obligatory additions to the standard process.

Remark: This is the standard process for Personnel Certification, Domain STIPEL BASIS.

OVERVIEW OF ACTIVITIES

	Process step	Deviations and additions	Systems	Means	Executor
	First contact with customer				Sales assistant / Account manager
2.	Customer assessment				Account manager
3.	Acquisition				Account manager
4.	Develop Certification Scheme				Quality Manager / Certification Manager / Product Expert
5.	Select Examination Institutes				Certification Manager / Product Expert
6.	Draw up Quotation				Account manager
7.	Follow Up Quotation				Account manager
8.	Transfer to Work Preparation				Sales assistant
9.	Preparation Order				Project Office
10.	Planning (Initial / Surveillance / Recertification) ISO 9001 / ISO 17024 audit				Project Office
11.	Prepare ISO 9001 / ISO 17024 audit				Auditor
12.	Perform ISO 9001 / ISO 17024 stage 1 audit				Auditor
13.	Perform ISO 9001 / ISO 17024 stage 2 audit				Auditor
14.	Process Audit Package				Project Office
15.	Process CMC				Project Office
16.	Planning Review Location				Project Office
17.	Perform Review Location				Auditor

	Process step	Deviations and additions	Systems	Means	Executor
18.	Process Audit Package				Project Office
19.	Planning Review Examiner				Project Office
20.	Perform Review Examiner				Auditor
21.	Process Audit Package				Project Office
22.	Planning Review Exam Material				Project Office
23.	Perform Review Exam Material				Auditor
24.	Process Audit Package				Project Office
25.	Planning Audit Examination Attendance				Project Office
26.	Perform Audit Examination Attendance				Auditor
27.	Process Audit Package				Project Office
28.	Certification Decision				Certification Manager
29.	Perform Corrective Action on Examination Institute				Auditor / Certification Manager
30.	Evaluation and Certification of Person				Project Office
31.	Perform Corrective Action on Certificate Owner				Project Office / Certification Manager
32.	Qualify Personnel				Quality Manager
33.	Maintain Certification Scheme				Certification Manager
34.	Analyze Validity and Reliability of Certification				Product Expert

Appendix XIII. Action plan for DEKRA

Actions DEKRA Certification	
Establish a dedicated Project Office for PC, dealing with planning and audit packages	Management
Clearify location of PC documents to relevant employees (format reports / checklists on 2connect or in QMS?)	Management
Update table 2 in procedure FLOW-PC-W21	Jos Trienekens
Communicate changes (procedures, locations, processes) to personnel (for PC in "Vakbroederoverleg")	Jos Trienekens
Verify procedures MEAN-H-PER21 and PROD-H-M10, delete by Theresa Fleskes if not needed	Jos Trienekens
Develop checklist for a location review for STIPEL BASIS (and add in reference of FLOW-PC-W7)	Ad Kaizer
Check whether new procedures are in line with domain **STIPEL PCE**. Add deviations where necessary. If possible, use the Standard Service Specification PROD-PC-D1 of PC for these deviations, and name the new specification for STIPEL PCE "PROD-PC-D2".	Fons van Outheusden
Check whether new procedures are in line with domain **KB**. Add deviations where necessary. If possible, use the Standard Service Specification PROD-PC-D1 of PC for these deviations, and name the new specification for KB "PROD-PC-D3".	Sandy Brinkhorst
Check whether new procedures are in line with domain **VASTGOED.** Add deviations where necessary. If possible, use the Standard Service Specification PROD-PC-D1 of PC for these deviations, and name the new specification for Vastgoed "PROD-PC-D4".	Jos Trienekens
Check whether new procedures are in line with domain **BTSW.** Add deviations where necessary. If possible, use the Standard Service Specification PROD-PC-D1 of PC for these deviations, and name the new specification for BTSW "PROD-PC-D5".	Jos Trienekens
Delete procedure MEAN-H-PER21 (not necessary; included in MEAN-H-PER20)	Theresa Fleskes
Delete procedure MEAN-H-PER20 from QMS. Newest version is on 2connect	Theresa Fleskes
Delete procedure QUA/ACO-H-012 (not necessary; included in FLOW-PC-H1)	Theresa Fleskes
Delete procedure PROD-H-M11 (not necessary; included in FLOW-PC-W7)	Theresa Fleskes
Delete procedure PROD-H-M12 (not necessary; included in FLOW-PC-W7 and FLOW-PC-W13)	Theresa Fleskes
Delete procedure QUA/ACO-P-010	Theresa Fleskes
Delete procedure QUA/ACO-P-011	Theresa Fleskes
Delete procedure QUA/ACO-P-013	Theresa Fleskes
Delete procedure QUA/ACO-P-014	Theresa Fleskes
Delete procedure QUA/ACO-P-016	Theresa Fleskes
Delete procedure QUA/ACO-P-017	Theresa Fleskes
Delete procedure QUA/ACO-P-018	Theresa Fleskes
Delete procedure QUA/ACO-P-019 (not necessary; included in FLOW-PC-W23)	Theresa Fleskes

