Breaking the Ice between Government and Business: From IT-Enabled Control Procedure Redesign to Trusted Relationship Building

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BREAKING THE ICE BETWEEN GOVERNMENT AND BUSINESS: FROM IT-ENABLED CONTROL PROCEDURE REDESIGN TO TRUSTED RELATIONSHIP BUILDING

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Preface

The journey towards completion of this book has been a personal adventure strewn with triumphs, failures and near misses. I have harvested a sum of richest life treasury during this four and half years’ PhD research. Looking back, however, I gained the most valuable experience not from the successes I achieved but from the failures I encountered and how I coped with them. I felt the pain of growing but retrospectively my feeling is one of “no pain no gain”.

In this thesis, the main topic for discussion is how to balance the relationship of control and trust between the government and businesses under the ICT-enabled environment. Specifically, the research was carried out within the domain of electronic Customs. The book is divided into two major parts. In the first part of the book we discuss e³-control, the main methodology applied throughout the thesis for control procedure redesign. We present the step-wise approach and technical guidelines for applying the methodology. Four real-life cases applying the e³-control methodology are presented and discussed in this book to give domain experts a practical guide and reference to their work. In part two of the thesis, based on the theory of information asymmetry and agency theory, we further discuss the rationale under the control procedure redesign and show the importance of introducing a trust-based control system. In the case study of Authorized Economic Operator (AEO) in Europe, we discuss how the new form of control delegation and the “In-control” statement may potentially influence the future European economy. To effectively promote the concept of AEO, we propose setting up a risk management-based, IT-enabled business model for better government-to-business interaction and mutual selection. At the end of this book, we also give an integrated framework for effectively evaluating IT innovations in a government-to-business context, containing evaluation criteria not only for financial, but also for social, operational and strategic values.

This book is suitable for and of interest to several audiences: general managers and compliance managers can use it for better strategic planning and compliance management; system developers and procedure experts can apply it to improve system design and better procedure control; government policy makers and Customs officers can refer to it for better policy making and implementation.

This PhD research is funded by the integrated project ITAIDE (nr.027829), under the 6th Framework IST programme of the European Commission (see www.itaide.org). I am greatly indebted to all participants in the project for their valuable contributions to this work and the financial support of IBM Global Business Services, in particular Rob Meerman and Norbert Kouwenhoven.

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Special thanks go to my promoters Yao-Hua Tan, who led into this research project and guided me through these four years; Frank den Butter, who helped a great deal in my final year’s research and in finishing this book; and my dear colleagues Ziv Baida, Boriana Rukanova, Zsofia Kraeussl, Joris Hulstijn, Romy Klop, Brigitte Burgemeestre, Eveline van Stijn and Hans Modder for their support throughout my PhD research.

In addition, I would like to express my deepest gratitude to my dear friends JingJing and Zhenxiong, ShuoShuo and Radboud, DaDa, MingMing, Rick, Graham, Daniel and Steve, without their support I would never have been able to accomplish the work today. And much credit goes to Lawrence, who carefully proofread the text of this book --- always on time, despite his tight working schedule.

This book is dedicated to my parents, my sister and my soul mate Ignace, who supported me and gave me their unconditional love along the way.

Jianwei Liu, Amsterdam
序言

完成这篇博士论文历程对我来说是一个充满曲折的人生历险，其中饱尽着的胜利喜悦，失败沮丧和近失迷失的自己。然而在这四年半的博士学习与工作中，我也收获了最为宝贵的人生财富。回头看来，我最大的收获并不在于我迄今所取得的成就，而在于自己经历的一次次的失败和一次次从失败的阴影中走出来经历。“在失败的痛苦中成长”，也许是最能表达我这四年的经历和此时此刻的心情吧。

在本篇论文中，我重点论述了在信息技术的影响下，如何在政府机关与商业机构之间调节与平衡“控制”与“信任”两者的关系。本书的具体研究则定位于欧盟电子海关的领域的研究。本书一共划分为两部分。第一部分具体介绍了 e³-control（作为本书中控制设计的核心方法论），其核心方法论及实践向导；并进一步提供了四个详尽的控制设计案例的研究（包括荷兰喜力啤酒公司，芬兰联合造纸厂，丹麦奥拉奶制品公司，爱尔兰生物制药等四个案例），以便于领域专家在实际工作中参考与借鉴。本书的第二部分，我着重根据信息的非对称性原理，探讨控制设计理念的起源，以及引入信任机制的必要性。以欧盟海关A E O（特许授权经营）作为研究案例，我进一步探讨了欧洲的“控制授权机制”以及“自我控制”声明对未来的欧洲及世界的经济产生的互动影响。为有效的推广 A E O理念，本书提议建立以风险管理为基础，电子科技为依托的政府与商务之间的互动模型。在本书的最后，为了对电子信息控制整改方案有一个较为整体客观评估，我针对电子政务领域中的电子创新提供了一个有效评估框架。此框架整合了不仅对整改经济效益的评估，而且包含了对社会效益，运营效率，决策方针等多方面的考虑。作者希望本书将为专家经理，商务专家，海关官员及政府政策的制定者提供实践上的积极的帮助及理论上的引导作用。

本论文所涉及的研究系由欧盟第六框架 IST规划下的整合项目 ITAIDE (nr.027829)资助的。我对项目的所有参与者宝贵的贡献以及 IBM 公司，尤其是 Rob Meerman 及 Norbert Kouwenhoven 先生在财政上的支持表示由衷的谢意！

最后，向我的父母，姐姐，姐夫和我亲爱的朋友们致以我最诚挚与深切的感谢！没有他们无条件的爱与支持我是无法完成这篇论文的。

刘建伟
于 2010 年 9 月
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Abstract

The emergence of e-Government has transformed the traditional government-to-business (G2B) relationship to a new form. The ice between government and business has begun to melt, so that the old style of stiff and counter-productive control/be-controlled relationship is no longer necessary; instead, more trust-based network collaboration with ICT facilitation has become desirable for both government and business.

This thesis propounds a novel view on the government-to-business (G2B) relationship in the information age. The research is set in the context of interactions between Customs administrations and trading companies. Two lines of research are drawn in this thesis:

First, it supports IT-enabled redesign for better e-Government/Customs control procedures. In order to do so, a software-supported systematic approach called “e³-control” has been developed. The “e³-control” is a self-contained redesign methodology with a clear, step-like arrangement, which makes it easy for any domain practitioners to understand and practice in various redesign situations. In the thesis, four real-life cases applying the “e³-control” methodology in different geographical and industrial environments are presented.

Second, to solve the dilemma of increased security and control requirements and at the same time to decrease the administrative burden for the European governments/businesses, we propose forming trusted collaboration between the government and businesses to lower the transaction cost. However, trust ought not to be granted by default; realizing the underlying social-economic reasoning and building up models on these issues may help both government and business to better understand what is going on during this transition. In the case of the Authorized Economic Operator (AEO), we discuss problems and requirements for building such a trusted relationship, we model corresponding solutions and we recommend an evaluation framework for IT innovation in a G2B context.
1. Introduction

One of the major trends in the past few decades is the formation of the modern networked society based on definitive adoption of the information & communication technology (ICT). ICT advances have been perceived as one of the important enablers of structural change (Huber, 1990; Markus & Robey, 1988). Internet-based systems, with their high degree of standardization and low cost, have accelerated the IT-enabled restructuring both within and among organizations. From advanced web search engines (e.g. Google and Bing) to knowledge management system (e.g., Wikipedia); from online personal and social communities (e.g. blogs, LinkedIn, Facebook and Twitter) to various eCommerce networks [e.g. Business-to-Business (B2B), Business-to-Consumer (B2C) and Consumer-to-Consumer (C2C) networks], our social structure and life styles have inevitably been changed in order to cope with the challenges that ICT and the Internet bring us.

Collaborative and networked organizations can achieve benefits that a single organization can scarcely achieve. Clear benefits can be shown by giving an example in modern supply chains: most multinationals and even some SMEs (small and medium sized enterprises) are able to develop their interlinked enterprise resource planning (ERP) systems to make the supply chain management more efficient and effective than ever before [see (Lancioni et al., 2000) and (Closs & McGarrell, 2004)].

Slowly but surely, the government has been participating in the reform of the network revolution and taking an active role especially in first decade of the 21st century. This movement is symbolized by the setting-up of many e-Government projects/programs in the past years. e-Government is defined as “the transformation of public sector internal and external relationships through net-enabled operations, information technology and communications, to optimize government service delivery, constituency participation and governance” (Baum & Di Maio, 2000). Esteves & Joseph (2008) point out that e-Government is about the changing nature of relationships from hierarchical command-and-control to an interactive collaboration among governments, citizens, businesses, public sector employees and other governments. e-Government provides a platform for multi-channel interaction and multi-service delivery options. Furthermore, e-Government is about having centralized yet dispersed operations to maximize efficiencies, productivity and service delivery. In line with the stakeholders involved, Evans & Yen (2006) define four broad types of relationships in e-Government: G2C (Government to Citizens), G2E (Government to Employees), G2B (Government to Businesses), and G2G (Governments to Governments). We place the emphasis in this thesis on the G2B relationship of the e-Government. The goals of the G2B are to reduce burdens on business, reduce costs and gather better information, thereby allowing the government to carry out better transactions with businesses as well as to conduct business in a more effective way.

However, changing the nature of G2B relationship from hierarchical and command-and-comply to a trust-based interactive collaboration is not an easy task. As ICT plays an important role in this transformation, our first focal point in this research is naturally the facilitating role of ICT. However, the purpose is not simply to digitize the existing paper documents. ICT facilitation shall only be perceived as a median and an enabler for better G2B relationships.
rather than as the final goal of the change. We argue that the ultimate goals of the redesign are to lower the information asymmetry, to reduce transaction costs and to improve the efficiency and effectiveness of the current procedure, thus maximizing total (social) welfare. Without realizing this fundamental issue, many redesign efforts may be in vain. Good social-economic reasoning behind ICT based redesign, proper policy designing and evaluation method are of great importance to reach these final goals of the redesign. These issues are elaborated in this thesis, based on various case studies of the e-Customs control procedure redesign. We propose that the redesign efforts should be taken by both sides of businesses and the government, including IT-enabled procedure redesign and sound policy design and implementation methods with a better understanding of socio-economic perspectives.

1.1 Research motivation & objectives

In the past few decades, globalization and growing international trade have brought great benefits to economic development all over the world. However, facing the challenges that globalization and accelerated trade have brought us, our international trade mechanisms (involving both the government and businesses) have been inadequate to cover the safety and security concerns and have become vulnerable to criminal and terrorist exploitation. Under the influence of the 9/11 terrorist attacks in 2001 and of global epidemics in recent years (e.g. the SARS\(^1\) outbreak in 2003 and the H1N1\(^2\) pandemic in 2009), governments worldwide have strengthened security requirements towards businesses by introducing various new regulations and standards relating to trade, health and financial control on an international scale. Businesses, on the other hand, have begun to actively enhance their own safety and security so as to safeguard their market position and brand image. A joint effort has been made by both sides to enhance a secure international trade environment.

An existing dilemma, however, is that governments would like on the one hand to reduce the administrative burden for businesses and on the other hand to increase level of security and control. But how can governments release the businesses from the extra administrative burden introduced by the new security regulations? One of the major government administrations fighting on this frontline is the Tax and Customs administration (TCA). The traditional single side power-posing by Customs administrations to trade parties is no longer appropriate in this case. The European Union (EU) is now realizing the potential benefits of applying advanced ICT in the Customs practices and establishing new Customs-and-Business partnerships. There are two main methods currently being exploited by the EU: the first is to redesign the current Customs procedures based on advanced ICT adoption, thus changing the traditional Customs to e-Customs; the second is to set up new collaborative partnership between Customs and businesses via a new certification mechanism, the “Authorized Economic Operator” (AEO).

e-Customs seeks to facilitate trade procedures while at the same time improve security. The goal of this regulation is to replace paper-based Customs procedures and harmonize national e-Customs systems. The new system will be introduced by 2013 (European Commission,


\(^2\) See, http://en.wikipedia.org/wiki/Influenza_A_virus_subtype_H1N1
2006d). According to the Electronic Customs Multi-Annual Strategic Plan (MASP) (European Commission, 2008), e-Customs aims to:

- **Control and facilitate the movement of goods into and out of the internal market through efficient import and export procedures;**
- **Increase the competitiveness of European trade through a reduction of compliance and administrative costs and improvement in clearance times;**
- **Facilitate legitimate trade through a coordinated approach relating to control of goods;**
- **Improve the safety and security of citizens with regard to dangerous and illicit goods;**
- **Offer improved protection of the financial interests of the European Community and its member states;**
- **Contribute to the fight against international crime and terrorism by providing rapid and relevant information with regard to the international supply chain;**
- **Allow a seamless flow of data between authorities of importing and exporting countries.**

In parallel to the goal of setting up pan-European e-Customs systems, another long-term strategy for EU governments is to form collaborative relationships with trusted businesses. The collaborative relationship aims to change the G2B relationship from the traditional “control and command” to a more “trust-based” relationship, which includes replacing the traditional labour-intensive Customs controls with businesses’ “self-control” regarding Customs issues. For the EU Tax and Customs Administration (TCA), the realization of this goal has become more visible with the emerging concept of the Authorized Economic Operator (AEO) (European Commission, 2007a). Businesses in the member states can apply for the AEO certificate. When it is being granted, simplified control procedures and trade facilitation will be provided by the TCA. A possible “win-win situation” can be achieved, with increased trade efficiency and lowered administrative burden. The underlying idea is that if businesses can prove to the TCA that they are in control of the tax and security aspects of their own business processes, they will be AEO certified by the TCA, which brings them the benefits of fewer physical inspections, fast Customs clearance procedures and trade facilitation by the TCA. The aim is to achieve a win-win situation for both government and businesses, with trade simplification and lowered administrative burden.

Furthermore, according to the MASP, governments must use the following means in order to change current Customs practices and achieve the above objectives for the future Customs, : first, a harmonized exchange of information on the basis of internationally accepted data models and message formats (Standardization); second, a re-engineering of existing Customs and Customs-related processes with the aim of optimizing their efficiency and effectiveness and of reducing the costs of Customs compliance (Redesign); and third, offering economic operators a wide range of electronic Customs service enabling those operators to harmonize interactions with the Customs authorities of any member state (Collaborative partnership building). This thesis focuses on the later two issues of the change, namely procedure redesign and trusted collaborative relationship building.
The objective of this research is to provide a novel view on the government-to-business (G2B) relationship in the 21st century. The thesis is aimed to provide an in-depth understanding of the underlying issues for G2B relationship under this new regime and to recommend solutions to solve governments’ current dilemma (increase security and control vs. decrease administrative burden) via two main approaches: with advanced ICT facilitation for the control procedure redesign and with sound socio-economic reasoning & modelling for building trusted G2B networks (in the case of AEO certification).

1.2 Research questions

In the context of e-Government (e-Customs in this research) and based on various modelling approaches (e.g. $e^3$-value, UML), with in depth theoretical study (e.g. control theory, agency theory, theory and information asymmetry and transaction cost economics), this thesis provides support for IT-enabled redesign for control procedures and advocates building a trust-based relationship between government and business as an effective governance approach.

Two key research questions in this thesis are:

1. *How to reach a sound design/redesign of Customs control procedures with ICT as an enabler?*

2. *How to effectively build a trust-based relationship between government and business to enhance supply chain governance?*

To answer the first research question, we developed the $e^3$-control methodology and applied it in four real-life redesign cases (Living Labs) in different industries located in four different EU countries. The $e^3$-control methodology supports the redesign in identifying control problems and providing solutions in an effective and efficient way. In the meanwhile, experiences learnt from the Living Labs help to validate and improve the methodology itself.

To answer the second question, we examine the AEO case in the Netherlands. Together with the Dutch Tax and Customs administration (Dutch TCA) and companies involved, we define the requirements for building trusted trade networks and propose socio-economic mechanisms/models for enhancing such trust-based relationships between government and business.

1.3 Research design

1.3.1 The research project and concept of Living Labs

This thesis is carried out within the context of the EU-funded project Information Technology for Adoption and Intelligent Design for e-Government (ITAIDE$^4$). The ITAIDE project

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$^3$ The term “governance” rather than “management” is used to distinguish the government focus in this thesis.

$^4$ Details refer to [http://www.itaide.org/](http://www.itaide.org/)
(Project Nr. IST-027829), funded by the 6th Framework Information Society Technology (IST) Program, started in January 2006 and will conclude in December 2010. e-Government research in the 6th Framework Program (FP6) focuses on the modernization of public agencies at all levels and the improvement of services for citizens and businesses, which can save them time and money in their dealings with the government. In particular, ITAIDE addresses issues related to e-Customs on “How can Customs documents and procedures be redesigned and supported by ICT? What are the drivers and barriers for adoption?” In a broader context, ITAIDE is a G2B IT project that seeks to provide new e-Customs solutions based on the directives given by the Electronic Customs Multi-Annual Strategic Plan (European Commission, 2008).

The Living lab concept is a new paradigm for a user-centric multidisciplinary research and development approach used in my research. Living Lab was a concept originated by Jarmo Suominen (from Finland and MIT) amongst others and it is now being used to cover a range of situated research methodologies involving new technologies and people (end users). “Living labs are a situated research methodology for sensing and prototyping at various different scales in real life contexts” (Suominen, 2005). Four Living Labs (LLs) are carried out in the ITAIDE project in four different EU member states – the Netherlands, Finland, Denmark and Ireland. The ITAIDE project examines Customs procedures for four different types of industry (beer, paper, food and pharmaceutical) in each of the above-mentioned countries, so the four Living Labs are accordingly labelled as Beer LL, Paper LL, Food LL and Drug LL. The scope of the ITAIDE Living Labs is to provide a concept for a new e-Customs system. The Living Labs provide a “real-time, real-life research setting where we develop and pilot our practical solutions and theoretical frameworks, which includes technical demonstrators and recommendations for the adoption of e-Customs, especially in the EU’s Customs Administrations and SMEs”5. The ITAIDE Living Labs examine Customs procedures in four different settings and report on multiple (governmental, business and research) perspectives. Each Living Lab develops a prototype in a real-life context, focusing on innovative ICT adoption in trade/Customs procedures and value-added services in enabling the collaborations between different stakeholders from both the private and the public sectors. Three main stakeholders (the government, the trading company and the IT solution provider) are involved in each Living Lab. They interact and collaborate with each other in order to develop a feasible e-Customs concept and prototype that can be adapted by both private and public sectors. The vision of the ITAIDE Living Labs is to provide innovative solutions for the future e-Customs.

A short introduction to the scope of each of the Living Labs is given below:

- **The Beer Living Lab (see Chapter 2.1)**

  The goal of the Beer LL was to transform the paper-based Customs procedure for the export of excise goods into an electronic procedure and to demonstrate how trade simplification can be achieved, while ensuring the preservation of the required level of control and security.

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5 From, [http://www.itaide.org/](http://www.itaide.org/)
The Beer LL redesigned procedure was achieved by making maximum reuse of business data for government control purposes (we refer to that as piggy-backing), collaborative co-design (involving businesses, government, technology providers and universities) and the use of innovative enabling technologies. The Beer LL provides a proof-of-concept that demonstrates how a new electronic Customs procedure can make a number of documents and systems, which companies used to report to the authorities, obsolete and replace them with electronic information that can be processed much more quickly and efficiently than paper documents. This may lead to substantial labour and cost reductions for businesses as well as governments.

Heineken in the Netherlands is the focal Beer Company.