Appendix XIV.   Cross Reference list ISO 17024:2012

ISO 17024:2012 Clause	Reference DEKRA	Explanation	Actions to Take	Dedicated to
4 General requirements		Expected to meet this requirement, as it is not changed		
4.1 Legal matters		Expected to meet this requirement, as it is not changed		
4.2 Responsibility decision		Expected to meet this requirement, as it is not changed		
4.3 Management impartiality		Expected to meet this requirement, as it is not changed		
4.3.1		Expected to meet this requirement, as it is not changed		
4.3.2		Expected to meet this requirement, as it is not changed		
4.3.3		Expected to meet this requirement, as it is not changed		
4.3.4		Expected to meet this requirement, as it is not changed		
4.3.5		Expected to meet this requirement, as it is not changed		
4.3.6		Expected to meet this requirement, as it is not changed		
4.3.7		Expected to meet this requirement, as it is not changed		
4.3.8		Expected to meet this requirement, as it is not changed		
4.4 Finance ad liability		Expected to meet this requirement, as it is not changed		
5 Structural requirements **5.1 Management**				
5.1.1		Expected to meet this requirement, as it is not changed		
5.1.2		Expected to meet this requirement, as it is not changed		
5.1.2a		Expected to meet this requirement, as it is not changed		
5.1.2b		Expected to meet this requirement, as it is not changed		
5.1.2c		Expected to meet this requirement, as it is not changed		
5.1.2d		Expected to meet this requirement, as it is not changed		
5.1.2e		Expected to meet this requirement, as it is not changed		
5.1.2f		Expected to meet this requirement, as it is not changed		
5.1.2g		Expected to meet this requirement, as it is not changed		
5.1.2h		Expected to meet this requirement, as it is not changed		
5.2 Structure				

5.2.1			Verify clause, or discuss how to deal with this clause	Certification Man.
5.2.2			Verify clause, or discuss how to deal with this clause	Certification Man.
5.2.3			Verify clause, or discuss how to deal with this clause	Certification Man.
5.2.3a			Verify clause, or discuss how to deal with this clause	Certification Man.
5.2.3b			Verify clause, or discuss how to deal with this clause	Certification Man.
5.2.3c			Verify clause, or discuss how to deal with this clause	Certification Man.
5.2.3d			Verify clause, or discuss how to deal with this clause	Certification Man.
5.2.3e			Verify clause, or discuss how to deal with this clause	Certification Man.
6 Resource requirements **6.1 General requirements**				
6.1.1	FLOW-PC-W21			
6.1.2	FLOW-PC-W21	Table 2 in this procedure		
6.1.3	FLOW-PC-W21	Requirements defined in relation to this procedure		
6.1.4	Agreement and Job description personnel			
6.1.5	System: Persis	Personnel information in Persis		
6.1.6	FLOW-PC-W21	Procedure requires confidentiality agreement		
6.1.7	FLOW-PC-W21	Procedure requires also declaration of independence		
6.1.8	FLOW-PC-W21 for Personnel and for example FLOW-PC-W9 for Examiners	Procedure requires relevant documents. For Examiners: the checklist for Examiners is used to maintain impartiality		
6.2 Personnel				
6.2.1 General		In general contract of employee?	Check if this is the case	Management
6.2.2 Examiners				
6.2.2.1	FLOW-PC-W9	In procedure and / or checklist review examiner		
6.2.2.1a	FLOW-PC-W9	In procedure and / or checklist review examiner		
6.2.2.1b	FLOW-PC-W9	In procedure and / or checklist review examiner		

6.2.2.1c	FLOW-PC-W9	In procedure and / or checklist review examiner		
6.2.2.1d	FLOW-PC-W9	In procedure and / or checklist review examiner		
6.2.2.1e	FLOW-PC-W9	In procedure and / or checklist review examiner		
6.2.2.2	FLOW-PC-W9 / W13	In review examiner and review exam attendance		
6.2.2.3	FLOW-PC-W9	No procedure, but is prevented by declaration of independance	If needed, define procedure and actions to take	Jos Trienekens
6.2.3 Other personnel				
6.2.3.1	PerC en Persis	Also added in step 9 of FLOW-PC-W1a	Add documented descriptions/requirements of invigilators	Ben Wichink-Kruit or Walter Hemmer
6.2.3.2	FLOW-PC-W9	No procedure, but is prevented by declaration of independance	If needed, define procedure and actions to take	Jos Trienekens
6.3 Outsourcing				
6.3.1		In agreement with Examination Institutes, etc.	Check Agreement on this issue	Certification Man.
6.3.2a		In agreement with Examination Institutes, etc.	Check Agreement on this issue	Certification Man.
6.3.2b	FLOW-PC-W4 / W5	ISO 17024 at the Examination Institute		
6.3.2c	FLOW-PC-W4 / W5	ISO 9001 at the Examination Institute. And step 2 of FLOW-PC-W1b		
6.3.2d	FLOW-PC-W1b	Step 2 in this procedure. Also, for operations, see documents provided in the Audit Package (FLOW-PC-W20)		
6.3.2e	FLOW-PC-W1b	Step 5 in this procedure	Document list of EI's explicitly (by adding location of this list to step 5 of procedure FLOW-PC-W1b)	Ad Kaizer
6.4 Other resources	FLOW-PC-W7 / W13	Review of Location, Review Exam Attendance		
7 Records and information				
7.1 Records persons				
7.1.1	FLOW-PC-W14	Documented in system: PerC		
7.1.2	FLOW-PC-W14			
7.1.3	Cert. Agreement	Is included in the Certification Agreement with Candidate		
7.2 Public information				
7.2.1		Ok		
7.2.2	Stipel.nl	For domain STIPEL Basis: Available at STIPEL online		

7.2.3	Stipel.nl	For domain STIPEL Basis: Available at STIPEL online		
7.2.4		Ok		
7.3 Confidentiality				
7.3.1		Expected to meet this requirement, as it is not changed		
7.3.2		Expected to meet this requirement, as it is not changed		
7.3.3		Expected to meet this requirement, as it is not changed		
7.3.4		Expected to meet this requirement, as it is not changed		
7.3.5		Expected to meet this requirement, as it is not changed		
7.4 Security				
7.4.1		Only a check for security of documents during exam attendance, but no check if EI has measures in place to take corrective actions when breaches occur.	Add a check in FLOW-PC-W13 or format report exam attendance to verify that EI has measures in place to take corrective actions when breaches occur.	Ad Kaizer
7.4.2	FLOW-PC-W13	Procedure and / or format report exam attendance (ch 7)		
7.4.2a	FLOW-PC-W13	Procedure and / or format report exam attendance (ch 7)		
7.4.2b	FLOW-PC-W13	Procedure and / or format report exam attendance (ch 7)		
7.4.2c	FLOW-PC-W13	Procedure and / or format report exam attendance (ch 7)		
7.4.2d	FLOW-PC-W5	Step 2 in this procedure.		
7.4.3a	FLOW-PC-W13	Procedure and / or format report exam attendance (ch 7)		
7.4.3b	FLOW-PC-W13	Procedure and / or format report exam attendance (ch 7)		
7.4.3c	FLOW-PC-W13	Procedure and / or format report exam attendance (ch 7)		
7.4.3d	FLOW-PC-W13	In format report exam attendance (ch 6): Exam Regulations		
7.4.3e	FLOW-PC-W13	Procedure and / or format report exam attendance (ch 7)		
7.4.3f	-	Not verified, but is prevented by different examinations	If needed, add check in FLOW-PC-W13 that different examinations (theoretical and practical) are used	Ad Kaizer
8 Certification schemes				
8.1		Ok		
8.2a	FLOW-PC-W1a	Step 9 in this procedure		
8.2b	FLOW-PC-W1a	Step 9 in this procedure		
8.2c	FLOW-PC-W1a	Step 9 in this procedure		