- **The Paper Living Lab (see Chapter 2.2)**

The Paper LL reinforces the synergy between the success of the Finvoice electronic invoice and the possibilities of developing Secure Trade Lane solutions with United Paper Mills (UPM) and Finnish Tax Administration/Customs. The Secure Trade Lane aims to fully utilize the potential of Secure Trade Lanes to obtain load reduction and increased security controls for Customs demands on the complex multinational supply chain logistics of the paper industry (forestry, timber, woodchip and finished paper product) across land bridges and sea lanes.

There are numerous procedures, information systems and data flows for the same business transactions, such as purchasing, transportation and Customs declarations. Customs processes in the Finnish Customs require at least six exchanges for the same transaction. Also, complexity and lack of standardization by different public administrations create overlapping sets of data dissemination requirements, disjointed sets of information that could be harnessed intelligently to create systems and working methods that achieve real productivity gains on both sides. The Paper LL studied the trade procedure of UPM for importing wood from Russia to Finland and processing it in Finland into paper for onward export to other EU consumer countries. In the Paper LL, we investigate how we can remove procedure redundancies with standardized data set.

United Paper Mills in Finland is the focal Paper Company

- **The Food Living Lab (see Chapter 2.3.)**

The Food LL was carried out with a Danish company ARLA, one of the largest dairy companies in the world, which collaborates with over 10,000 farmers in Denmark and Sweden. The main goal for the Food LL is to analysis the Customs procedure for the food export and proposes a more efficient paper-less IT-based procedure, which can at the same time fulfil the food safety and Customs security requirements. Facing the dynamic changes in the dairy industry, we aimed to reach two main objectives in the Food LL:
1) To develop e-Government standards across the ministries. It is an important step towards the pan-European interoperability and Single Window\(^6\) vision.

2) To introduce a simplified Customs/certificate procedure, possibly in line with the Authorized Economic Operator, whereby ARLA can benefit from EU simplification and satisfy the requirements from the C-TPAT (Customs-Trade Partnership Against Terrorism) in the USA.

Arla Food in Denmark is the focal Food Company

- **Drug Living Lab (see chapter 2.4)**

The Drug Living Lab investigated how to introduce e-Customs into controls for legal imports/exports of pharmaceutical products into/outside the EU. The Drug LL redesign focused on two procedures. First, we aimed to redesign the IT enabled export procedure for high value pharmaceutical product under temperature control (the Cold Chain procedure, see chapter 2.4). Second, as parallel trade is allowed and encouraged within the EU, while re-imports from third countries are not, the proliferation of online pharmacies poses additional challenges for Customs control. We tried to redesign Customs procedures with better control and anti-counterfeiting functions.

The Drug LL aimed at applying the ITAIDE instruments in order to improve the information access of European and national regulatory and pharmaceutical control authorities, to facilitate reliable information management systems, and to build on mechanisms for exchange of independent information on drug quality, safety and efficacy.

A bio-pharmaceutical company\(^7\) in Ireland is the focal Drug Company.

### 1.3.2 The e\(^3\)-control methodology

The e\(^3\)-control is a model-based control procedure redesign methodology initially developed by Kartseva (2005 & 2008) and further improved in this thesis for IT-enabled Customs control procedure redesign. The e\(^3\)-control presented in this paper is a structured modelling approach that combines both value and process-level analysis for redesign. It also provides a software-supported redesign interface\(^8\), a concrete visualization to support value-based scenario development. It utilizes the e\(^3\)-value interface [see (Gordijn, 2002) and also Chapter 2.1 in this thesis] and the Unified Modelling Method [UML] (Fowler & Scott, 1997), which present a full picture for control procedure redesign embedding both value and process perspectives.

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\(^6\) A Single Window is defined as a facility that allows parties involved in trade and transport to lodge standardized information and documents with a single entry point to fulfil all import, export, and transit-related regulatory requirements. If information is electronic, then individual data elements should only be submitted once. (see, http://www.unece.org/)

\(^7\) Company name is not mentioned because the company in question has asked for confidentiality.

\(^8\) The e\(^3\)-value interface, see Section 2.1
In contrast to the earlier work done by Kartseva (2005 & 2008), various revisions and improvements have been carried out to make the e³-control more suitable for control procedure redesign, especially in terms of the integration of rule-based process analysis instead of the “pattern-based” approach proposed by Karsteva (2008). However, Kartseva attempted to integrate some process perspective on controls by eliciting so called “control patterns”, as argued by Kartseva: “these patterns may structure the design of controls in such a way that with a limited number of generic controls a large number of specific situations can be described” (Kartseva 2008). A major advantage of the pattern-based approach is that each pattern can provide a reusable solution for the same repeated control problems. Nevertheless, the proposed pattern-based approach has certain limitations in identifying control problems and we improved e³-control in this respect.

The reasons are twofold. First, the control patterns proposed by Kartseva (2008) are designed to provide a solution in a simple context with one fixed control problem, but when faced with the complex real-life situation where multiple control problems co-exist, the patterns become too big and complicated to use. As the pattern-based approach follows the elicitation line of “context-problem-solution”, when facing the multiple context, different types of patterns have to be applied together to give suitable solutions. However, multiple context and solution-giving patterns are not provided and discussed by Kartseva’s work. Second, the detachment between control patterns and the e³-value approach limits the application of the earlier work. No systematic method was given by the earlier work on how to link together the value-based analysis and process-based patterns. Thus most domain experts, having done a value-based analysis, do not know how to carry out the next step of process-level redesign. Learning from the experience of the earlier work, the e³-control methodology presented in this thesis extends and enriches the work of Kartseva (2008) with a systematic application method, embedding both value and process perspectives for redesign into one approach. We developed a new Control Procedure Ontology (CPO), which is the basis of our systematic application method.

Above all, we have also provided four real-life application cases for the e³-control methodology in four Living Labs to support effective redesign of the Customs control procedure. It can be systematically carried out by following four steps (Figure 1.1):

1. A value-based analysis, to understand the AS-IS business model and to identify the critical value transfers that should be safeguarded by means of control mechanisms.

2. A process-level analysis, to understand how control procedures are carried out to secure the critical values identified above and whether the current procedures are at their optimal level or flawed.

3. A process-level control procedure redesign, for developing corrective measures, i.e. new governance and control mechanisms, resulting in improved business processes.
4. A value-based analysis has been carried out to investigate how the suggested changes influence the TO-BE business model. Though the evaluation is mainly based on financial feasibility analysis, it can also be based on other drivers (e.g. social/operational) defined by stakeholders.

![Diagram of the four steps of the e³-control methodology]

**Figure 1.1: The four steps of the e³-control methodology**

The e³-control methodology has been successfully applied in four Living Labs (Beer LL, Food LL, Paper LL and Drug LL) during the past four years in the ITAIDE project. Experience shows that the e³-control methodology worked well with the control procedure redesign and received positive feedbacks from domain expert on its usability.

### 1.3.3 Research approach

Two types of research methods have been used for this thesis. In the first part of the thesis, *action research* is adapted as a main method to test the redesign of the Customs procedures using the e³-control methodology. In the second half, the *case study* method is used to collect knowledge, to build models for AEO assessment and to evaluate our framework.

Figure 1.2 presents the applied research methods, the cases used in different publications, as well as how they are interlinked with the building blocks of this thesis. In the following paragraphs, each research method is highlighted.
**Figure 1.2. Research methodologies applied throughout the thesis**

In the first part of the thesis, we apply the action research method with four different Living Labs in the ITAIDE project to redesign Customs control procedure. These LLs are used as test beds in which we apply a design artefact: the e³-control, a structured model-based methodology for control procedure analysis and redesign. The development of e³-control as a design artefact relies on cycles of applying, testing, modifying and extending the kernel theories and the artefact through experience (Hevner et al., 2004). The LLs provide such a cycle. By applying e³-control in different LLs we enhance our understanding of the domain innovative control procedure redesign; we validate and further develop our design artefact.
Action research is defined by Kurt Lewin, a professor at MIT as “a comparative research on the conditions and effects of various forms of social action and research leading to social action” that uses “a spiral of steps, each of which is composed of a circle of planning, action, and fact-finding about the result of the action” (Lewin, 1946). It is an interactive inquiry process that balances problem-solving actions implemented in a collaborative context with data-driven collaborative analysis or research to understand underlying causes, enabling future predictions about personal and organizational change (Reason & Bradbury, 2007). The aim of the action research is to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework (Rapoport, 1970).

Typical three types of action research are discussed in literature [e.g., (Grundy, 1982; Holter & Schwartz-Barcott, 1993; McKernan, 1996)]; Masters (1995) concluded them as:

- TYPE 1: Technical/Technical-Collaborative/Scientific-Technical/Positivist
- TYPE 2: Mutual-Collaborative/Practical-Deliberative-Interpretivist Perspective
- TYPE 3: Enhancement approach/Critical-Emancipatory Action research/Critical Science perspective

The current research can be classified as TYPE 2 of the three models; researcher and the practitioners come together to identify potential problems, their underlying causes and possible interventions (Holter & Schwartz-Barcott, 1993). The problem is defined after dialogue with the researcher and the practitioner and a mutual understanding is reached. The practitioners involved in the mutual collaborative approach gain a new understanding of their practice; the changes implemented tend to have a more lasting character. "The goal of practical action researchers is to understand practice and solving immediate problems" (McKernan, 1996).

In the second half of the thesis we mainly use the case study method to expand our horizon in the socio-economic perspectives of G2B relationship. Case study is an empirical inquiry that analyzes a contemporary phenomenon within a real-life context (Yin, 2003). Case study inquiry relies on multiple sources of evidence and benefits from the prior development of theoretical propositions to guide data collection and analysis. There are three strategies for conducting case study research that can be used separately or together: exploratory, descriptive and explanatory.

Both exploratory and descriptive approaches are applied in this study. Exploratory study is carried out for the case of AEO and building the AEO assessment model. Fieldwork and data collection were undertaken prior to defining the research questions and hypotheses. A descriptive study was done when we applied the theory of information asymmetry / theory of principal-agent and transaction cost economics to the G2B relationships in the case of AEO. With descriptive theories in mind, and we first set up our hypothesis and then we propose solutions based on adapted theories.
Different techniques can support case study research; brainstorming sessions, semi-structured interviews, workshops and questionnaires are used in this study. For details on how these methods are applied please refer to Yin (2003).

1.3.4 Data collection

Data collection and analysis took place using multiple sources: participation in workshops (brainstorming and work meetings), in-depth interviews, participant observation and document analysis. Detailed meeting notes were taken; interviews and key meetings were recorded. Data and models were validated with subject matter experts. Apart from these structured and documented meetings and interviews, we also interacted with the project participants extensively by e-mail and telephone to collect data and exchange ideas. Data were collected within the four years’ research on the ITAIDE project from March 2006 to January 2010. Multiple researchers collected and assessed this data as a team in order to interpret the findings. In such way we were able to address biases that may arise when individual researchers interpret data.

Additional data was extracted from document analysis. These documents and archival material substantially increased our understanding of key evolutionary and historical events and the concerns of various supply chain participants. Collected data were used for different purposes during the different steps in the redesign.

Using the example of the Beer LL (carried from November 2005 to September 2007), a non-exhaustive list of extensive data and documents we have collected and analyzed in the Beer LL is presented in Table 1.1 and 1.2. Similar settings of the data collection are carried out with the other four case studies in thesis.

<table>
<thead>
<tr>
<th>Interaction type</th>
<th>Number of interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming</td>
<td>5 full day sessions</td>
</tr>
<tr>
<td>Work session</td>
<td>19 (16 meetings; 3 conference calls)</td>
</tr>
<tr>
<td>Participant observation</td>
<td>2 full days</td>
</tr>
<tr>
<td>Interview</td>
<td>29 (duration between 1 and 3 hours)</td>
</tr>
</tbody>
</table>

Table 1.1. Case study data collection (Beer LL): summary of interactions with stakeholders

<table>
<thead>
<tr>
<th>Types of documents analyzed in the Beer LL</th>
<th>Number of Copies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial and Customs documents related to the export of beer</td>
<td>18</td>
</tr>
<tr>
<td>Related process models</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 1.2. Types of documents analyzed in the Beer LL
3 Internal documents of Customs NL describing their working practices

4 Documentation of current, past and future information systems projects, mainly on the Excise Movement Control System (EMCS)

5 WCO (World Customs Organization) documents

6 DG/TAXUD (European Union Directorate General dealing with Tax and Customs) documents on trade procedures, trade facilitation and Customs visions

<table>
<thead>
<tr>
<th></th>
<th>Table 1.2. Case study data collection (Beer LL): summary of documents analyzed</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Internal documents of Customs NL describing their working practices</td>
</tr>
<tr>
<td>4</td>
<td>Documentation of current, past and future information systems projects, mainly on the Excise Movement Control System (EMCS)</td>
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<td>WCO (World Customs Organization) documents</td>
</tr>
<tr>
<td>6</td>
<td>DG/TAXUD (European Union Directorate General dealing with Tax and Customs) documents on trade procedures, trade facilitation and Customs visions</td>
</tr>
</tbody>
</table>

1.4 Research contribution

This thesis provides a novel view on the government-to-business (G2B) relationship in the information age. It supports IT-enabled redesign for better Customs control procedures and at the same time suggests forming trusted collaboration between the government and businesses to lower the transaction cost. Two major contributions established in this thesis are:

First, in order to support e-Government (in this case, e-Customs) control procedure redesign, a software-supported systematic approach called “e³-control”, introduced by Vera Kartszeva, has been further developed and further improved. It is a self-contained redesign methodology with a clear, step-like arrangement, which makes it easy for any domain practitioners to understand and practice in various redesign situations. This thesis provides four real-life cases applying the “e³-control” methodology for procedure redesign in different geographical and industrial environments.

The e³-control methodology builds upon the following key ideas: (1) structured modelling approach; (2) process-based analysis; (3) value-based analysis; and (4) a combination of the three with a stepwise approach. The e³-control methodology helps in Customs procedure redesign as well as by providing sound and innovative IT solutions.

The e³-control also provides software-supported redesign interface and concrete visualization to support value-based scenario development. The e³-control methodology has been successfully applied in four of the Living Labs (Beer Living Lab, Food Living Lab, Paper Living Lab and Drug Living Lab) during the past four years in the project. It helps the domain expert identify control problems and provide solutions in a much more effective and efficient way. At the same time, experience gained from the Living Labs helps to

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9 The e³-value interface, for details refer to section 2.1.
validate and improve the methodology itself. Our experience of working in the Living Labs shows that e³-control methodology worked well with the control procedure redesign and received positive feedback from domain experts on its usability.

Second, to solve the dilemma of increased security and control requirements and at the same time to decrease the administrative burden for the European governments/businesses; and in line with the new European (EU) initiatives of the Authorized Economic Operator (AEO) (see Chapter 2.5), we propose forming “trusted trade networks”. Revolutionary changes have to be made in this new scheme, so the traditional stiff “command and comply” government-to-business relationships need to be replaced by more trust-based ones enhanced by the reputation effect, and some critical capabilities have to be met by organizations. With the case of the Authorized Economic Operator (AEO), we discuss problems and requirements for building such a trusted relationship, we model corresponding solutions and we recommend an evaluation framework for IT innovation in a G2B context.

We argue that even with the most advanced IT facilitation, seamless (near 100%) control is almost impossible to achieve and not desired by most organizations. First, there are always human factors involved in the procedure handling, even one day when complete automation is fulfilled, there will be still mistakes made by computers/systems themselves. Second, adding any control mechanisms and IT applications will be burdensome to an organization’s financial resource, which makes a high level of control too expensive to achieve. Thus, only a reasonable level of control matching the organization’s optimal situation is plausible.

To reach this optimal level of control and lower the transaction cost, developing the concept of trust between the government and businesses is necessary. However, trust ought not to be granted automatically; otherwise economic problems of moral hazard and adverse selection may occur. Consequently, this thesis first clearly identifies the benefits of the trust-based system and further recommends implementation methods for effectively carrying out trust-based policies.

We propose “being in control” of the businesses themselves is one of the core ideas behind the trusted trade network. If businesses can prove themselves “in control” and establish an “in-control” statement, government may grant them a trust-based certificate such as AEO. However, trust must not be given by default, a number of critical capabilities must be possessed by the businesses, such as real-time monitoring of goods and information flows, imbedding control into business processes, enhanced IT security, information-sharing and collaborations amongst the supply chain partners. Findings from the AEO case study indicate that government can better carry out trust-based regulation based on three criteria, namely contractual, competence and goodwill.

Further, the emergence of IT innovation and trusted network forming between government and business will raise new challenges for the government-to-business (G2B) governance issue in general. Due to the different backgrounds and interest of stakeholders, in particular their difficulties in understanding each other raise the challenges of assessing
the value of G2B IT innovations for both sectors. This thesis contributes to the development of a value assessment framework that combines the value perception from both public and private sectors and that incorporates different needs and requirements of various stakeholders, but that also provides common criteria for a comparative evaluation.

1.5 Thesis structure

The thesis has been written as form of cumulative paper collection, which includes eight publications written during my PhD research work between 2006 and 2010. Figure 1.3 outlines the thesis structure linked to the publications and relevant topics.

This work is divided into four main chapters. The core of this thesis is to solve the relationship dilemma (control vs. trade facilitation) between the government and businesses via two main approaches: IT facilitation in redesign and better socio-economic reasoning for policy designing and implementation. After the introduction chapter (Chapter 1), we discuss in Part I (Chapter 2-6) of the issues for IT enabled control procedure redesign, introducing our e³-control redesign methodology and its technical guideline, and we guide readers through a real-life case study of the Beer Living Lab to illustrate how to apply the methodology in a systematic way (Chapter 2). We then provide three more case studies on the paper industry (Chapter 3), food industry (Chapter 4) and pharmaceutical industry (Chapter 5) to further validate our methodology and to show the practical implications of our research. Seeing IT-based redesign and network-forming as one of the inevitable trends for the future businesses to make success, in Chapter 6 we present the IT-based requirements for EU businesses in response to trusted network-forming.

In the second half of the thesis (Chapter 7-10) we try to reach a deeper understanding on the purpose of control redesign with a socio-economic perspective. We argue that although IT-facilitated redesign can enhance control levels for both government and businesses, 100% control is almost impossible and too expensive to achieve. Yet IT enabled procedure redesign is not just to digitize the existing paper procedures. Without realizing the underlying problems and reasons (especially socio-economic) for the redesign, policies can be wrongly or ineffectively implemented and valuable resources may be misused. To support our argumentation, we first discuss information asymmetry problems existing between government and businesses, which are the key factors hindering the G2B relationship (Chapter 7). To counter the negative effect of information asymmetry we propose building collaborative G2B business models using an IT-based risk management approach, a case of the AEO assessment in the Netherlands is given as an example (Chapter 8). Examining the AEO case further, in Chapter 9 we focus on the important roles that trust and reputation play in the G2B relationship forming. We use the implication of transaction cost economics under the Principle-agent model to compare two types of governance approaches (control vs. trust). And we recommend enhancing the reputation effect of AEO with more government involvement. Then in Chapter 10 we propose a new evaluation framework and criteria for IT innovations in the government-business context. Finally, Chapter 11 summarizes the key findings and concludes the thesis by giving its limitations as well as the outlook for future research.
Figure 1.3. Thesis structure
1.6 Publications overview

This thesis is based on nine double-blind reviewed publications/submissions that have been either presented/submitted at international conferences and published in the conference proceedings or published/submitted to international journals and book chapters (Table 1.3).