8.2d	-	Not described; Only if applicable		
8.2e	-	Not described; Only if applicable		
8.2f	-	Not described; Only if applicable		
8.3a	FLOW-PC-W1a	Step 9 in this procedure (Recertification is not applicable)		
8.3b	FLOW-PC-W1a	Step 9 in this procedure		
8.3c	FLOW-PC-W1a	Step 9 in this procedure		
8.3d	FLOW-PC-W1a	Step 9 in this procedure		
8.3e	FLOW-PC-W1a	Step 9 in this procedure		
8.4a	FLOW-PC-W1a	Step 6 and 8 in this procedure		
8.4b	FLOW-PC-W1a	Step 6 and 8 in this procedure		
8.4c	FLOW-PC-W1a	Step 9 in this procedure		
8.4d	FLOW-PC-W1a	Step 9 in this procedure		
8.4e	-		Identify job or practice analysis	Ben Wichink-Kruit or Walter Hemmer
8.5	FLOW-PC-W22			
8.6	FLOW-PC-W1a	As a note in this procedure.		
9 Certification process				
9.1 Application process				
9.1.1				
9.1.2				
9.1.2a	FLOW-PC-W5	In step 2 of ISO 17024 audit (criteria for application)		
9.1.2b	FLOW-PC-W5	In step 2 of ISO 17024 audit (criteria for application)		
9.1.2c	FLOW-PC-W5	In step 2 of ISO 17024 audit (criteria for application: Norm is included in the Certification Agreement with Candidate)		
9.1.2d	FLOW-PC-W5	In step 2 of ISO 17024 audit (criteria for application: Norm is included in the Certification Agreement with Candidate)		
9.1.2e	FLOW-PC-W5	In step 2 of ISO 17024 audit (criteria for application: Norm is included in application form or exam regulations of EI)		

9.1.3				
9.2 Assessment process				
9.2.1	FLOW-PC-W11			
9.2.2	FLOW-PC-W22	Added step: Verify Change	Inform Certification Managers about added step	Certification Man.
9.2.3	FLOW-PC-W13	Procedure and Format Exam Attendance ch 6		
9.2.4	FLOW-PC-W11 / 13			
9.2.5	FLOW-PC-W13	Check during exam attendance, if applicable		
9.2.6	PerC	Documents stored in archive of PerC		
9.3 Examination process				
9.3.1	FLOW-PC-W13			
9.3.2	FLOW-PC-W13	For EI: Format Exam Attendance ch 6. For DEKRA: Not available yet	Develop a workinstruction within Project Office to ensure consistent examination administration. Include a reference in FLOW-PC-W14	Arien van Dijk
9.3.3	FLOW-PC-W13	Procedure and Format Exam Attendance ch 4		
9.3.4	FLOW-PC-W13	Procedure and Format Exam Attendance ch 4		
9.3.5	FLOW-PC-W23			
9.4 Decision on certification				
9.4.1	FLOW-PC-W13	Procedure and Format Exam Attendance ch 6		
9.4.1a	FLOW-PC-W13	Procedure and Format Exam Attendance ch 6 (official report)		
9.4.1b	FLOW-PC-W13	Procedure and Format Exam Attendance ch 6 (official report)		
9.4.2	FLOW-PC-W14 / 16	Note in procedures W14 and W16		
9.4.3	FLOW-PC-W14	Described as *relevant* certification scheme		
9.4.4	-	Ok; completely outsourced		
9.4.5	FLOW-PC-W21	Table 1 in this procedure		
9.4.6	FLOW-PC-W14	Step 5 in this procedure		
9.4.7	FLOW-PC-W14	Steps 6 and 7 in this procedure		
9.4.8a	FLOW-PC-W14	Steps 6 and 7 in this procedure		
9.4.8b	FLOW-PC-W14	Steps 6 and 7 in this procedure		

9.4.8c	FLOW-PC-W14	Steps 6 and 7 in this procedure		
9.4.8d	FLOW-PC-W14	Steps 6 and 7 in this procedure		
9.4.8e			If not yet included: include the scope on certificate	Arien van Dijk and Ad Kaizer
9.4.8f	FLOW-PC-W14	Steps 6 and 7 in this procedure		
9.4.9	-	Ok		
9.5 Suspension, withdrawing				
9.5.1	FLOW-PC-W16			
9.5.2	FLOW-PC-W16	Step 6 in this procedure		
9.5.3	Cert. Agreement	Is included in the Certification Agreement with Candidate		
9.5.4	Cert. Agreement	Is included in the Certification Agreement with Candidate		
9.6 Recertification process				
9.6.1			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.2			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.3			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.3a			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.3b			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.3c			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.3d			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.3e			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.3f			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.3g			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.3h			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.4			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.5a			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.5b			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.5c			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.5d			Verify clause, or discuss how to deal with this clause	Certification Man.

9.6.5e			Verify clause, or discuss how to deal with this clause	Certification Man.
9.6.5f			Verify clause, or discuss how to deal with this clause	Certification Man.
9.7 Use of certificates, marks				
9.7.1				
9.7.2	Cert. Agreement	Is included in the Certification Agreement with Candidate		
9.7.2a				
9.7.2b	Cert. Agreement	Is included in the Certification Agreement with Candidate		
9.7.2c				
9.7.2d	Cert. Agreement	Is included in the Certification Agreement with Candidate		
9.7.2e	Cert. Agreement	Is included in the Certification Agreement with Candidate		
9.7.3				
9.8 Appeals				
9.8.1		For appeals and complaints, an EI uses a complaint form which is available for the candidate during and after the examination (this is checked during an exam attendance: format chapter 6). For appeals and complaints regarding the certification, a reference is made to the website of DEKRA. Within DEKRA, there are general procedures for handling the appeals and complaints, including FLOW-ALL-Q-F2 and FLOW-ALL-Q-W20.		
9.8.1a				
9.8.1b				
9.8.1c				
9.8.2				
9.8.3				
9.8.4				
9.8.5				
9.8.6				
9.8.7				
9.9 Complaints				
9.9.1		For appeals and complaints, an EI uses a complaint form which is available for the candidate during and after the examination (this is checked during an exam attendance: format chapter 6). For appeals and complaints regarding the certification, a reference is made to the website of DEKRA. Within DEKRA, there are general procedures for handling the appeals and complaints, including FLOW-ALL-Q-F2 and FLOW-		
9.9.2				
9.9.3				
9.9.3a				
9.9.3b				

9.9.3c		ALL-Q-W20.		
9.9.4				
9.9.5				
9.9.6				
9.9.7				
9.9.8				
9.9.9				
9.9.10				
10 Management system				
10.1 General	FLOW-PC-W1b	Step 2 in this procedure		
10.2 General requirements 10.2.1 General		These requirements are included in the ISO 9001 audits at the EI.		
10.2.2 Documentation				
10.2.3 Control of documents 10.2.3a				
10.2.3b				
10.2.3b				
10.2.3c				
10.2.3d				
10.2.3e				
10.2.3f				
10.2.3g				
10.2.4 Control of records 10.2.5 Management review 10.2.5.1 General				
10.2.5.2 Review input				

10.2.5.2a				
10.2.5.2b				
10.2.5.2c				
10.2.5.2d				
10.2.5.2e				
10.2.5.2f				
10.2.5.2g				
10.2.5.2h				
10.2.5.3 Review output				
10.2.5.3a				
10.2.5.3b				
10.2.5.3c				
10.2.6 Internal audits				
10.2.6.1				
10.2.6.2				
10.2.6.3				
10.2.6.4a				
10.2.6.4b				
10.2.6.4c				
10.2.6.4d				
10.2.6.4e				
10.2.7 Corrective actions 10.2.7a				
10.2.7b				
10.2.7c				
10.2.7d				

10.2.7e				
10.2.7f				
10.2.7g				
10.2.8 Preventive actions 10.2.8a				
10.2.8b				
10.2.8c				
10.2.8d				
10.2.8e				