Nine publications linked to the thesis chapters are presented in the first half of Table 1.3. They consist of four conference papers, one book chapter and three journal articles (paper submission of Chapter 4 and 9 are still under review). Publications that constitute Part 2 (Chapter 2-6) are dedicated to the issues relating to IT-enabled control procedure redesign; in particular, we introduce our e3-control redesign methodology and guide readers through three real-life case studies (Living labs). Publications in Part 2 (Chapter 6-10) give a deeper understanding of the purpose of control redesign with a socio-economic perspective, based on which we propose new solutions and evaluation criteria for forming government-business relationships. For the purpose of keeping the integrity of the original work, but also to avoid text repetitions from multiple publications (e.g., description part of the e3-control methodology), I keep the section structure of the original publication but delete most of the repeating text, where only references are made to earlier chapters of the thesis.

Besides publications included in this thesis, I have authored/co-authored other 12 publications during the period of my PhD research, which are presented in the second half of Table 1.3. The other published works not presented in this thesis can be used as fast references for interesting readers to further understand this thesis.

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Publications included in this thesis</th>
<th>Type</th>
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**Additional publications relevant in the context of the thesis**


<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Type</th>
<th>Publication Details</th>
</tr>
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</table>

**Table 1.3. Publication list**
Part I: IT enabled control procedure redesign
2. E³-control: A redesign methodology for control procedures ¹⁰

Abstract

This chapter highlights the core research methodology, e³-control, applied throughout the ITAIDE project for the purpose of control procedure redesign. We present the key concept of the e³-control methodology and its technical guidelines. Based on the output of this chapter, domain experts may carry out step-by-step analysis and redesign of control procedures, taking both value and process perspectives into consideration. In addition, we present detailed e³-control application showing how it can be used in real case study the Beer LL.

2.1 Introduction

In this chapter, we introduce the core methodology applied in the ITAIDE project for the control procedure¹¹ redesign, the so called e³-control methodology. The e³-control methodology has been successfully applied in the four Living Labs (beer, paper, food and drug Living Labs) in analyzing and redesigning the Customs procedures under different government-business environment in four different EU member states. Our model-based redesign methodology is proven to be of great value for analyzing and redesigning Customs control procedures: it enables identifying control flaws and validating compliance of procedures with control principles; visualized models capture business intricacies in a network organization, therefore serve as a supporting tool in discussions aimed at eliciting knowledge from business/government experts and exploring possible redesigns scenarios. From a research perspective, we conceptualize existing knowledge of the control ontology, based on which we developed the Control Procedure Ontology (CPO) components and corresponding control models; the combined value and process-based redesign approach takes into account both control procedure concerns and value feasibility of introducing controls into a business model. All the above-mentioned features for the e³-control can serve as logical fundaments to support domain experts for the redesign. For example, in redesigning Customs control procedures for better export declaration and duty collection: e³-control can help domain experts clearly identify various tax/duty frauds, different types of opportunistic behaviours from trading parties; as well as designing better procedures to safeguard critical values and correcting fraud behaviours.

Specifically, we present technical guidelines for applying the e³-control methodology for supporting the domain experts in the activity of redesigning control procedures, so that it can be applied as a systematic and structured guidance by the readers in analyzing relevant cases

¹⁰ Note: This chapter is adapted from Jianwei Liu, Wout Hofman and Yao-Hua Tan (2010), Redesign methodology for control procedures, in book chapter of ITAIDE book @ Springer.

¹¹ Customs control procedure is defined as policies and procedures established to provide reasonable assurance of the success of control.
in their own domain. Further we incorporate our e³-control methodology with four of the Living Lab cases we encountered in the ITAIDE project, namely, Beer Living Lab (LL), Paper LL, Food LL and Drug LL. These real-life case studies will help domain experts get more insights into how the e³-control models are developed and further applied in various business redesign scenarios. The scope of application of the e³-control redesign methodology is not only limited in Custom control procedures, but also can be used in contracts design, reports, invoices and bank statements inspection etc.

2.2 The e³-control: In a nutshell

Even the most profitable business models will not be adapted by a company if its interests in the business model are not properly safeguarded, and if there are no control mechanisms in place that will guarantee a fair share of the profits or benefits. The e³-control has been developed as a conceptual modelling methodology for analyzing and designing control procedures (Kartseva, 2008; Kartseva et al., 2005; Liu et al., 2007a; Liu et al., 2006). It provides sustainability of value creation and exchange by focusing on the design of inter-organizational controls. It captures knowledge on internal and inter-organizational control from academic research [e.g. (Arens & Loebbecke, 1999b; Bons et al., 1998; Bons et al., 1999b; Kuo-Tay Chen & Ron M. Lee, 1992; Romney & Steinbart, 2006)] as well as industry best practices [e.g. (COSO, 1992a, 2004b)]. The e³-control proposes visual-based models as a means for communication between stakeholders (including both government and businesses), to achieve a shared understanding of the problem domain for possible solutions. It is based on the following key ideas:

(1) Structured modelling approach;
(2) Value-based analysis;
(3) Process-based analysis;
(4) and a combination of the three.

First, e³-control uses a structured modelling approach. Structured modelling approach is a systematic way of thinking about models and their implementations, based on the idea that every model can be viewed as a collection of distinct elements, each of which has a definition that is either primitive or based on the definition of other elements in the model (Geoffrion, 1987). It has been shown that structured modelling approaches can be used as a means to solve complex inter-organizational problems [e.g. (Baida, 2006; Franken & Janssen, 1998; Gordijn & Akkermans, 2003)]. We use models to facilitate knowledge elicitation, communication between stakeholders and scenario exploration.

Second, e³-control uses a value-level analysis to reason about controls issues. As suggested by Kartseva et al. (2005, 2008), we adapt value-based business models by focusing on the exchange of objects of economic value between actors – to understand the values that can be lost if no controls exist in a business model. The value-based analysis emphasizes on the fundamental value of the redesign, which provides a high-level view that pinpoint important control issues and improving points. It gives an easier access for redesign scenario development and a good way to communicate with stakeholders. Value models are drawn using the e³-value notation (Gordijn & Akkermans, 2001). This usage mode focuses on the value that may be lost
by some actor in a network if no controls are implemented. To this end, we use value models, visualizations of business models that focus on the exchange of objects of economic value between actors to understand which values have to be safeguarded by control mechanisms. In this context, we consider a business model to be the articulation of the value propositions in a business network and a value model to be a visual representation of a business model.

Third, $e^3$-control uses a process-level analysis to identify and redesign control procedures. As controls are commonly defined in the literature as processes (Arens & Loebbecke, 1999b; Bons et al., 1998; Bons et al., 1999b; Kuo-Tay Chen & Ron M. Lee, 1992; Romney & Steinbart, 2006), and value models do not provide enough details to reason about operational (i.e., process level) solutions for fraud and opportunistic behaviour, we propose to complement the value modelling with (business) process modelling (Liu et al., 2007a; Liu et al., 2007b). It follows ideas of researchers who have been deploying process-level analyses to reason about control procedures and best practices that view control as a process element. Typically, controls consist of checking procedures that are based on the exchange between business partners of documents like contracts, inspection reports, invoices, bank statements etc. A broad consensus exists in the literature that the design and analysis of control is about identifying actors, activities and exchanges of control-related documents, and in particular the interdependencies between these concepts. Control principles are rules prescribing these interdependencies. A well-known control principle is Segregation of Duties, which states that when an activity is checked in an organization, the actor checking the activity should be different from, and socially detached from, the person that is executing the activity. If this principle is not complied with, the likelihood of fraud in the checking is high. By applying control principles from auditing and accounting literature to process models [e.g., (Romney & Steinbart, 2006; Starreveld et al., 1994)] we are able to identify control flaws and to propose control mechanisms to handle these flaws.

Fourth, $e^3$-control combines these three ideas: modelling, process-level analysis and value-level analysis and provides a stepwise approach. We argued in Liu et al. (2007a) to combine models using a value perspective with models using a process perspective, because value models and process models provide complementary viewpoints, both of which are required (Weigand et al., 2006). The combined approach (see Figure 2.1) includes four-step iterations. In step 1 we focus on understanding the logic behind business networks, i.e. identifying actors, their value propositions, and how network sustainability can be put at risk due to fraud or opportunistic behaviour of an actor. Next, business process models provide the operational details required for reasoning about how such threats can occur (control problems, step 2) in business processes and be handled (control mechanisms, step 3). Finally, in step 4 we investigate the implications of changes in the new business value model, as a result of introducing new controls in step 3. If the evaluation shows a positive result, the redesign is acceptable. If not, we can go back to step 3 and even step 1 for a new iteration. In the section below we provide further details about the four steps.
The $e^3$-control methodology consisting of four steps of analysis (see Figure 2.1) is applied as follows:

1. A preliminary value analysis is performed to understand the initial business model of the current situation (i.e., AS-IS\textsuperscript{12} scenario including both ideal and sub-ideal situation) and to identify which value exchanges between actors in a network are at risk. We analyze which economic values (what) are being exchanged by which actors (from who to whom), and which value exchanges are at risk (weak control points). In this step, we identify the critical value transfers that should be safeguarded by means of control mechanisms.

2. Once the weak control points in the AS-IS value model have been identified, a process-level analysis follows. It facilitates an understanding of how – in business processes – value can be lost by exchanging among actors. With the help of domain experts we investigate the business processes of the earlier identified critical value transfers (weak control points). We study how current controls procedures are applied in the network to safeguard these value transfers and we identify control flaws by applying control principles from auditing and accounting to current processes. As we do detailed analysis for the identified weak control points only rather than the entire business process model, it simplifies the whole redesign a great deal.

3. The next step in process analysis is the development of corrective measures, i.e. new governance and control mechanisms, resulting in revised business processes. We add or change control mechanisms according to process-level control principles, resulting in a redesign of the business process. The introduction of new controls may change the related business value model, as controls are mostly with price tags and can be offered

\textsuperscript{12} Our approach deviates from Kartseva et al. (2005) already in this stage. We consider the current situation where existing controls have already been taken into account, whereas in Kartseva et al. (2005) controls are considered only in the later stages. In the next two steps we perform a process level analysis. By focusing on critical value transfers we reduce the work in steps 2 and 3 to a manageable level.
as commercial services (by existing or new actors), thus cause value redistribution in a network.

4. Therefore it is essential to draw a new TO-BE business model (with value perspective) in step 4 and to evaluate its financial\textsuperscript{13} feasibility. In this step we investigate how the suggested procedure changes may influence the business model, and the evaluation is based on whether the new business model creates new values and network synergy and is acceptable to most of the stakeholders involved.

To undertake step 1 and 4 we need to use a software tool and its notation of e\textsuperscript{3}-value. The website of e\textsuperscript{3}-value shows a number of examples of possible control patterns with the e\textsuperscript{3}-value interface (see http://www.e3value.com/e3family/e3control/). To perform the analysis in steps 2 and 3 we use process models of the Unified Modelling Method [UML] (Fowler & Scott, 1997).

2.3 A software support tool for control procedure redesign

The e\textsuperscript{3}-control is a software support tool for control procedure redesign, which consists of both value and process level modelling. It is a further improvement of the first version of the e\textsuperscript{3}-control that was developed in the research of Kartseva et al. (2005; 2006; 2007; 2008). For the value level based modelling, e\textsuperscript{3}-value interface is deployed. The e\textsuperscript{3}-value tool is different from the usual business modelling software tools, because e\textsuperscript{3}-value supports modelling of value exchanges between actors in the economic sense, whereas most of the other tools only model processes. For the process level modelling, we developed the Control Procedure Ontology (CPO) components, together with the UML we are able to build control templates, which can be used to analyze control problems and redesign control mechanisms. Whereas e\textsuperscript{3}-value can be used to model and analyze value co-creation in network systems, e\textsuperscript{3}-control is used to make the value co-creation sustainable by modelling processes in a more detailed way. In this section, we discuss both modelling techniques and their applicability.

2.3.1 Value level modelling: The e\textsuperscript{3}-value

Value-based business modelling focuses on what is offered by whom to whom and why. It takes into account the economic interests of all the partners of a network and is fundamentally important for starting up with an IT-based network system redesign. Two arguments support this choice. First, control mechanisms are safeguards, in the sense of Transaction Cost Economics, to guarantee that an exchange of economic values between organizations takes place as agreed (e.g. in a contract) without faults (intentional fraud or unintentional mistakes) [see also (O. E. Williamson, 1979)]. In other words, we need control mechanisms in order to ensure that value transfers – exchanges of objects of economic value – take place correctly. Second, as models are used to identify differences in the interests of the parties involved in the procedure redesign, value-based modelling approaches are useful for analyzing whether a win-win situation is achieved in a multi-actor setting.

\textsuperscript{13} Financial feasibility is the evaluation factor that is under current consideration but it can be enhanced with other factors e.g., social and operational.
The first step in redesigning control procedure is the development of a value model, focusing on value creation (Porter & Millar, 1985), distribution and consumption in a network. We show how the $e^3$-value and its supporting tools can be used to support designing a business value model. The $e^3$-value is different from other business modelling languages, as it focuses not on the modelling of business processes or very high-level strategic issues, but rather on the modelling of value exchanges between business partners in the economic sense. This modelling of value exchanges is, in particular, useful for analyzing value co-creation among business partners of a service system in a network setting. For example, in a network organization, like a mobile service offering, the various partners, including the end consumer, have to combine their service offering in such a way that all partners obtain a fair share of the profit or benefit from their participation in the network. This is essential, because otherwise such a partner will end its participation and the network will collapse.

The $e^3$-value tool supports the design of a business model by constructing a value model, representing it graphically in a rigorous and structured way, and by performing an economic sensitivity analysis of this model. The $e^3$-value provides modelling concepts for showing which parties exchange things of economic value with whom and expect what in return. The methodology has been previously applied in a series of case studies including media, news, banking and insurance, electricity and telecommunication companies to design value models of network organizations (Gordijn & Akkermans, 2001).

Most of the currently available design methodologies lack a value-based view representing what the value proposition is; rather they focus on business processes representing how a value proposition is implemented. There are a few value chain design methodologies that provide concepts for describing value constellations in network settings, for example the AIAI Enterprise conceptual framework (Uschold et al., 2000) and the Resource Event Agent (REA) (Geerts & McCarthy, 2002) conceptual framework. However, these frameworks only focus on the description of the final result and do not support the value chain design process itself. Other business modelling methodologies offer only generic conceptual frameworks and do not provide software tools to support the actual modelling in a proper analysis (Pateli & Giaglis, 2004). Tapscott et al (2000) offer a graphical diagramming approach to represent economic exchanges between enterprises. However, compared to $e^3$-value, it has several drawbacks: for example, it has no notion of economic reciprocity, economic activity, it does not allow the profitability assessment of individual organizations and it lacks the proper level of formality.

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14 For further info on the tool see [www.e3value.com](http://www.e3value.com), where free demo versions of the tool can be downloaded as well.
Figure 2. The $e^3$-value model of a purchase with tax payment [adapted from (Kartseva, 2008)]

The upper part of the Figure 2.2 shows the legend explaining the drawing in the lower part. For instance, ‘actor’ is represented by a square and has a name like ‘buyer’. We explain the concepts of the $e^3$-value tool using a simple example.

In Figure 2.2 a buyer obtains goods from a seller and offers money in return. According to the law, the seller is obliged to pay the value added tax (VAT) to that tax administration. This is conceptualized by the following $e^3$-value constructs:

- **Actor.** An actor is perceived by its environment as an independent economic (and often legal) entity. An actor makes a profit or increases its utility. In a sound, sustainable, business model each actor should be capable of making profit. The example shows a number of actors: a buyer, a seller and a tax administration.

- **Value Object.** Actors exchange value objects, which are services, products, money or even consumer experiences. The important point here is that a value object is of value for one or more actors. Goods and payment are examples of value objects, but legal compliance to pay tax is also a value object.

- **Value Port.** An actor uses a value port to show to its environment that it wants to provide or request value objects. The concept of port enables to abstract away from the internal business processes and to focus only on how external actors and other components of the business model can be ‘plugged in’.

- **Value Interface.** Actors have one or more value interfaces, grouping reciprocal, opposite-directed value ports. A value interface shows the value object an actor is willing to exchange, in return for another value object via its ports. The exchange of value objects is atomic at the level of the value interface.

- **Value Exchange.** A value exchange is used to connect two value ports with each other. It represents one or more potential trades of value objects between value ports.

With the concepts introduced so far, we can explain who wants to exchange value with whom, but we cannot yet explain what happens in response to a particular end-consumer need. For this purpose we include in the value model a representation of dependency paths between value interfaces. A dependency path connects the value interfaces in an actor and represents
triggering relations between these interfaces. A dependency path consists of dependency nodes and segments:

- **Dependency node.** A dependency node is a start stimulus (represented by a bullet), a value interface, an AND-fork or AND-join (short line), an OR-fork or OR-join (triangle), or an end node (bull's eye). A start stimulus represents a consumer need; an end node represents a model boundary.

- **Dependency segment.** A dependency segment connects dependency nodes and value interfaces. It is represented by a link.

- **Dependency path.** A dependency path is a set of dependency nodes and segments that leads from a start stimulus (also called a consumer need) to an end stimulus. The meaning of the path is that if values are exchanged via a value interface, other value interfaces connected by the path also exchange values.

Additionally, profitability sheets are used to support cost-benefit analysis for each individual actor (see Figure 2.3). Profitability sheet can be constructed for each actor involved, and presents revenues and expenses associated with the execution of the e-commerce idea under consideration. It contains for each actor value objects flowing into- and out as a result of scenario path execution. Profitability sheets are found by following for each scenario the scenario paths. Each time the path crosses a value interface; value objects are entering and leaving an actor (Gordijn, 2002). The object(s) flowing out the interface of that actor are added to the actor’s profitability sheet in the column value object out (i.e., Investment and Expense), while the objects flowing into an actor are added to the actor’s profitability sheet in the column value object in (i.e., Money). Based on type of value objects, times of occurrences (i.e., 10 times) and underlying economic value attached to the value objects (i.e., $10), the total amount of value each actor gives or receives can be easily calculated (i.e., $100). The advantage of e3-value is that it is based on an ontology that contains a minimal number of basic concepts, which makes it a modelling technique that is easy to understand and apply, even for non-technical marketers or business analysts.

<table>
<thead>
<tr>
<th>Value Interface</th>
<th>Value Trans</th>
<th>Occurrence</th>
<th>Valuation</th>
<th>Value Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONEY GOOD</td>
<td>10</td>
<td>10</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>MONEY</td>
<td>10</td>
<td>10</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>(all transfers)</td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>INVESTMENT</td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>EXPENSES</td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>total for actor</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**Figure 2.3. Example of a profitability sheet**

It is important to understand that the original $e^3$-value model only models an ideal situation with a given structure. The **Principle of Reciprocity**, defined in $e^3$-value is the requirement that if an actor offers something of value to someone else, this actor always gets in return something that he/she wants (Gordijn et al., 2001; Gordijn & Akkermans, 2003). Hence, it assumes that all actors behave correctly. However, in real life, the violation of the principle of reciproc-
ity usually happens (e.g. an actor receives something without returning another service for it), which can be seen as a violation of an obligation or contract, which would lead to $e^3$-value models with a value interface with only one incoming or outgoing value object (e.g. delivering goods and not receiving a payment in return). We expand such a scenario in our $e^3$-control methodology as a sub-ideal situation and we express value transfer of the undelivered incoming or outgoing value object with a dotted blue line between actors (e.g. a sub-idea situation where the seller does not pay VAT to the tax office, see Figure 2.4).

![Diagram](image)

Figure 2.4. The $e^3$-value model of a sub-idea situation for purchase without tax payment

2.3.2 Process-level modelling: Utilizing Control Procedure Ontology (CPO) with UML template

We extend the earlier work of Kartseva et al. on $e^3$-control with process-level modelling. Value-based perspective helps understand the primary purpose of control mechanisms and ensure that one does not only “electronify” existing paper documents without considering the fundamental reasons behind current control practices, while a process model shows how a particular business case should be carried out, selected, negotiated, contracted and fulfilled operationally (Gordijn et al., 2001). We argue that while a value analysis is important for understanding the benefits of controls, it is not rich enough to identify control problems and offer solutions. A more elaborate process perspective has to be added to the above approach. A number of reasons support our proposition. First, control is clearly defined as a process issue: “a process… to provide reasonable assurance regarding the achievement of objectives…” (COSO, 1992b). Second, the existing knowledge base of control (from scientific research and best practices) assumes a process perspective [e.g. Bons et al.(1999a); Romney & Steinbart (2003); Arens & Loebbecke (1999a)]. Third, in our experience with domain experts (e.g. business managers, auditors), the process perspective is more natural for them than the value perspective. Fourth, the two perspectives address different issues, both of which are required. A value perspective describes which value transfers should be safeguarded by control mechanisms. However, as it does not describe how these values are transferred (which is a process element), it is not suitable for describing and designing operational solutions, i.e. control mechanisms.

We developed a Control Procedure Ontology (CPO) and proposed a systematic approach to apply it. First, the “CPO” serves as a supporting tool for executing step 2 and 3 in the redesign. Second, our conceptualization of CPO can serve also as a basis for developing IS support for domain experts.
To identify control problems and redesign control procedures we need supporting theories. Chen & Lee (1992) apply auditing control principles to design an internal accounting control system. Seven internal control principles should be followed according to Chen & Lee (1992) (see Table 2.1):

1. *If an operational task exists, its corresponding control task should exist as well and should always follow the operational task.*
2. *If a control task exists, it must be furnished by supporting documents. These supporting documents should be the result of a previous control task that directly witnesses the activity to be controlled.*
3. *Supporting documents should be generated by a source independent of the source which generates the document to be verified.*
4. *If a control task uses a supporting document, this should be transferred directly from the control task which verified it.*
5. *An operational task and its corresponding control task should be segregated into two different positions and into two different agents.*
6. *The position responsible for a control task must not be lower in the formal power hierarchy than the position responsible for the operating task.*
7. *The agents responsible for the operational task and its corresponding control task should be socially detached.*

**Table 2.1. Internal control principles (based on Chen & Lee, 1992)**

Bons et al. (1999a) transform Chen’s principles to an inter-organizational context and analyze controls for trade. They assume independent and non-hierarchical relationship between organizations (thus, ruling out the above principle 6), and pay special attention to outsourcing activities and to the reciprocal character of contracts. However, there are several limitations for applying Bons’s principles in practice. First, though delegated roles with different outsourcing activities are presented, no clear role/activity delegations are defined. Different roles (e.g. role 1, role 2, role 3) related to implicit activities are repeatedly mentioned in the principles. It is already difficult to differentiate primary and counter activities, without adding outsourcing activities and relating them to numeredated roles. Second, Bons’s principles contain a controversial term “trust”, which is difficult to quantify and has numerous interpretations (T3-Group, 2010). “Trust” cannot be designed simply by procedures\textsuperscript{15}, thus considering it as control factor creates barriers for understanding and applying controls and for designing IS support.

Extracting useful concepts from various literatures and extending them into an inter-organizational context, we conclude that an effective inter-organizational control procedure should enable a control actor to carry out control activities by means of sufficient and independent documentary evidence\textsuperscript{16}. Three ontological components, namely actor, activity and

\textsuperscript{15}In the second half of this thesis we will provide detailed discussion on this issue.

\textsuperscript{16}If the control actor can directly witness the execution of the operational activity (e.g. direct exchange of money and goods), this documentary evidence will not be necessary. Experience shows that, in most cases under inter-organizational context (e.g. internet transaction and international trade), such direct witnessing is not possible.
document, can be identified in this observation. These three components served as the bases of our control procedure ontology and have been discussed extensively in control literature, including best practices of accounting and auditing (COSO, 1992b, 2004a; PCAOB, 2004), organizational theory (Thompson, 1967), transaction cost economics (Williamson, 1985), value chain analysis (Porter, 1985), ISA framework (Sowa & Zachman, 1992; Zachman, 1987), ontology framework (2005) and network management framework (2006). Yet only exchanging documents between actors could not ensure a good control; a constraint of independence needs to be perceptible. This constraint stems from one of the most fundamental principles of accounting practice – segregation of duties: “the separation of assigned duties and responsibilities in such a way that no single employee can both perpetrate and conceal errors or irregularities” (2003). A further analysis of control literature [e.g. Starreveld (1985), Chen & Lee (1992), Romney & Steinbart (2003) and Schaad (2003)] shows that we can further distinguish three subclasses under each component: Actor – Responsible actor, Evidencing actor and Control actor; Activity – Operational activity, Evidencing activity and Control activity; Document – To-be-verified Document, Supporting Document and Verified Document. By separating different actors with corresponding activities and documents, effective inter-organizational control can be conducted. A detailed description of the CPO components is given in Table 2.2.

<table>
<thead>
<tr>
<th>Actor</th>
<th>An actor is a person or a group of people(^{17}) that plays a role or performs certain activities to achieve its objectives based on mutual cooperation with other actors in the network. Actors are responsible for and/or responsive to triggering and causing changes in the states of objects. They are aware of their intentions and able to react to fulfill their goals (Leppänen, 2005).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible (Operating) actor (R-actor):</td>
<td>The actor who performs the operational activity to be controlled and is responsible for the activity being promised (operational activity).</td>
</tr>
<tr>
<td>Evidencing actor (E-actor):</td>
<td>The actor who witnesses the execution of the operational activity and testifies to the completeness, accuracy and compliance with organizational policies and rules of the operational activity. (The E-actor can be seen as a delegate of the control actor)</td>
</tr>
<tr>
<td>Control actor (C-actor):</td>
<td>The actor who has a direct interest in checking the operational activity executed by the responsible actor.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>An activity is undertaken by a human agent/ a group of people, i.e., organization (subject, e.g. actor) who is motivated towards solving a problem or achieving certain purpose (object, e.g. control), and mediated by certain tools (artefact, e.g. documents) in collaboration with others (community, e.g. other actors in the network) (Ryder, 1998).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational activity (O-activity):</td>
<td>Perform the basic business operations to achieve certain business value or some operational goal, e.g. business transactions.</td>
</tr>
<tr>
<td>Evidencing activity (E-activity):</td>
<td>Witness the execution of the operational activity and testify to the completeness, accuracy and accordance with organizational policies and rules.</td>
</tr>
</tbody>
</table>

\(^{17}\) In the inter-organizational context, actors can be seen as different agents/organizations.
Control activity (C-activity): Reconcile and verify records, documents or messages sent from the responsible actor and evidencing actor.

**Document**

Document denotes all information contents interchanged among actors. Each document is directed to a corresponding activity. It includes different forms like paper documents, records, or electronic messages.

**To-be-verified Doc.**

The document issued by the responsible actor to prove his completion of the operational activity.

**Supporting Doc.**

The document issued by the evidencing actor after an evidencing activity, which supports the execution of a control activity by the control actor if he/she could not directly observe the performance of the operational activity.

**Verified Doc.**

The document issued by the control actor after verifying/reconciling the To-be-verified Doc. and Supporting Doc., from which a conclusion of an effective control can be drawn.

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<td>The document issued by the evidencing actor after an evidencing activity, which supports the execution of a control activity by the control actor if he/she could not directly observe the performance of the operational activity.</td>
</tr>
<tr>
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</tr>
</tbody>
</table>

Table 2.2. The CPO components

**CPO control components (1): Actor**

We initiate our CPO model first by looking at the *actor* component. Former research [e.g. Mautz & Sharaf (1961), Chen & Lee (1992)] showed that people are the deciding factor for effectiveness of internal control and that the nature of internal control is ‘people control people’. An actor is an encapsulation of parameterized actions performed on input to produce output. Actor orientation separates the functionality concerns from the component interaction concerns and gives well-defined scopes for model refinement and system realization (Liu et al., 2004). By looking at critical actors involved, we can achieve an overview of the whole control procedure: who are the stakeholders involved and what are the relationships (operational/hierarchical/social) between them. As the most crucial principle of control is the “Separation of Duties”, duties and activities are definitely accomplished by actors, so identifying and specifying different actors is a primary task for control procedure redesign.

Here we specify three different actor types: Responsible actor, Evidencing actor and Control actor (see Table 2.2). In order to ensure a good control with “segregation of duties”, different actors need to execute corresponding and separated activities, which compose the second component of our CPO model - the *activity*.

**CPO control components (2): Activity**

Study about human activities - activity theory - became prominent during the 1920’s and 1930’s and originated in the former Soviet Union as part of the cultural-historical school of psychology founded by Vygotsky, Leont’ev and Lurija. In activity theory the unit of analysis is an activity that is being composed of subject, object, actions and operation. A *subject* is a person or a group engaged in an activity. An *object* is help by the subject and motivates activity. Activities are realized through chains of *actions*, which are carried out through
operations. Human activity is carried out through actions, realizing objective results. These actions are controlled by the subject’s conscious goals (Leont'ev, 1978; Vygotsky, 1978). Activity theory has recently attained increased attention within the HCI (human-computer interaction) community, which helped researchers achieve a better understanding of plans and process models for decision support system [e.g. (Bardram, 1997; Suchman, 1990)]

We find that activity theory fits well in our control research, especially for its well defined linkage between actors, activities, control goals and control mediation - documents. We adopt the recent definition of (Ryder, 1998), namely that an activity is undertaken by a human agent/group of people, i.e. an organization (subject, e.g. actor) that is motivated to solve a problem or achieve a certain purpose (object, e.g. control) and is mediated by certain tools (artefact, e.g. documents) in collaboration with others (community, e.g. other actors in the network). Three types of activities are defined in the CPO control model, namely, Operational activity, Evidencing activity and Control activity (See Table 2.2).

CPO control components (3): Document

Document or documentation is the “audit trail” for the business case, which serves as the foundation for data analysis and decision making. Control is inevitably affected by exchanging information repositories, i.e. documents and records, among tasks. Sufficient and appropriate documentation not only serves as the “audit trail” for the ex-post control but can also provide functionalities of cost estimation or value analysis for decision making.

The documentation we mention here is not as simple as just recording the information. According to (GAO (United States General Accounting Office), 2001), following documentation rules should be followed:

- Written documentation exists covering the agency’s internal control structure and for all significant transactions and events.
- The documentation is readily available for examination.
- The documentation for internal control includes identification of the agency’s activity-level functions and related objectives and control activities and appears in management directives, administrative policies, accounting manuals and other such manuals.
- Documentation for internal control includes documentation describing and covering automated information systems, data collection and handling, and the specifics of general and application control related to such systems.
- Documentation of transactions and other significant events is complete and accurate and facilitates tracing the transaction or event and related information from authorization and initiation, through its processing, to after it is completed.
- Documentation, whether in paper or electronic form, is useful to managers in controlling their operations and to any others involved in evaluating or analyzing operations.
- All documentation and records are properly managed, maintained, and periodically updated.

It is clear that in order to ensure certain level of control, each actor should be responsible for the corresponding activity and each activity should be linked and facilitated with the corre-
sponding document. We combine Chen’s and Bons’s principles using CPO concepts and formulate our CPO control principles as listed below.

1. If an Operational activity exists, its corresponding Control activity must exist as well and should always follow the Operational activity.
2. If a Control actor cannot directly witness the execution of the Operational activity, the Evidencing (witnessing) activity should be delegated to an Evidencing actor (trusted third party).
3. If an Evidencing (witnessing) activity exists, it must be furnished by Supporting documents.
4. These Supporting documents should be the results of an Evidencing (witnessing) activity that directly witnesses the Operational activity.
5. Supporting documents used by the Control activity should be transferred directly from the Evidencing actor to the Control actor.
6. The Evidencing actor who generates Supporting documents should be independent of the responsible actor who generates the To-be-verified document.
7. An Operational activity and its corresponding Control activity should be segregated into two different positions and done by two different actors.
8. The actors responsible for the Operational activity and its corresponding Control activity (respectively, Responsible actor and Control actor) should be socially detached.

Figure 2.5 is a UML-like visualization of the CPO control model. Figure 2.6 is a use case description of the CPO mapping model in case the C-actor cannot direct witness the O-activity.
Based on the CPO mapping model we can produce a checklist to help domain experts identify control problems and redesign control mechanisms. We refer to the CPO control principles, control model and the checklist as the CPO approach. The application of this approach is mainly to facilitate step 2 and 3 analysis of the e³-control.

2.4 The e³-control application guideline

Having introduced all the background theory and terminology needed, we now give a techni-
cal guideline on how to apply e³-control with a four-step analysis as presented in Figure 2.1. For non-academic experts and practitioners, this section can serve as practical guidelines when carrying out real-life cases of control procedure redesign. In addition, in later chapters of this book detailed real-life case studies are given on how to apply the guidelines in practice.

2.4.1 Step 1: Value based preliminary analysis under AS-IS situation

In this first step of the redesign, we focus on understanding the logic behind business networks, i.e. identifying actors, their value propositions (how they contribute to the sustainability of a network) and how network sustainability can be put at risk due to fraud or opportunistic behaviour of some actor. Due to the problem complexity and the strategic implications of procedural decisions, the focus in this stage is not on operational details (e.g. how a value proposition translates to business processes). Using the value perspective as a starting point enabled us to focus on the purpose of controls: to safeguard against the loss of value, thereby identifying the most critical value exchanges.

As a starting point we take the current AS-IS situation to build up value-based business model that describes a common understanding among stakeholders regarding who is offering and exchanging what with whom and expects what in return. We interviewed domain experts to explore which value transfers in the business model may be violated and what the severity of violations is. By doing so we identified critical value transfers: value transfers for which control problems should be tackled. Here we focus on the risks that violations of value exchanges may occur and critical value may be lost. We specify such violations of the ideal business model in a sub-ideal business model (see Figure 2.3, 2.4). All models are drawn using e³-value supporting software tool [for details see Kartseva et al. (2005) and Kartseva (2008)]. Value models facilitated a discussion between stakeholders, to study roles and interdependencies between actors.

To perform step 1, we need to iteratively

- Conduct interviews and workshop and read existing documentation to understand the business network;
- Draw models such as the one shown in Figure 2.3, 2.4 using the e³-value modelling tool¹⁸, and
- Discuss these models with domain experts.

Real-life case examples will be given for detailed implementation of this step. Models were validated with redesign participants and served for exploring control problems in trade proce-

¹⁸ The e³-value tool can be downloaded from http://www.e3value.com/tools/
dures; domain experts will prioritize the exchanges where violations may occur, so that we can focus the analysis on the most crucial violations.

Step 1 is characterized by the following inputs and outputs:

- **Inputs:** interviews and workshops with domain experts; documentation on the relevant actors, their goals and their activities.

- **Outputs:** understanding the logic behind the business network; value model(s); understanding of possible violations of value model(s); prioritization of violations, being control problems (including a decision to focus on specific control problems).

So far the analysis abstracts from the high-level operational view; to see how controls are applied in detail we need to move to the next step – a process level redesign.

### 2.4.2 Step 2: Process level control problems identification

Once an understanding of the business network and its vulnerabilities is achieved (step 1) and a decision is made to focus on specific threats, business process models can provide the operational details required to reason how such threats can occur (control problems) and be handled (control mechanisms). As described in section 2.3, control principles can be described as rules or dependencies between actors, activities and documents in a CPO model. We drew process models for the processes that realize the focal violations of value models (output of step 1) and investigated whether the process models adhered to the dependencies (step 2). Wherever a control problem was identified, an abstract solution was provided for it.

In order to apply the CPO model to a case study, we first need to identify the CPO components involved in the redesign (see Table 2.3). It should be noted that if some CPO components cannot be identified, this is already an indicator for potential control problems. After identifying the CPO components, the following checklist (Table 2.4) is used to identify control problems. The table consists of three columns: interrogations of the CPO control principles, specification of components and checking compliance.

<table>
<thead>
<tr>
<th>Actors</th>
<th>Activities</th>
<th>Documents</th>
</tr>
</thead>
</table>

---

<table>
<thead>
<tr>
<th>Actors</th>
<th>Activities</th>
<th>Documents</th>
</tr>
</thead>
</table>
Table 2.3. Identification table for CPO components

<table>
<thead>
<tr>
<th>Control Principles</th>
<th>Specification</th>
<th>Check (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 Does the control activity exist and follow the corresponding operational activity?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2 Can the Control actor directly witness the execution of the operational activity? If not, is the evidencing (witnessing) activity delegated to an evidencing actor (trusted third party)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3 Is there a supporting document furnishing the evidencing activity?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P4 Is the supporting document the result of the previous evidencing activity directly witnessing the operational activity to be controlled?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P5 Is the supporting document directly transferred to the control actor from the evidencing actor who witnesses the operational activity to be controlled?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P6 Is the supporting document generated by an actor independent of the actor who generates the to-be-verified document?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P7 Are the operational activity and its corresponding control activity segregated into two different positions and done by two different actors?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P8 Are the actors responsible for the operational activity and its corresponding control activity socially detached?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2.4. Checklist for applying CPO control principles

If the checklist shows that the current control procedure violates control principles (see Section 2.3), a corresponding control process model in the current situation shall be drawn, mapping the same violations identified. The problematic control processes are indicated with the red explosion mark in the process models mapping the same violations as earlier defined in the value models.

It should also be noted that, except for obvious control flaws, efficiency mismatching (e.g. labour redundancy and high operating costs) is also one of the major redesign points.

Step 2 is characterized by the following inputs and outputs:
- **Inputs:** a set of violations of value models to focus on; interviews and workshops with domain experts; documentation on business processes; set of CPO control principles and checklist as listed in Section 2.3.

- **Outputs:** process models of the processes that realize the earlier defined focal value-level control problems; set of process-level control problems; abstract suggestions for control solutions.

### 2.4.3 Step 3: Process level control mechanism redesign

In Step 3, domain experts develop concrete solutions for the earlier identified abstract solutions, and map with the CPO template to ensure that the new processes do not violate control principles. In this way e³-control provides a supporting tool for domain experts, but the introduction of the concrete solution remains in the human hands.

Step 3 is characterized by the following inputs and outputs:

- **Inputs:** process models for the focal value-level control problems; set of process-level control problems; abstract suggestions for control solutions; interviews and workshops with domain experts; documentation on business processes.

- **Outputs:** concrete solutions for earlier-defined control problems; process models mapping with the CPO template that realize these solutions.

As CPO control template model only provides an abstract of control solutions, numerous scenarios can be developed, implementing different concrete solutions by domain experts. Especially when these scenarios use new (IT) technologies, their introduction may cause changes in the business model. Different scenarios should therefore be assessed from a value perspective in the next step.

### 2.4.4 Step 4: Value based network and redesign evaluation
In step 4, we explored the business models behind the proposed redesign procedures. The various value models can be drawn under different scenarios, based on different redesign solutions agreed upon or intended to be carried out by stakeholders. Stakeholders can ultimately compare alternative redesign proposals via either profitability sheets or subjective evaluation. In this way the value of the redesign becomes visible.

Moreover, the value models created in step 4 can show whether value exchanges among stakeholders in a redesigned network are going to be implemented correctly, meaning that each remaining actor in the network shall enjoy extra benefit or at least not lose interest in the redesigned system. These models are essential for the sustainability of a network, because even the most visible and profitable business plans will not be adapted if there is an insoluble conflict of interest between stakeholders.

To this end, we are currently studying what the notion of value entails in the public sector. Early results show that the financial perspective has to be complemented by a social perspective, an operational perspective and a strategic perspective. In our ongoing work we seek to extend our models to these value categories, thus facilitating a broader value assessment than cash flow analysis.

Step 4 is characterized by the following inputs and outputs:

- **Inputs**: value models of the initial situation (output of step 1); concrete solutions for earlier-defined control problems (output of step 3); interviews and workshops with domain experts.

- **Outputs**: understanding of the logic behind the new business network and of how the network changed due to the introduction of new procedures; value model(s) of the new business network (or networks, in the case of multiple scenarios analysis); e3-value profitability sheets being a financial business model evaluation; alternative study among different proposed solutions.

### 2.5 Application and case studies

The e³-control methodology has been successfully applied for analyzing export/Customs control procedures and proposing redesigned solutions for four case studies in the ITAIDE project during the past years. We call these case studies Living Labs (LL), which are the Beer LL, Paper LL, Food LL and Drug LL (Baida et al., 2008; Baida et al., 2007b; Liu et al., 2007b; Liu et al., 2010). Different focuses are placed in four different Living Labs. The focus of the Beer LL was on the excise-free export of excise goods [for details see ITAIDE internal report¹⁹, ITAIDE (2007)]. Within the Beer LL the focus was placed on the transit of excise goods (in this case beer) between EU member states (in particular the export of beer from the Nether-

¹⁹ All ITAIDE reports are available from www.ITAIDE.org
lands to the UK) and export from an EU member state to non-EU countries (in particular the export of beer from the Netherlands to the US in our case). The Paper LL focused on the redesign solutions for e-Government and Business integration in the Finnish paper industry consisting of process, networks interfaces, electronic documents and administrative processes, which aim to reduce the administrative burden and costs for UPM (United Paper Mills) in Finland and other SMEs within the paper industry. At the same time, an investigation was made of whether the redesigned solution increases the security and information sharing from participating stakeholders’ perspective, particularly from SMEs (for details see ITAIDE (2008)). Our third Living Lab (Food LL) focuses on export of dairy products from Denmark and the related certificates (e.g. Hygienic certificate, Health certificate, Certificate of origin and Gost certificates) and VAT (value added tax) issues. We proposed e-Customs and eCertificate solutions for food export in cross-border trade (between Denmark and Russia) instead of the traditional paper-based procedures [for details see ITAIDE (2009)]. Lastly, in the Drug LL we investigate the export of pharmaceutical products from Ireland, particularly how to introduce new supply chain solutions, on the one hand satisfying the temperature control requirements for the high value pharmaceutical product, and on the other hand facilitating drug safety and security for Customs simplification and fast clearance procedure (e.g. FDA and USDA procedures) [for details see ITAIDE (2010)]. The table below summarizes key application areas of redesign across the four Living Labs. And in the next section, we give a detailed e³-control application case study on the Beer LL.

<table>
<thead>
<tr>
<th>Living Lab</th>
<th>Focused control issues</th>
<th>Cross border countries</th>
<th>Trading products</th>
<th>Adopted redesign solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beer LL</td>
<td>Excise</td>
<td>NL-UK</td>
<td>Beer</td>
<td>TREC+SOA</td>
</tr>
<tr>
<td>Paper LL</td>
<td>Double invoicing</td>
<td>FI-RU</td>
<td>Paper product</td>
<td>Green corridor</td>
</tr>
<tr>
<td>Food LL</td>
<td>Certificates (Hygienic/Health, Origin and Gost) &amp; VAT</td>
<td>DK-RU</td>
<td>Dairy product</td>
<td>EU-level single window</td>
</tr>
<tr>
<td>Drug LL</td>
<td>Certificates (FDA, USDA) &amp; Temperature monitoring</td>
<td>IE-US</td>
<td>High value vaccination</td>
<td>Improved Air-cargo box + Arviem²⁰ IT service</td>
</tr>
</tbody>
</table>

Table 2.5. The e³-control application in Living labs: An overview

2.5.1 The Beer Living Lab

In the Beer LL, our study investigates how to introduce e-Customs for handling excise goods (e.g. alcoholic beverages, cigarettes) in cross-border trade instead of the current paper-based

²⁰ Source: Arviem AG, trade monitoring services. See, www.arviem.com
procedures. We examine the export of beer from the Netherlands to the UK\(^{21}\). When beer is sold, excise duty must be paid in the country where the beer is consumed. Hence, a Dutch beer producer can export beer without paying excise in the Netherlands if he can prove that the beer has indeed been exported. The following actors are involved in this study: (1) BeerCo\(^{22}\) NL, a large Dutch beer producer; (2) BeerCo UK, the UK branch of BeerCo NL, functions as an intermediary between BeerCo NL and retailers in the UK; (3) Customs NL: the Dutch Customs authority; (4) Customs UK: the British Customs authority; (5) Excise Warehouse (EW) in the UK, a warehouse which has been certified for the deposit without payment of duty of excise goods; and (6) Retailer, a UK-based company that buys Dutch beer from BeerCo UK.

Currently, the core document for excise-free shipments in the EU is the paper-based *Administrative Accompanying Document* (AAD)\(^{23}\). Two roles are performed by the AAD: one as export evidence when stamped by EW and UK Customs, the other to identify the cargo in case of a physical cargo inspection en route. An Excise Warehouse, or also called Bonded warehouse is a building or other secured area in which dutiable goods may be stored, manipulated, or undergo manufacturing operations without payment of duty. It may be managed by the state or by private enterprise. In the latter case a Customs bond must be posted with the government. This system exists in all developed countries of the world\(^{24}\). The AAD accompanies the beer from the Netherlands to the UK and is stamped by the EW, then by Customs UK, as proof that the goods have arrived in the UK. Customs UK returned the stamped AAD back to the EW who will send it to BeerCo NL. Customs NL periodically checks BeerCo NL’s excise declarations. For the beer that BeerCo NL sold outside the Netherlands, excise exemption is given by default and will be verified afterwards by comparing excise declarations with AADs. As transferring paper-based AADs can take weeks or months, the verification is done several months later. In practice, this checking is often not done at all because it is labour intensive; BeerCo NL only submits AADs upon request of Customs NL. The current paper-based AAD control leads to administrative burden and possible excise fraud (e.g. tampering and missing AADs). According to the European Commission (2006b), excise fraud for alcohol in the EU amounts to €1.5 billion yearly, approximately 8% of the total excise duties receipts on alcoholic beverages. Therefore the EU intends to introduce e-Customs for excise goods, replacing paper-based control procedures by electronic ones. As a pilot of e-Customs redesign, our case study investigates 1) What control problems exist in the current scenario and how can they be addressed? 2) How to replace the paper-based solution with an electronic one with effective control? 3) What are the effects of the ICT solution on future government (Customs) and business relationships?

As argued in Subsection 2.1.2, a satisfactory redesign requires four steps of analysis in both value and process perspectives. A preliminary description of this approach was given in Liu et al (2006), but lacks a detailed discussion on how to perform steps 2 and 3. In the current paper we focus on these two steps and we apply the CPO approach to identify control problems and

\(^{21}\) Shipments within the EU are officially not considered export but intra-community supplies. We use the term export as our study encompasses also shipments outside the EU (not described in the current paper).

\(^{22}\) BeerCo is in real life Heineken NV.

\(^{23}\) Note that here the “AAD” is a paper based supporting document; in some of our former publications we have also referred our process level redesign methodology as AAD, in this thesis I renamed it as CPO.

redesign procedures. We do not discuss steps 1 and 4 in detail here, but some brief insights are given.

2.5.1.1 Step 1. Value perspective: Preliminary analysis

As a starting point we take the current value-based business model that describes a common understanding among stakeholders regarding who is offering and exchanging what with whom and expects what in return.

In order to draw the preliminary value model with the $e^3$-control, we first need to understand the formation of the business network: who are the involved stakeholders in our redesign? And what are the key value activities they carry out? Via interviews and workshops we have identified the following stakeholders and their main activities (see Table 2.6):

<table>
<thead>
<tr>
<th>Actors</th>
<th>Main activities/roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>BeerCo NL (Heineken NL)</td>
<td>Produce beer in NL</td>
</tr>
<tr>
<td>BeerCo UK (Heineken UK)</td>
<td>Sell beer to local retailers in UK</td>
</tr>
<tr>
<td>Customs NL</td>
<td>Implement Dutch Customs &amp; Tax law</td>
</tr>
<tr>
<td>Customs UK</td>
<td>Implement UK Customs &amp; Tax law</td>
</tr>
<tr>
<td>Excise Warehouse (EW)</td>
<td>Collecting and handling excise</td>
</tr>
<tr>
<td>Retailer</td>
<td>Sell beer in the local market</td>
</tr>
<tr>
<td>Carrier (Maersk)</td>
<td>Transport beer from one country to another</td>
</tr>
<tr>
<td>Supermarket UK</td>
<td>Resell beer in UK market</td>
</tr>
<tr>
<td>Consumer UK</td>
<td>Buy and consume beer in UK</td>
</tr>
</tbody>
</table>

Table 2.6. Actors and main activities involved in Beer LL AS-IS scenario

After clear identification of the actors and activities for the focused business network, we drew model blocks such as the one shown in Figure 2.7 (without consideration of value transfer yet in this stage) using the $e^3$-value modelling tool\(^{25}\).

\(^{25}\) The $e^3$-value tool can be downloaded from [http://www.e3value.com/tools/](http://www.e3value.com/tools/)
Then we interviewed domain experts to explore what are critical value transfers among different actors, which value transfers in the business model may be violated and what the severity of violations is. By doing so we identified critical value transfers: value transfers for which control problems should be tackled. Here we focus on the risk that BeerCo NL will sell beer in the Netherlands and declare it as exported in order to obtain exemption from excise duties. We specify such violations of the ideal business model as sub-ideal situations in the AS-IS model (see Figure 2.8). The sub-ideal situation route (left leg of the OR) is separated by the Or fork with the ideal situation (right leg of the OR), and indicated with the red explosion mark as control problems identified. Both models are drawn using a supporting software tool of e³-value [for details see Kartseva et al. (2005)]. As shown in Figure 2.8, actors (visualized as rectangles) exchange (visualized as blue lines) objects of economic value (text labels), in such a way that every actor gives something and receives something in return (the economic principle of reciprocity). The analysis abstracts from the operational view. To see how controls are applied we move to the next step – a process level redesign.

AND and OR connection elements. An AND fork connects a dependency element to one or more other dependency elements, while the AND join connects one or more dependency elements to one other dependency element. An OR fork models a continuation of the scenario into one direction, to be chosen from a number of alternatives. The OR join merges two or more sub-scenarios into one scenario.
2.5.1.2 Step 2. Process perspective: Applying the CPO approach to identify control problems

In order to apply the CPO model to the case study, we first identify the CPO components involved in the beer case (see Table 2.3 and Table 2.7). It should be noted that if some CPO components cannot be identified, this is already an indicator for potential control problems. After identifying the CPO components, the following checklist (see Table 2.4 and Table 2.8) is
used to identify control problems. The table consists of three columns: interrogations of the CPO control principles, specification of components and checking compliance.

<table>
<thead>
<tr>
<th>Actors</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R-actor</td>
<td>E- actor</td>
<td>C- actor</td>
</tr>
<tr>
<td>BeerCo NL</td>
<td>EW/ Customs UK</td>
<td>Customs NL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activities</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>O-activity</td>
<td>E- activity</td>
<td>C-activity</td>
</tr>
<tr>
<td>Export beer from NL to UK without excise payment</td>
<td>Evidence/ witness beer exported by BeerCo NL indeed arrives in UK and stamp AAD</td>
<td>Verify excise declaration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Documents</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Excise declaration</td>
<td>Stamped AAD</td>
<td>Excise declaration acknowledgement</td>
</tr>
</tbody>
</table>

Table 2.7. Beer LL CPO components

<table>
<thead>
<tr>
<th>Control Principles</th>
<th>Specification</th>
<th>Check (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P1</strong></td>
<td>Does the control activity exist and follow the corresponding operational activity?</td>
<td>Operational activity: Declare export without excise payment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control activity: Verify excise free declaration</td>
</tr>
<tr>
<td><strong>P2</strong></td>
<td>Can the Control actor directly witness the execution of the operational activity? If not, is the evidencing (witnessing) activity delegated to an evidencing actor (trusted third party)?</td>
<td>No direct witness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control actor: Customs NL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evidencing actor: EW/ Customs UK (Trustworthy)</td>
</tr>
<tr>
<td><strong>P3</strong></td>
<td>Is there a supporting document furnishing the evidencing activity?</td>
<td>Supporting doc.: AAD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evidencing activity: acceptance of beer shipment by EW and Customs UK</td>
</tr>
<tr>
<td><strong>P4</strong></td>
<td>Is the supporting document the result of the previous evidencing activity directly witnessing the operational activity to be controlled?</td>
<td>Supporting doc. AAD is directly stamped after EW/Customs UK witness the import (i.e. completion of the export activity)</td>
</tr>
<tr>
<td><strong>P5</strong></td>
<td>Is the supporting document directly transferred to the control actor from the evidencing actor who witnesses the operational activity?</td>
<td>The AAD is not directly transferred to the control actor, Customs NL, but via the responsible actor, BeerCo</td>
</tr>
</tbody>
</table>
Table 2.8. Checklist for applying CPO control principles in Beer LL

<table>
<thead>
<tr>
<th>Activity to be controlled?</th>
<th>Actor issuing the document to be verified: BeerCo</th>
<th>Actor issuing/ testifying the supporting documents: EW/Customs UK</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>P6 Is the supporting document generated by an actor independent of the actor who generates the to-be-verified document?</td>
<td>Operational activity is performed by O-actor: BeerCo</td>
<td>Control activity is performed by C-actor: Customs NL</td>
<td>Yes</td>
</tr>
<tr>
<td>P7 Are the operational activity and its corresponding control activity segregated into two different positions and done by two different actors?</td>
<td>Operational activity is performed by O-actor: BeerCo</td>
<td>Control activity is performed by C-actor: Customs NL</td>
<td>Yes</td>
</tr>
<tr>
<td>P8 Are the actors responsible for the operational activity and its corresponding control activity socially detached?</td>
<td>Operational activity is performed by O-actor: BeerCo</td>
<td>Control activity is performed by C-actor: Customs NL</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The above checklist shows that the AAD-based procedure violates control principles 3 and 5. Figure 2.9 shows the control process model in the current situation. The dashed outline indicates control problems: the supporting document (AAD) is not transferred directly from the evidencing actor (EW/Customs UK) to the control actor (Customs NL) and checking AADs is often not done.

**Figure 2.9. Control problems in the current EU procedures for intra-EU trade in excise goods**

Besides control flaws, the current procedure includes an efficiency flaw. Namely, the AAD is used only for excise handling, while separate information flows are required for export declaration, VAT handling and national statistics. These separate information flows involve very similar commercial data, but are processed by different information systems, thereby creating redundancy and high operating costs for businesses and governments.
2.5.1.3  **Step 3. Process perspective: Applying the CPO approach to redesign control mechanisms**

The CPO mapping model (see Figure 2.4 and Figure 2.5) serves as a template for new procedure (re)designs. In the simplest redesign, good control with the paper-based AAD is achieved if AADs are transferred directly from EW/Customs UK to Customs NL and verified (Figure 2.10). However, there are inevitable drawbacks to the paper-based solution, as it is time consuming, fraud prone and does not support Internet-based supply chains. Also, there is also a legal reason why the AAD is not transferred directly from the Control actor (EW/Customs UK). UK-Customs is willing to stamp the AAD, but they are not willing to send the AAD directly back to the NL-Customs, to avoid legal responsibility if in case the AAD does not arrive properly at the NL-Customs, they will be responsible.

![Diagram](image)

**Figure 2.10. Redesign of the paper-based AAD procedure according to the CPO control model**

Currently, European governments and businesses are developing ICT-based solutions to cope with these and other deficiencies in international trade. One solution is *smart seals* such as TREC devices. The TREC (Tamper-Resistant Embedded Controller) is a container-mounted device which has a mobile receiver tracking the container’s precise location; sensors monitoring environmental parameters in the container (e.g. temperature, humidity), sensors monitoring the physical state of the container (e.g. door opening, tampering attempts) and communication modules for exchanging data (e.g. via handheld devices, via satellite, GSM/GPRS or short range wireless). By monitoring a container’s position coordinates, automatic messages can be sent by TREC devices to supply chain partners and Customs NL when containers actually leave the Netherlands or deviate from their predefined routes. TREC devices could therefore replace the AAD’s functionality to provide evidence of export.

Next, we describe the core ideas of the Beer LL proposed trade procedure. In the new procedure, when BeerCo NL prepares a shipment of beer, it can publish the goods’ commercial data (originating from its ERP system) in its own database that is accessible through the Internet for authorized supply chain partners, including Customs NL. For the sake of the current discus-

---

sion, we shall call this database EPCIS\(^{28}\) (standardized version of the organizations ERP database) without discussing it in detail. As soon as a beer container is closed at the premises of BeerCo NL, the TREC device on that container triggers sending a message to the carrier and a notification is sent to Customs-NL. This message contains a Unique Consignment Reference number (UCR), which the carrier and Customs can use to query and retrieve commercial data from BeerCo’s EPCIS and use it for all their control procedures, including excise, VAT, statistics and more. Hence, data is kept at BeerCo’s EPCIS and is accessible for all relevant supply chain partners (based on mutual agreements) and government systems, also for periodic auditing. As soon as a container physically leaves Dutch territory (or: arrives at the country of destination), the TREC device provides digital export evidence. If the shipment is physically inspected en route, Customs officers can use handheld devices to obtain access - via the Internet and using a UCR that the TREC device provides - to commercial information identifying this shipment in EPCIS databases of BeerCo and other supply chain partners. Also the digital export evidence (produced by a TREC device) is stored in the carrier’s EPCIS database and can be accessed by authorized supply chain partners. Because the scenario presented in Figure 2.11 is based on Service Oriented Architecture (SOA), it offers two more very interesting opportunities. First, whenever a supply chain participant (e.g. BeerCo, an ocean carrier, Customs-NL and the buyer) seeks some data regarding a shipment, they can use the shipment’s UCR to search for this data through the Internet, using a discovery service. If the data is available in the EPCIS of any supply chain partner, the data can be retrieved by authorized parties through a Web interface. We refer to this mechanism as “googling”. Second, the discovery service is informed about the presence of data in the EPCIS databases. Supply chain participants can register to receive notifications for predefined events. For example, every time a TREC device notifies the carrier’s EPCIS that a shipment has arrived in the UK or US, a notification can be sent to Customs NL as export evidence, removing the need for the current cumbersome paper-based export evidence procedure. This solution therefore supports a main goal of the EU: to design simplified Customs procedures for businesses that have a high degree of control of their supply chain, referred to as AEOs – Authorized Economic Operators (European Commission, 2005). We visualize the new procedure in Figure 2.12.

\(^{28}\)The EPC Information Service [EPCIS] is a specification for a standard interface for accessing EPC-related information. An Electronic Product Code (EPC) gives each object a unique serial number, each individual object can be tracked and fine-grained real-time information about each object can be collected, stored and acted upon. See http://www.epcglobalinc.org/
Figure 2.11. TREC devices and EPCIS databases are used to share information and guarantee security and control

Figure 2.12. Control with TREC devices and related Internet-based EPCIS technology
The CPO model serves again as a template to verify that the new procedure complies with theoretic principles and hence does not include control flaws. After all, as the new procedure is an instantiation of the model in Figure 2.5, it complies with the proposed CPO control model. The evidencing actor’s role is assumed by the TREC service provider (which should be certified by the government). The supporting document (electronic TREC location message) is sent directly to the control actor (Customs NL) without possible manipulation by intermediate parties. By using handheld devices, Customs officers can access TREC devices and commercial data in BeerCo’s EPCIS. This enables Customs officers to obtain secured and reliable information about the content of a container. The TREC performs real-time “evidencing” when sending a message to Customs NL as soon as the container has left the Netherlands. It supports an IT-based 100% check of excise-free declarations for Customs NL, because electronic TREC messages will be sent for every secured container to Customs NL and verified. This is in contrast to the current situation, where humans do sample testing of the paper-based AADs, and therefore for many companies control hardly ever takes place.

2.5.1.4 Step 4. Value perspective: Financial Feasibility Evaluation

The paper-based AAD is replaced by TREC and EPCIS technology. New controls require a new actor – the TREC provider – to be involved. The introduction of the TREC provider may change the roles-linkage among network actors and the structures of the business network. The new actor (indicated in the dashed frame) and change of value transfers can be seen in the value-based business model in Figure 2.13. From the perspective of Customs NL, the TREC technology and related services are used as a control mechanism, to verify BeerCo’s excise declarations. The uniqueness of this business network is that when control is performed by an external commercial party combined with ICT solutions, a higher degree of control is achieved. From BeerCo’s perspective, the TREC technology enables more control of the supply chain, because by using TREC devices (1) BeerCo can always tell where exactly its shipments are and (2) theft and smuggling are prevented or detected immediately by detecting unauthorized container openings.

The model in Figure 2.13 is used to evaluate the financial feasibility of the redesigned procedure: whether all actors can make profits or increase their economic utilities. The services of using TREC devices have a price tag, and BeerCo NL will have to pay a fee per shipment for using the device. The new actor – TREC provider – will increase the profit through charging for the corresponding services, and Customs NL will enjoy a better control of the excise payment. BeerCo will have to pay for TREC services. Some incentive is required for BeerCo to justify these costs. Customs NL can provide such an incentive by granting AEO certifications to business partners. The idea of AEO is that if a business can prove to the Customs that it controls its own processes well enough with modern ICT to ensure the safety and security of its international supply chain, the Customs grants an AEO certificate to this business. The AEO status will result in tangible benefits such as expedited processing and fewer physical inspections by the Customs offices. Companies that use TREC or similar technologies have a better control of their supply chain, and therefore can be certified as AEOs by Customs offices.
Figure 2.13. TO-BE redesigned business model: Customs-NL certifies BeerCo NL as AEO and a TREC service provider is introduced
2.5.1.5 Summary

The Beer LL is a pilot project of the ITAIDE project for redesigning EU Customs procedures. It focuses on procedures for shipments of beer from the Netherlands to destinations outside the EU (export) and within the EU (intra-community supplies). It serves as a proof of concept for the implementation of the AEO concept, aligning commercial and governmental supply chain benefits, and is also aligned with the Single Window (SW)\(^{29}\) vision, whereby trade-related information and/or documents need only be submitted once at a single entry point to fulfill all import, export, and transit-related regulatory requirements. A collaboration between one of the world’s largest beer producers (BeerCo), the Dutch Tax and Customs Administration, two large technology providers (IBM and SAP) and universities aims to demonstrate that trade facilitation, reduced administrative burden for supply chain partners and improved control and security are not necessarily contradictory efforts and can actually coexist. The project investigates a redesign of Customs procedures such that BeerCo can enjoy an AEO status and related benefits, once it demonstrates by means of innovative IT that it is in control of its international supply chain.

As a theoretical framework we use the e\(^3\)-control modelling approach, which specifically focuses on designing inter-organizational controls. We discuss the application of e\(^3\)-control, having carried out a step-by-step analysis in the Beer LL, where modelling is a way of facilitating innovation and network transformation.

While in the past Customs control has been considered as an issue of Customs administrations only, nowadays businesses are seen as partners, and a Win-Win situation is required, such that businesses are responsible for control of their own supply chains and Customs can rely on this control. Because this relieves Customs administrations of control tasks, these businesses can be rewarded with simplified procedures. Customs administrations can then focus their resources on high-risk shipments. Bearing these issues in mind, we analyzed existing Customs procedures concerning the export of beer from the Netherlands. We examined possible redesigns for current procedures. We showed that the use of advanced container security technology (TREC) with service-oriented architectures based on EPCIS databases can achieve paperless control procedures. Finally, we proposed a control procedure in which businesses make commercial data about the shipment of goods available for government, and any authorized government agency can retrieve this data. Consequently, businesses are no longer required to submit declarations to silos of automation of the government. This realizes the Single Window vision, a key EU goal in the field of Customs and Taxation. Businesses that use our procedure will greatly improve supply chain and security control thanks to the use of container security technology, thereby helping companies to qualify for an AEO status. A pilot implementation of this scenario involved containers shipped from the Netherlands to the UK and to the US in December 2006 – January 2007 and showed that control can be maintained and security can be guaranteed while using the Beer LL simplified trade procedure.

\(^{29}\) A Single Window is defined as a facility that allows parties involved in trade and transport to lodge standardized information and documents with a single entry point to fulfil all import, export, and transit-related regulatory requirements. If information is electronic, then individual data elements should only be submitted once. (see, http://www.unece.org/)
In the meanwhile, we have experienced some difficulties in investigating the financial feasibility of the Beer LL scenario. This is not a straightforward task, because a number of obstacles have to be tackled. First, the Beer LL technology is innovative and still under development. It does not have a known price tag yet. Second, many of the benefits of the Beer LL are hard to quantify, including accelerated procedures and increased levels of security. Last but not least, as the government is an important actor involved in the redesign, the definition of value for the public sector is different from that for the private sector; value for a government is not primarily expressed in terms of cost reduction and increasing profit margins.

2.6 Conclusions

We present in this chapter the e³-control, a redesign methodology with software support tool for analyzing and designing control procedures. Guidelines for applying e³-control methodology are provided and we illustrate it with a detailed case study of the Beer LL. Applications and results from other three Living Labs (i.e., Paper LL, Food LL and Drug LL) are discussed briefly in the chapter to give an overview of the scope of e³-control application across industry. The e³-control contributes to both business practice and research. From a business perspective, our model-based approach is shown to be a useful tool for redesigning Customs controls; it enables identifying control flaws and validating compliance of procedures with control principles. Visual models capture business intricacies in a network organization. They therefore serve as a supporting tool in discussions aimed at eliciting knowledge from business experts and exploring possible procedure redesigns. From a research perspective, the contribution of this paper is twofold. First, rather than developing new theories of inter-organizational control, we conceptualize existing knowledge, so that it can be used for systematic and structured reasoning. The CPO components, control principles and control model can serve as logical fundament for developing IS tools to support domain experts in control procedure (re)design. Second, the combined value and process-based redesign is a novel approach for control procedure redesign, because it takes into consideration control concerns, as well as the financial feasibility of introducing controls into a business model, and the shifts in roles when control is offered as a commercial service. The value perspective enables not just financial feasibility analysis, but also a reduction in complexity by focusing the control analysis on critical value transfers. An in-depth case study of a current e-Customs pilot concerning beer export illustrates this. We further developed the earlier e³-control research of (Kartseva et al., 2005; Kartseva, 2008) to understand the context and we extended this research with the structured and systematic CPO approach for analyzing control problems and redesigning control mechanisms in business processes.

The scope of application of the e³-control redesign methodology is not only limited in Custom control procedures, but also can be used in contracts designing, reports, invoices and bank statements inspection etc. Future research efforts will be focused on following directions. First, we will further study other cases to test the usability and generalizability of our approach. Second, we seek to extend our CPO control principles with new insights from accounting and auditing literature as well as best industrial practices to enhance applicability of the methodology. Finally, we will further develop and investigate the effectiveness of the e³-control software tools to better support domain experts in designing their control procedures.
3. Design and analysis of e-government control: The green corridor between Finland and Russia

Abstract

Confronted with the pressure of increased security threats and financial fraud, Customs administrations worldwide have changed regulations and added restrictions to international trade in recent years. At the same time, governments also want to reduce the administrative burden for businesses in order to create an economically competitive zone. The EU is now implementing e-government ideas in new procedures. An important issue in designing new Customs and trade procedures is whether the new procedures mitigate control risks. In this chapter we present a model-based approach to support domain experts in investigating whether (redesigned) Customs procedures mitigate control risks. We describe a methodological application of our “CPO” (Control Procedure Ontology), from accounting and auditing literature, to redesign trade procedures. As a proof of concept, we apply our “CPO” approach to the case of the Green Corridor between Finland and Russia.

3.1 Introduction

Global trade is vulnerable to terrorist exploitation and financial fraud. Confronted with increased fraud, health risks and terror threat, Customs administrations worldwide added new restrictions to international trade in recent years. A major challenge for European governments is to solve the dilemma of providing increased security and control for international trade, while at the same time decreasing the administrative burden of commercial and public administration organizations. ICT is broadly perceived as a key enabler for solving this dilemma and designing new government procedures. However, the (re)design process should also ensure that the ICT-based e-government procedure is still in control, in other words – manages to mitigate risks.

Customs control is a special case of government procedures. In this chapter, we analyze and redesign Customs control procedures, replacing paper-based procedures by ICT-based ones while coping with business and administrative challenges. As a tool for redesign we deploy e³-control, a model-based (re)design approach using two levels of abstraction: value and process perspectives. Kartseva (2005) proposed to design control procedures by focusing on value exchanges in a network, because controls safeguard the transfer of values between actors. Liu et al. (2006) proposed to combine the value perspective with a process perspective because control is a process element, and because the value perspective is not rich enough for actual control mechanism design. Here, we describe systematic approach for performing the process

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30 Note: This chapter is adapted from Jianwei Liu, Ziv Baida Yao-Hua Tan and Kari Korpela (2007), Design and Analysis of e-Government control; the Green Corridor between Finland and Russia, in the Proceedings of the 20th Bled eCommerce Conference (Bled 2007), Bled, Slovenia, 2007.

31 In the original publication we call it “AAD” approach, Actor-Activity-Document approach of control principles
level analysis. Our “CPO” approach (or Actor-Activity-Document approach from the initial publication) is based on control principles from accounting and auditing literature, to redesign control procedures. We present our approach and its application using the case of the Green Corridor (GC) between Finland and Russia. The uniqueness of this case is that it manifests both pillars of modern Customs, identified by the World Customs Organization: government-business (G2B) partnership and government-government (G2G) collaborations (WCO, 2005).

The rest of the chapter is organized as follows. First, in Section 3.2 the e³-control procedure redesign approach is presented. Our “CPO” approach for process level analysis is also discussed in this chapter. In Section 3.3 we apply this approach to the Green Corridor. Finally, in Section 3.4, conclusions and further research directions are given.

3.2 The e³-control: A modelling approach for designing controls

<As details of this have been discussed in a previous chapter of the thesis, to avoid repetition the four pages text from the original publication have been omitted. For details, please refer to Chapter 2, p 32-50>}

3.3 Case study: The green corridor between Finland and Russia

Finland has the longest EU border with Russia. 1300 trucks cross this border daily. Due to the slow import clearance and inspection procedure of Russian Customs, truck queues of 15-25 kilometres are common at the border (Finnish Road Administration, 2007). Trucks may wait several days at the border and whole supply chains are brought to a halt. The long delays cause direct financial losses to involved businesses, especially for perishables. Due to high volumes of trade, 100% physical control at the border is too labour-intensive and no longer practical. The traditional procedure need to be redesigned.

We consider the following actors in this chapter:

(1) Finnish export company; (2) Russian import company; (3) carrier, a transport company that physically transports goods from Finland to Russia by truck; (4) Finnish Customs; and (5) Russian Customs. Starting from here, we analyze and redesign the procedure in four steps as we proposed in Subsection 3.2.2.

3.3.1 Step 1. Value perspective: Preliminary analysis

We take the current business value model as a starting point. This model describes a common understanding among stakeholders regarding who is offering what to whom and expects what in return. In the ideal situation (no fraud or opportunistic behaviour) the Finnish export company and the Russian importer exchange goods for money. The Finnish exporter pays carriers for transporting goods to Russia, and declares export information to Finnish Customs to comply with Finnish legislation. Finally, the Russian importer pays import tax to Russian Customs, thereby complying with Russian tax law. (The ideal value model is not presented here, but available on request).
In interviews with domain experts we explored which value transfers in the business model may be violated, and what the severity of violations is. We identified critical value transfers: value transfers for which control problems must be analyzed and handled. In this section we focus on the risk that the Russian import company will not pay proper import tax to the Russian Customs. This violation can be caused by the “double invoicing” phenomenon. “Double invoicing” indicates that Russian companies import goods and present the real invoice to Finnish Customs, but a fake invoice – with a lower amount – to Russian Customs, so that they pay less import tax. Double invoicing is a common practice in Russian trade. The discrepancy between Finnish export and Russian import statistics was nearly 60% in 2005 (EnterpriseFinland, 2006).

Figure 3.1 shows an e³-control model for the sub-ideal scenario of “double invoicing”, which is indicated by a dashed blue line. In order to see how controls are applied, we move to the next step – a process level redesign.

Figure 3.1. AS-IS scenario of the Paper LL with the “double invoicing” problem

3.3.2 Step 2. Process perspective: Applying the CPO approach to identify control problems

In applying the CPO approach to the case study, we first need to identify the AAD components in the scenario (see Table 3.1). In the current case, the Russian import company – the responsible actor – looks after the operational activity (importing goods from Finland and reporting to the Russian Customs to pay the corresponding import tax); Finnish Customs acts as the evidencing actor, which performs an evidencing activity to witness goods exported by Finnish companies, based on purchasing invoice information provided by the Finnish company (purchasing invoice-Finland); Russian Customs acts as the control actor. As the Russian Customs cannot directly (physically) check all the imported goods, they perform the control activity based on verifying the supporting Doc. (purchasing invoice-Russia, which states the value of the goods) and the to-be-verified doc, (Import declaration). In the ideal situation, the
supporting doc. (purchasing invoice-Russia) provided by the Russian import company should be identical to the purchasing invoice-Finland. However, the Russian company may give the Russian Customs a fake invoice with a lower value to get a lower tariff ("double invoicing"). A difficulty in identifying some CPO components is an indication of potential control problems.

<table>
<thead>
<tr>
<th>Actors</th>
<th>Activities</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-actor</td>
<td>E-actor</td>
<td>C-activity</td>
</tr>
<tr>
<td>Russian import company</td>
<td>Finnish Customs</td>
<td>Russian Customs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.1. CPO components of Finland-Russia trade procedure

After identifying the CPO components, the checklist in Table 3.2 is used to identify control problems. The table consists of three columns: interrogatives of the CPO control principles, specification of components and checking of the compliance. Any "No" in the third column signals a control problem of the Customs procedure.

<table>
<thead>
<tr>
<th>Control Principles</th>
<th>Specification</th>
<th>Check (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P1</strong></td>
<td>Does the control activity exist and follow the corresponding operational activity?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Operational activity: import goods from Finland and pay import tax</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control activity: verify import tax payment</td>
<td></td>
</tr>
<tr>
<td><strong>P2</strong></td>
<td>Can the Control actor directly witness the execution of the operational activity? If not, is the evidencing (witnessing) activity delegated to an evidencing actor (trusted third party)?</td>
<td>No direct witness</td>
</tr>
<tr>
<td></td>
<td>No direct witness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control actor: Russian Customs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evidencing actor: Finnish Customs</td>
<td></td>
</tr>
<tr>
<td><strong>P3</strong></td>
<td>Is there a supporting document furnishing the evidencing</td>
<td>No, after evidencing</td>
</tr>
<tr>
<td></td>
<td>Supporting doc.: purchasing invoice-Russia</td>
<td></td>
</tr>
</tbody>
</table>

32 The Finnish Customs is not a real evidencing actor, as it does not provide any supporting docs to the control actor.

33 The purchasing invoice-Russia used by Russian Customs is actually not a real supporting doc., as it is provided by the Russian import company but not by Finnish Customs.
**Table 3.2. Checklist for applying CPO control principles**

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>P4</td>
<td>Is the supporting document the result of the previous evidencing activity directly witnessing the operational activity to be controlled?</td>
<td>Supporting doc.: purchasing invoice - Russia is not direct evidence by Finnish Customs after witnessing the export of Finnish company</td>
</tr>
<tr>
<td>P5</td>
<td>Is the supporting document directly transferred to the control actor from the evidencing actor who witnesses the operational activity to be controlled?</td>
<td>Supporting doc.: purchasing invoice - Russia is not provided by the evidencing actor - Finnish Customs, but by the responsible actor, Russian import company</td>
</tr>
<tr>
<td>P6</td>
<td>Is the supporting document generated by an actor independent of the actor who generates the to-be-verified document?</td>
<td>Actor issuing the document to be verified: Russian import company</td>
</tr>
<tr>
<td>P7</td>
<td>Are the operational activity and its corresponding control activity segregated into two different positions and done by two different actors?</td>
<td>Operational activity is performed by O-actor: Russian import company, Control activity is performed by C-actor: Russian Customs</td>
</tr>
<tr>
<td>P8</td>
<td>Are the actors responsible for the operational activity and its corresponding control activity socially detached?</td>
<td>Operational activity is performed by O-actor: Russian import company, Control activity is performed by C-actor: Russian Customs</td>
</tr>
</tbody>
</table>

**Figure 3.2. Problematic “AS-IS” Customs control process**

The checklist in Table 3.2 shows that the AS-IS Customs procedure between Finland and
Russia violates control principles 3, 4, 5 and 6, resulting in substantial control problems. Figure 3.2 shows the control process model in the current situation. The sparkles indicate control problems: The evidencing actor (Finnish Customs) does not provide any further supporting documents to facilitate control actor (Russian Customs) after the evidencing activity. The supporting document (Purchasing invoice-Russia) used by the control actor (Russian Customs) is provided by the responsible actor itself; this document can be altered and falsified so it should not be used as supporting document.

3.3.3 Step 3. Process perspective: Applying the CPO approach to redesign control mechanisms

According to the CPO control model, good Customs control can be achieved if a supporting document can be provided by Finnish Customs, acting as evidencing actor, and directly transferred to Russian Customs as the verification evidence. An example procedure redesign is the Green corridor (GC) between Finland and Russia.

3.3.3.1 The Green Corridor

The Green Corridor (GC) is an agreement between Finland, Sweden and Russia. The idea is that Finnish/Swedish companies that sell goods to Russian companies send electronic messages with information about the business transaction to the Finnish/Swedish Customs before the cargo arrives at the border. Then Finnish/Swedish Customs forward this information to the Russian Customs, eliminating the risk of double invoicing. The goods are cleared faster at the border, and involved companies may pay import duties at the Customs office at the destination anywhere in Russia. Only certified businesses are allowed to participate in the GC. The Green Corridor procedure is visualized in Figure 3.3, where flow of information refers to pre-arrival information concerning the business transaction or acknowledgements thereof.
The implementation of the Green Corridor does not only change the traditional trade procedures, but also creates new values and relationships: Customs-to-business (G2B) partnerships and Customs-to-Customs (G2G) collaboration. To keep the Customs procedures in control and the network relationships sustainable, we need a redesign approach combining both value and process perspectives.

### 3.3.3.2 Applying the CPO Control Model to the Green Corridor

We re-identify the CPO components in the GC procedure (see Table 3.3). The supporting document is now replaced by pre-arrival goods information sent by Finnish Customs. The real evidencing functionality of Finnish Customs is now being fulfilled, and linked with the control actor (Russian Customs) by this pre-arrival goods information.

<table>
<thead>
<tr>
<th>Actors</th>
<th>Activities</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russian import company</td>
<td>Finnish Customs</td>
<td>Russian Customs</td>
</tr>
</tbody>
</table>

Table 3.3. CPO components of Green Corridor

Figure 3.4 is obtained by mapping the CPO components from the GC procedure to the CPO model. We compare Figure 3.4 with Figure 2.6 (CPO principle mapping figure) and find that in the GC, the order of the evidencing activity and supporting document is reversed. By further filling in the CPO checklist (not presented here for the sake of brevity), we see that the GC procedure satisfies most of the control principles except for principle 4: “The supporting documents should be the result of an evidencing/witnessing activity that directly witnesses the activity to be controlled”. In the GC, Finnish Customs assumes the Finnish export companies are trustworthy, and sends the pre-arrival information (supporting document) to Russian Customs prior to the actual Finnish Customs control (evidencing activity). However, are all the Finnish export companies trustworthy? To conduct seamless Customs controls, reversing the order of “sending pre-arrival information” and “evidencing export activity” is prescribed by existing theories. The current GC procedure reinforces trustworthiness differently: by GC certification. To obtain the certification, companies have to fulfil certain requirements and be pre-audited in such a way that certified companies can be considered trustworthy for the GC procedure. So far, however, only few Finnish companies are certified for the GC.
3.3.4 Step 4. Value perspective: Evaluation

A major difference between the GC scenario and the traditional procedure is the replacement of the supporting document of purchasing invoice (provided by the Russian import companies) by the ICT-enabled pre-arrival information (sent by Finnish Customs). To evaluate the success of the redesign, we go back to the value perspective analysis and find all parties benefit from the GC (Figure 3.5):

- **Russian Customs**: “double invoicing” is solved, higher tax revenues; less fraud; faster Customs clearance
- **Finnish Customs**: increased economic competitiveness of Finland; trade facilitation
- **GC certified businesses (exporter)**: supply chain efficiency; accelerated procedure, short queues at the border; tax payment at a later time rather than at the border
- **Russian importer**: faster delivery
- **Carrier**: faster transportation, security and efficiency; faster turnover

**Figure 3.4. Green Corridor Customs control process**
The GC procedure can be seen as an effective and satisfactory Customs redesign: control goals are achieved, the total value of the network increases, the network is sustainable and all parties involved benefit. By linking governments and businesses, the innovative GC procedure also creates a new circular situation consisting of both G2B and G2G collaboration (Figure 3.5), the two pillars of modern Customs (WCO 2005). Once such a circle is created, it will further facilitate the “Authorized Supply Chain” proposed by the WCO (2005).

3.4 Conclusions and future research

The e³-Control has been suggested as a methodology for (re)designing inter-organizational controls. Kartseva et al. (2005) suggest that e³-control should assume a value perspective on control. Liu et al. (2006) argue that e³-control should combine both value perspective and process perspective, because the literature on control uses business processes as a unit of analysis. In this chapter we present a combined approach and we describe a well-structured and theoretically sound method for performing the process level analysis, namely the CPO approach.

Our study contributes to business practice and research. From a business perspective, our model-based approach is shown to be a useful tool for redesigning Customs procedures; it enables identifying control flaws and validating compliance of procedures with control principles. Graphical models capture business intricacies in a network. They therefore serve as a tool in discussions for eliciting knowledge from business experts and exploring possible procedure redesigns. A structured modelling approach ensures that all concerns are taken into consideration in a redesign. From a research perspective, the contribution of this chapter is twofold. First, the combined value and process-based redesign is a novel approach for control procedure redesign. The value perspective reduces the complexity of redesign by focusing control analyses on critical value transfers. The process perspective offers the details required for designing actual control mechanisms. The whole approach takes into consideration control...
concerns, economic concerns, network structure and changes that new controls introduce in actor interdependencies, roles and relationships. Second, we conceptualize broadly-accepted auditing theories in our CPO control model, as a basis for developing decision support software tools for systematic and structured reasoning by domain experts. Thus, we provide tools to support the human decision-making process in designing control systems. An in-depth e-Customs case study provides proof of concept for our approach.

As our study shows, the current Russian import procedure was not designed properly, and as a result double invoicing is a common phenomenon. The Green Corridor is an attempt to solve this problem. However, as we showed in the case, even the GC has a design flaw. Certification is supposed to cope with this flaw. In a different study, we applied the same auditing and accounting theory to the EU-wide procedure for handling intra-community supplies of excise goods (e.g., beer) and found that the EU procedure does not comply with basic control principles, resulting in large-scale fraud. Future research efforts will investigate whether our approach is generic enough to cope with other control problems in different contexts, and whether our CPO control principles are exhaustive or should be extended. The current case study shows that a principle concerning certification may have to be added to our control model.

A remark needs to be made here. As only a few companies were actually certified to use the GC, the amount of pre-arrival information that the Russian Customs receives is limited. US Customs also requires carriers to provide pre-arrival information before goods arrive in the US. Pre-arrival information is used for risk assessment. However, the amount of information in the US is so large that good risk management becomes very difficult, while this administrative burden has a negative effect on the competitiveness of the US economy (companies may prefer to trade with China and Hong Kong, for example).
4. Designing e-Customs scenarios for food export: An application of the e³-control methodology

Abstract
In this chapter we investigate how to introduce e-Customs solution for the export of food such as dairy products in cross-border trade instead of the traditional paper-based procedures. The e³-control methodology is applied to analyze the current and proposed future Customs export procedures and we present the possible redesign scenarios for the best adoption of e-Customs in food export. A case study of Food Living Lab (Food LL) for dairy product export from Denmark to Russia is used in this study. The application result shows that the “e³-control” methodology provides a clear and systematic approach for the redesign development, which can be of great value in reaching an efficient redesign involving multiple stakeholders in the government-to-business (G2B) context.

4.1 Introduction

Government actively interacts with businesses and plays various roles in control, trade facilitation and ensuring safety and quality. One of the major government administrations serving such roles is the national Tax Administration and Customs (TCA). The role of TCA in international trade determines to a large extent the efficiency and effectiveness of the business trading operations. Thus, governments would like to reduce the administrative burden for businesses as much as possible to boost the trade efficiency and competitiveness of the national economy, but on the other hand they do not want to lose the level of control and security. The traditional Customs procedures (mostly paper-based) are no longer appropriate in this case. The European Union (EU) is now realizing the potential benefits of applying advanced ICT in the Customs practices and establishing new Customs-to-Business partnerships, thus changing the traditional Customs to collaborative e-Customs.

One of the major barriers to forming G2B (in this case Customs-to-Business) collaboration is to set up a better information sharing scheme for network participants to overcome control problems and to deploy maximum utility (value) within the network. Procedure redesign and its corresponding IT solutions have to be conducted in such a way that inter-organizational control problems are solved and different concerns of value perspectives among stakeholders are considered. For the above purposes, we have developed e³-control methodology during the recent years, for procedure redesign especially in the government-to-business (G2B) context (Baida et al., 2008; Baida et al., 2007; Liu et al., 2007a, b).

In this chapter, instead of single-sided focus on either business or government, we emphasize the redesign of collaborative networks formed by both government administrations and businesses. We discuss how via the e³-control redesign methodology, government (e.g. Tax

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35 We take not only financial value (e.g., business revenue and tax) but also social value (e.g., safety and security) into account.
Administration Customs, Central Bureau of Statistics (CBS), and certification authorities etc.) together with trading companies can have a better understanding and handle export control issues in a more effective way.

The Food Living Lab (Food LL) is used as an example to illustrate the application of the methodology. Using the e\textsuperscript{3}-control redesign methodology, we investigate the problems of exporting organic dairy products that potentially could be carriers of pesticides and diseases from EU countries to non-EU countries, and we deploy the feasibility of IT enabled redesign of export procedure for dairy products from Denmark to Russia with two possible e-Customs scenarios for the company and Danish Customs to adopt.

The remainder of this chapter is organized as follows. We first give a short introduction of our e\textsuperscript{3}-Control methodology in Section 2. Then we show the case of Food LL, where we describe the problem domain (Section 3). In Section 4, we present our research method and redesign procedures applying the e\textsuperscript{3}-control methodology. Finally, Section 5 contains our conclusions.

### 4.2 The e\textsuperscript{3}-Control methodology

Some text is skipped here from the original publication to avoid repetition, for detailed description for the e\textsuperscript{3}-control methodology please refer to Chapter 2, p32-50

Depending on stakeholders’ budget and requirements, not all four steps have to be undertaken in the redesign. As the purpose of this chapter is to propose high level redesign scenarios rather than detailed processes implementation, we focus on step 1 and 4 of value-based analysis.

### 4.3 The Food Living Lab

The Food LL is a collaborative project undertaken by Arla Foods (Denmark), Danish Tax & Customs administration (SKAT), technology provider (SAP) and various research institutes, carried out from July 2007 to December 2008. The main goal for the Food LL is to analyse the Customs procedure for the food export and proposes a more efficient paper-less IT-based procedure, which can at the same time fulfil the food safety and quality and Customs control requirements.

In particular, we study the dairy product export procedure form Denmark to Russia. The following are the main actors involved in this procedure:

**Arla Foods:** Arla Foods is the largest producer of dairy products in Scandinavia and the second largest producer of dairy products in Europe; it produces 7% of the total milk processed in Europe. In this case, Arla exports its product from Denmark to a Russian import Company.

**Local buyers:** Danish local customers who buy the Arla products
**Russian import Company:** Russian company which imports Arla dairy products.

**Certification authorities:** as aforementioned for
- Hygiene certificate--- issued by specialized laboratories, accredited by the Ministry of Health of the Russian Federation;
- Health certificate --- issued by the Danish Food Industry Agency (DFFE);
- Certificate of origin--- issued by the Danish Chamber of Commerce or the Agricultural Council and endorsed by the Ministry of Foreign Affairs and the Embassy of the receiving country;
- Gost certificates --- provided by SGS, the Swiss-based inspection and certification company and checked by Russian Customs

**SKAT (Danish Tax & Customs):** Danish Tax & Customs administration

**Russian Tax & Customs:** Russian Tax & Customs administration

**LSP/Shipping company:** Logistic service provider and shipping companies, who are responsible for transporting and shipping the goods to different locations.

### 4.3.1 Redesign concerns

The Food LL distinguishes itself from the other projects we have undertaken before, in that the exporter (Arla Foods) has to deal with several governmental authorities, including Tax and Customs, Agriculture department and many other certification authorities. Due to the need for traceability and the sensitivity of dairy products to transportation conditions and the need for rapid export processes, it creates particularly demanding conditions for companies that export dairy products.

After discussion with domain experts, we have identified the following concerns that need to be especially taken into account for the Food LL redesign.

**First, the subsidy concern:** according to the CAP (Common Agricultural Policy), food manufacturers can receive a certain percentage of the subsidies from the EU based on their output, thus subsidy distribution and control was one of the important issues for Customs in relation to the food industry. However, as the EU has planned to take away subsidies from October 2008, we decided not to further elaborate on this issue for the current redesign.

**Second, the certificate concern:** due to the strict EU food laws and regulations, certification plays an especially important role in the food industry. The following certificates are generally required by the food import/export procedures in the Food LL, namely, hygiene certificate, health certificate, certificate of origin and Gost certificates (see following explanation).

- Hygiene certificate: the hygiene certificate confirms conformity of products and services to the sanitary norms and strict observance of the established rules in the process of manufacture, storage, transportation and the sale of products and services. The hygiene
certificate is issued by specialized Laboratories, accredited by the Ministry of Health of the Russian Federation, after checking products for poisons, chemical contents and so on.

- **Health certificate**: the health certification is specific for the Food/Dairy industry and issued by the Danish Food Industry Agency (DFFE), a different government body from SKAT.
- **Certificate of origin**: this is a commercial document, referring to the country where the goods are actually made. The certificate is issued by the Chamber of Commerce or the Agricultural Council (in DK). The exporting company fills in the certificate themselves and the Chamber of Commerce stamps the certificate, thereby confirming that the exporting company is a member of their organization and a trustworthy company. In addition to the verification by the Chamber of Commerce, quite often this certificate (as well as other documents) must also be endorsed by the Ministry of Foreign affairs and the Embassy of the receiving country. This involves a lot of manual transport between the various offices.
- **Gost certificates**: Gost certificates apply only in the case of exports to Russia. GOST is very important for Russian companies and exporters to Russia and carries the same meaning as ISO 9000 series certificates for western companies. GOST is the approved quality indicator for Russia. Gost certificates are completely paper-based and specific to export to Russia; they are a mark of conformity and declare that products bound for Russia are tested and certified in accordance with Russian standards of Conformity. Gost certificates are issued by SGS, the Swiss-based inspection and Certification Company.

In this phase, all of the aforementioned certificates are all handled manually in paper-based mailing procedures, which create considerable efficiency loss (time consuming for posting) and possible control flaws (in case of lost mails or parties falsifying certificates).

**Third, the Customs duty and VAT concern**: these two issues are not merely food export specific; however, as they are directly linked with the national tax income, special attention needs to be paid in the Food LL analysis.

The most common Customs duty fraud is the misreporting of the commodity codes. Based on our interview with the experts from SKAT, commodity codes for the goods are the basis for calculating the duty rate. There are approximately 80,000 codes for different goods on which Customs duty needs to be paid. Selecting/submitting the wrong code (intentionally or unintentionally) will cause fraud. For example, the composition of one type of Adidas shoes: where the upper part of the shoe is made of leather the tax rate is only 8%, but where the upper part of the shoe is made of textile the tax rate is 17%. Similarly, as the percentage of sugar/other additives in the food product vary, the exporter has to report the right code accordingly to pay the right tax.

Another issue is VAT fraud, which has been one of the major headaches for the Customs and Tax administration. VAT fraud is the main source of fraud in the internal EU market. For example, a Danish company declares that it is selling goods from Denmark to a German company in Germany (without charging 25% VAT in DK, but expecting that 19% VAT will be paid in Germany); however, if in reality the buyer/receiver is a private person who is not registered for VAT, SKAT ought to charge 25% VAT to the Danish company. Currently, the VAT information is controlled by the VIES (VAT information exchange system) on a periodi-
cal basis (quarterly, biannually even annually depending on the company trade volume). However, the time lag and discrepancies between the VIES data and companies’ accounting information make VAT control very difficult. The situation becomes more severe if goods are reported to be exported outside the EU for VAT exemption but in reality are sold within the EU member states.

4.4 Food LL redesign scenario development: Value- based analysis

4.4.1 Research method

An action research method relying on Living Labs study (Argyris et al., 1985; Hughes & Wood-Harper, 1999) was used to structure the research design, in order to illustrate and better understand the application of the e³-control methodology for inter-organizational control procedure redesign (Kartseva et al., 2005; Liu et al., 2007a, b). In this case, the development of e³-control as a design tool is itself dependent on a cycle of applying, testing, modifying and extending the kernel theories and the tool through experience (Hevner et al., 2004). The e³-control methodology can be applied either in its full four-step usage or in part, according to the stakeholders’ requirements (e.g. only value-based or only process-based analysis). For the purpose of this study, we focus on the value-based analysis, to give a helicopter view of the redesign scenarios.

With the e³-control value model analysis we focus on understanding the logic behind business networks, i.e. identifying actors and their value propositions (how they contribute to the sustainability of a network), and how network sustainability can be put at risk due to fraud or the opportunistic behaviour of some actor. We are not yet interested in operational details, such as how a value proposition translates to business processes. Moreover, due to the complexity of the problem and the strategic implications of procedural decisions, at this early stage it is necessary to abstract from the process details. Using the value perspective as a starting point enables us to focus on the purpose of controls: to safeguard against loss of value.

In the Food LL analysis, to derive e³-control value models we iteratively (1) conduct interviews and workshop and read existing documentation to understand the business network, (2) draw value models using the e³-value modelling tool and (3) discuss these models with domain experts. Models are further validated with Living Lab participants and serve in exploring control problems in procedures; domain experts prioritize the exchanges where violations may occur, so we can focus the analysis on those violations that are considered most crucial.

Three e³-control value models are drawn to show three different Customs solutions under the current and future redesign situations. First we analyze the current paper-based scenario and draw the “AS-IS” value model. The “AS-IS” model serves as starting point for discussion to pinpoint critical control problems and desired improvement points. Based on the current available IT, together with the key stakeholders, the “Transitional” model is proposed. It is based on the ‘easy to reach’ redesign solution using the current existing Electronic Data Interchange (EDI) procedure to replace the traditional paper-based procedure. Lastly, a “Radi-

36 The e³-value tool can be downloaded from http://www.e3value.com/tools/.
cal redesign” model is proposed, which is based on a radical redesign solution that requires setting up a central European IT Kernel. This solution is not achievable by a single company in the short term but can be fulfilled in the long term with the support from the EU. If it can be implemented, significant gains can be achieved in a much larger scope. The list of three scenarios is shown in Table 4.1.

<table>
<thead>
<tr>
<th>Solutions</th>
<th>AS-IS Scenario</th>
<th>Transitional Scenario</th>
<th>Radical Redesign Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current paper-based scenario</td>
<td>Electronic data interchange (EDI) with pre-advice</td>
<td>Centralized solution with EU IT Kernel single window</td>
</tr>
</tbody>
</table>

Table 4.1. List of AS-IS and two proposed redesigned solutions for Food LL

4.4.2 The AS-IS value model

The model below (Figure 4.1) illustrates the AS-IS situation of the Arla dairy product export procedure from Denmark to Russia, which currently uses the paper-based procedure. From the model we can see that, in order to export dairy products from Denmark to Russia, Arla Denmark has to undertake five critical value exchanges:

a) To get money from the Russian import company and offer the dairy products in return.

b) To arrange shipping and logistics, which involves value exchange by paying money to the logistic service provider (LSP)/shipping companies and getting a transportation service in return;

c) To get ready for various certificates for export to Russia (e.g. certificate of origin, health certificate and GOST certificate), which involves interactions with certification authorities (e.g. DFFE, foreign embassy etc.) to which Arla submits a compliance report and gets a signed/stamped certificate in return;

d) To enable the goods to leave Denmark, export declaration has to be made by Arla to the Danish Customs, which gives Arla the trade legitimacy and evidence for (export) VAT exemption

e) To enter Russia, the stamped certificates have to be presented to the Russian Tax & Customs at the border for control purposes. If the certificates do not accompany the goods, the entry of the cargo may be denied by the Russian Customs at the border.

f) In addition, in order to take the goods into Russia, the Russian import company has to fill in the import declaration and pay the relevant Customs duty to the Russia Tax and

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37 Different from selling to local buyers, when Arla has to charge VAT from the buyer and pay it back to Danish Customs afterwards [see value exchange (g) and (h) in Figure 3]; for export ales no VAT has to be charged and paid. But to get this exemption Arla needs to present the evidence of export (e.g. invoice for export goods and export declaration)
In the ideal situation, the legitimate export trade procedure should be carried out as described above. However, in the real world the above-mentioned value exchanges are not always reciprocal. We carried out interviews and workshops with domain experts and identified the three sub-ideal routes (separated by the Or fork with the ideal value exchange) which are most likely to happen in the real world and which may cause control problems. These sub-ideal value exchanges may cause control problems of VAT fraud (d’), Certificate mishandling (e’) and Import duty fraud (f’), which are represented with the dotted line in the Figure. Details are described below.

**d’) VAT fraud.** In the export declaration procedure, the core document for export control is the Export Accompanying Document (EAD) with a Movement Reference Number (MRN), a hard-copy version of which must physically accompany the goods/container that have been

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38 **AND and OR connection elements.** An **AND fork** connects a dependency element to one or more other dependency elements, while the **AND join** connects one or more dependency elements to one other dependency element. An **OR fork** models a continuation of the scenario into one direction, to be chosen from a number of alternatives. The **OR join** merges two or more sub-scenarios into one scenario.
released from the Office of Export to the Office of Exit. Currently, the MRN for a shipment container is printed out by Arla and transported by the LSP to the port. There a handover takes place from LSP to shipping agent. In 90% of all cases the roles of LSP (truck driver) and shipping agent will be performed by the same company, namely Maersk. Then the shipping agent will print out a ship’s manifest, after having received all MRN documents for his ship or when the loading time for his vessel has ended. The shipping agent provides all MRN-documents and the ship’s manifest to SKAT. SKAT has to scan the MRN paper documents via barcode scanner, as well as enter the data from the ship’s manifest into their system. The current paper-based MRN control leads to administrative burden and possible VAT fraud. Though the major part of the export procedure has been computerized via export control system (ECS) and most of the data exchange is done electronically, the paper-based EAD with MRN as export control evidence simply left a loophole in the system. In the case of missing EAD or if the MRN number is not provided in time, export trade flow will be interrupted. Even worse, huge financial loss may occur in the case of intentionally tampering and falsifying the paper document (which is relatively easy), with opportunistic exporters taking the chance to evade tax by falsely declaring VAT exemptions to which they actually may not be entitled, for example by declaring that the goods have been exported when in fact they have been sold in the local market without VAT.

e’) Certificate mishandling. Currently, all the certificate handling is still 100% paper-based. For example, health certificates are being printed on special paper by Arla, then sent via mail or courier service to a veterinarian, who signs and stamps the documents and sends them back to Arla by mail. Furthermore, all these stamped paper certificates have to accompany the goods all the way from Denmark to Russia for checking at the border by Russian Customs. There are several drawbacks to the current procedure: First, this process is very time-consuming (approximately one day’s delay because of the mail/courier service) and cost-inefficient; second, as the process is paper-based, human mistakes inevitably occur during the handling, resulting in missing documents, incorrect input etc; last but not least, the current paper-based procedure is vulnerable to fraud – paper and stamps can be easily falsified.

f’) Import duty fraud. This possible sub-ideal route occurs on the Russian import side. As there is no direct communication between Russian and Danish Customs, Russian Customs makes their decision and levies the corresponding tax, relying mainly on the data received from the importer. The core document for levying the tax is the invoice that the importers get from the Danish exporter. In the ideal situation the type and value of the goods on the invoice presented to the Russian Customs should be identical to the invoice value stated on the sales invoice from the Danish exporter. However, opportunistic Russian importers may falsify the invoice and give the Russian Customs a fake invoice with a lower value and pay less import tax (“double invoicing”).

The aforementioned three sub-ideal value exchanges represent major loopholes in the current export control procedure. Our redesign effort will be made mainly to execute effective control which can effectively prevent such sub-ideal situations from happening, to maximize trade facilitation and assure safety and security coverage and at the same time to minimize the cost and administrative burdens for both businesses and the government.
4.4.3 Redesign solutions

Two redesign solutions have been discussed extensively during the Food LL workshop to simplify the procedure and solve the sub-ideal exchanges. The first redesign solution proposes enhancing data collection and exchanges between stakeholders by replacing the current paper-based procedure with an EDI procedure, which is a moderate solution and relatively easy to implement. The second redesign solution is more radical: this proposes setting up an EU-level central data management system via a SOA-based web service. The implementation of the system can greatly improve the efficiency of the current Customs procedure and realize better risk management in the pan-European level. However, even though it is technically possible to implement the second solution, in reality there are many other barriers at a political and legislation level that make this radical redesign scenario unlikely to be implemented in practice. Still, we would like to discuss and present both solutions for future reference.

The first redesign scenario is created on the basis of current technology that is achievable during the transitional stage. In this scenario the IT component of the redesign can actually be realized. A real-life demonstrator was set up according to this redesign scenario. The Food LL Demonstrator plays an important role as proof of concept. It encompasses a UN/CEFACT-compliant export procedure providing stakeholder perspectives and logins to follow up, observe and maintain any relevant export data and align it to internal and external processes. With a centralized service and role-based IT architecture the demonstrator addresses the need for a common European data model.

The second scenario is a visionary design that suggests a radical transformation of the current export processes and e-Customs solution. The radical redesign is based on the idea that if companies can prove themselves to be in control of their own business processes and product flows, they can receive greater simplified export procedures. In this case, it further eliminates the need to send various strings of information (e.g. eCertificate, eImport and pre-advice information) to different government organizations. It enables centralized clearance and single window access. The redesign extends the concept of Authorized Economic Operator (AEO) by applying similar thinking to domains other than Customs clearance, for example the issuing of veterinary and health certificates.

4.4.3.1 Transitional Scenario

The first redesign solution is to replace current paper-based EAD, MRN and certificate documents with integrated eExport declaration (with eImport pre-advice) and eCertificate processes (Figure 4.2).

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39 AEO is a type of “trusted operator” status: if businesses can prove to the TCA that they are in control of the tax and security aspects of their own business processes, they will be AEO-certified by the TCA, which brings them the benefits of fewer physical inspections, fast Customs clearance procedures and trade facilitation by the TCA.
As we discussed before in the AS-IS situation analysis, we find that the certificates and MRN (together with EAD) handling procedures, which are still paper-based, make major control flaws possible. Together with major stakeholders – the technology provider (SAP), Arla and Danish Customs – we reach a transitional redesign solution, which simply replaces the current paper-based EAD (with MRN) and certificate handling with integrated eExport declaration (with eImport pre-advice) and eCertificate Process. Shifting from paper-based to paperless processes in first place does not involve significant changes in the processes. However, in order to make full use of the optimization resulting from the reduction of paper, a process redesign can yield further significant optimizations in time, complexity and finally money.

In order to realize the redesign, a new actor – GTS and IT service provider – is introduced. This new actor is responsible for providing IT services to the relevant stakeholders, including setting up the technical framework, data (eDoc.) management and possible track and trace services. And of course by helping the corresponding stakeholders utilizing the new system, IT service provider will charge fees accordingly. In this redesign scenario, the paper-based handling of MRN numbers can be replaced by paperless electronic interchange, which will be merged with the “eExport” declaration. This data interchange makes the EAD stamp redundant. SKAT will benefit from an increase in efficiency, since no paper documents need to be scanned in. Therefore custom officers can spend more time on their core competencies and
thus increase the quality and security of the Customs process. In addition, as paper documents will no longer be used, all data will be interchanged via an authentic information system, falsification of the data will be monitored and reported, thus tax fraud will be more difficult. Arla will save time through the paperless processes: sending data and receiving the MRN acknowledgement will take place virtually in real time, so no waiting time will be necessary. Further, as MRN is merged with eExport message, Arla will not need to submit separate MRN messages to Arla anymore; all data related to export and be submitted via eExport. Arla will benefit from direct cost savings and better and faster logistic management. The LSP and shipping agent will also improve their process quality and time and increasing process efficiency.

An information bridge between Danish Customs and Russian Customs will be linked by extra information, the “eImport” information, which is directly derived from the “eExport” information received from the Danish Customs. With this linking between the two Customs offices, the Russian Customs will know about the status of the goods before the goods actually arrive and will have proof of the value of the goods from a trusted foreign authority rather than importers themselves. The import tax fraud with double invoicing can thus be minimized.

The same applies to the certificate handling: the “eCertificate” will replace the current paper and postage-based certificate. No posting and human handling will be necessary and all the certificates will be verified electronically by the certification authorities and sent directly to the Russian Customs. The chance of the certification fraud is thus minimized.

4.4.3.2 Radical redesign scenario

To think one step further, in combination with the concept of Authorized Economic Operator (AEO) and the idea for a company “in control” statement, we propose a radical redesign scenario (Figure 4.3), which consists of setting up the EU-level central data management system via an SOA-based web service.

From the radical redesign value models we can identify the following:

- If the local traders (i.e. Arla Denmark) can prove to local authorities that they are “in control”, they will be given the recognized AEO status by the local authorities [Customs, Central Bureau of Statistics (CBS), Foreign Embassies, veterinarians etc.] and will enjoy a faster trade procedure.

- As a centralized EU body, the EU central Kernel collects the information and provides information service (e.g. user management, role management) to all the corresponding stakeholders. And local authorities need give legal status to the EU Kernel. Traders and LSPs may pay the fee for acquiring the information or use another information service for the Kernel.

- The authorities from member states can pull information from the Kernel; they can still keep their national requirements which relate to their national revenues (e.g. VAT, Excise). The different authorities (health etc) from the different MS would provide authorized access to the Kernel directly.
• The authorities from member states would need to interact with companies for certification and monitoring of the AEO status.

• The EU Kernel can send information to other EU/Non-EU authorities, such as Russia as well.

Figure 4.3. TO-BE Food LL export procedure value model with radical redesign scenario

However, to realize this scenario, some assumptions have to be made:

1) The scenario is developed only for AEO companies who are proven “in-control”.

2) National authorities in the EU have to provide AEO certificates to companies.

3) It relies on mutual recognition of AEO status between the EU member states and other economic zones.

4) It requires periodical system auditing and maintenance.

Further, via this radical redesign, companies can achieve visible benefits with various simplifications in a much larger scope, including:

- “Export is import”: export data from the exporting company will be interchanged or transferred directly from local export Customs to foreign import Customs.
- **Limited data submission with single window:** all data will be submitted only once or, even more radically, the data can be kept in companies’ own database; when Customs offices feel the need to check the data, they can pull the data from the company database.

- **Centralized clearance:** as an EU-level Kernel manages the information service, the Customs clearance can be made only once in any country.

- **Green lane treatment:** with the better information interchanges, such as pre-arrival information, between foreign and local authorities, the Customs risk assessment will be greatly improved, and fraud and insecure trade actives will be minimized. Thus companies who can be proven “in control” and companies having AEO status can go through the check-free green lane Customs procedure.

### 4.5 Conclusion

In this chapter we presented the preliminary redesign scenario for European export procedure that has been developed within the Food LL. We integrated the e³-control methodology into the redesign and proposed innovative redesigns that on one the hand can improve the administrative processes (to reduce the administrative burdens) and on the other hand can maintain and enhance the security.

In addition to the general problems faced by exporting companies, export within the food industry faces two specific problems. First, due to its nature, food is sensitive goods and as an organic product it can be a carrier of diseases and dangerous pesticides, thus food quality and security control has to be carried out. Second, partly related to the sensitivity of the products, food exporters have to deal with many different government authorities and procedures. After defining problems and opportunities within the Food LL, together with the domain expert we discussed two redesign solutions utilizing the e³-control tool. The transitional scenario could be implemented in the short run, but is less effective; the radical scenario is much advanced and can be seen as the next step for European Customs. However, to realize the radical redesign scenario, not only does the IT solution have to be fully implemented, but other improvements such as changes in legislation and Customs praxis have to be realized.

The major conclusions made in this study are related to what can be achieved and not achieved through innovation in IT. To enable the full potential of IT innovation, the innovations must be combined with changes in praxis and legislation and with international agreements. Innovations in IT systems enable proven control over networked business processes is potentially even more effective and reliable than inspections of a single business transaction, especially, if certifications of trusted traders are recognized both within the EU member states and by the other governments of the trading partners. Much of the potential benefits build on mutual recognition and trustworthiness cannot be achieved unless the EU assumes a common strategy and develops common ways to identify, describe and control which traders can be regarded as trusted traders.
5. IT enabled redesign of export procedure for high value pharmaceutical product under temperature control: The case of Drug Living Lab

Abstract

In this chapter, we analyze and redesign the export procedure for shipping a high-value pharmaceutical product in a strict temperature-controlled logistics environment (cold chain) from Ireland to the US using the e²-control methodology. The e²-control methodology has been used in this case to support the introduction of a novel cold-chain innovation in a pilot project running in a live 3rd Party Logistics (3PL) environment. The resulting pilot project has attempted to prove the feasibility of providing real-time shipment temperature and location data in international multi-modal supply chains. The pilot is designed to satisfy more stringent control requirements for temperature-sensitive bulk pharmaceutical shipments and thereby enhance drug safety and security. In the meantime, supply chain interactions with various governmental bodies for regulatory clearance and Customs simplification (e.g. FDA and USDA procedures) are considered. The e²-control model-based redesign methodology is demonstrated in this case to be a useful approach to analyzing and redesigning international logistics procedures in reaction to a technological innovation, which facilitates trade security and transparency for both government and businesses.

5.1 Introduction

Collaborative and networked inter-organizational forms have provided competitive advantages that a single organization can hardly achieve alone. In particular, with facilitation of modern information technology, this point has been further realized in the highly innovative pharmaceutical industry. Many well established information systems and logistic systems are built so as to link supply chain partners together to achieve common goals and enlarged network synergy. Not only can industry benefit from such inter-organizational networks, the public sector can benefit from forming collaborative networks with businesses as well. Potential benefits are clearly identifiable, especially in the government regulatory and tax & Customs domain. For example, one of the major challenges for the pharmaceutical company is to ensure its drug quality and safety, so as on the one hand to safeguard its own reputation and on the other hand to comply governmental food and drug security requirements. If the original business system/network can be redesigned in such a way that it can be shared by both businesses and government, we will achieve much better and more efficient government –

business (G2B) collaborations. Somehow, G2B collaborations are often difficult, as government procedures are mostly still paper-based and not necessarily harmonized, and government has different concerns with businesses (e.g. different value perspectives, legislation/political concerns).

One of the crucial barriers but also incentives for forming G2B networks is to set up a better information sharing scheme for network participants to overcome market failure and to deploy maximum utility (value). Procedure redesign and its corresponding IT solutions should be conducted in such a way that inter-organizational control problems are solved and different concerns of value perspectives among stakeholders are considered. For the above purposes, we have developed e³-control methodology during the recent years, especially in the field of Business - Customs procedure redesign (Baida et al., 2008; Baida et al., 2007b; Liu et al., 2007b).

In this chapter, using the e³-control redesign methodology, we deploy the feasibility of IT enabled redesign of export procedure for high value pharmaceutical product under temperature control. In the following sections we present the problem domain (Section 5.2), our research methodology (Section 5.3), the case of Drug Living Lab (Section 5.4), our redesign procedure (Section 5.5) and conclusions (Section 5.6).

5.2 Cold chain challenge

Cold chain and chain of custody had become an area of growing concern for the life sciences sector. A cold chain is defined, for the purpose of this chapter, as a logistics environment (covering storage, handling and transport) maintained within specified temperature ranges, for example between +2 to +8°C. Industry would like to follow shipments much more closely than is currently possible. Industry expectations and questions focus on information needs across the areas of temperature data, shipment disposition, package integrity, and documentation. Several issues have been raised during interviews with experts:

1) Temperature – was the product outside the approved and agreed ambient, transit temperature range?
2) Duration – did the product arrive at its final destination within the approved time schedule?
3) Physical integrity – has the product and packing been dropped or tampered with, where is it stored, in what environment (e.g. outside, inside, in direct sunlight, ambient temp, etc), who has access to the product or container?
4) Documentation – are the accompanying documents and labels complete, accurate and up to date, can they be improved or reduced?

The key issue identified here is that many of these questions can be answered only after a shipment is completed, however, for a time-critical (<96 hours) cold chain procedure it is very important to know this information in real-time or near real-time, to take corrective actions and minimise risks of loss.
5.3 Research method

An action research method (Argyris et al., 1985; Hughes & Wood-Harper, 1999) relying on Living Labs’ study was used to structure the research design, in order to illustrate and better understand the application of the e³-control methodology for inter-organizational control procedure redesign (Kartseva et al., 2005; Liu et al., 2007a; Liu et al., 2007b). In this case, the development of e³-control as a design tool is itself dependent on a cycle of applying, testing, modifying and extending the kernel theories and the tool through experience (Hevner et al., 2004). We attempted to illustrate such a cycle with the application of e³-control to enhance our understanding of the problem domain and subsequently attempt to transform the situation by supporting the introduction of technology innovation. The demonstration of such an innovative control procedure redesign has been used to validate and further develop the tool and deepen our understanding of its usage.

5.3.1 The Living Lab concept

Living Lab is a new paradigm for a user-centric multidisciplinary research and development. The concept was originated by Jarmo Souminen (from Finland and MIT) amongst others and it is now being used to cover a range of situated research methodologies involving new technologies and people (end users). “Living labs are a situated research methodology for sensing and prototyping at various different scales in real life contexts” (Souminen, 2005). The Living Labs provide a “real-time, real-life research setting where we develop and pilot our practical solutions and theoretical frameworks, including technical demonstrators and recommendations for the adoption of e-Customs, especially in the EU’s Customs Administrations and SMEs”. Under the Living Lab concept, we examine Customs procedures and report on multiple (governmental, business and research) perspectives. The Living Lab develops a prototype in a real-life context, focusing on innovative ICT adoption in trade/Customs procedures and value-added services in enabling the collaborations between different stakeholders from both the private and the public sectors. Three main stakeholders (the government, the trading company and the IT solution provider) are involved in each Living Lab. They interact and collaborate with each other in order to develop a feasible e-Customs concept and prototype that can be adapted by both private and public sectors.

The Living Lab used in this chapter is the Irish manufacturing arm of a multinational biopharmaceutical company (detailed in Section 5.4). Data collection and analysis took place using multiple methods including participation in workshops (brainstorming and work meetings), in-depth interviews, participant observation and document analysis. Semi-structured interviews were used as the primary method for the data collection as described by (Eisenhardt, 1989b; Yin, 2003). Detailed meeting notes were taken and data and models were validated by subject matter experts. Apart from these structured and documented meetings and interviews, we also interacted with the project participants extensively via e-mail and telephone to collect data and exchange ideas. Additional data was extracted from document analyses. The major sources of documentary data were (1) commercial and Customs documents related to the

41 From, http://www.itaide.org/
export procedure, (2) related process models, (3) internal documents of the test bed company describing their working practices, (4) documents on trade procedures, trade facilitation and government compliance checking related documentations (e.g. USDA, FDA) and (5) other related documentation for procedure quality control (Higgins et al., 2009). These documents and archival material substantially increased our understanding of the history, context and concerns of various supply chain participants. Data presented in this report were collected from March 2009 to September 2009. The technology pilot continues to run until spring 2010. Multiple researchers collected and assessed this data as a team in order to interpret the findings. In this way we were able to address biases that may arise when individual researchers interpret data.

5.3.2 The e³-Control methodology

Some text is skipped here from the original publication to avoid repetition, for detailed description for the e³-control methodology please refer to Chapter 2, p32-50>

5.4 The Drug Living Lab

The Drug Living Lab is set at GTA, an advanced biopharma production facility of the pharmaceutical giant Groight and Co. based in Garrydaniel, Kilkenny, Ireland (Higgins et al., 2009; Kavanagh & Kelly, 2002). The Garrydaniel Factory 1 plant manufactures of a number of specialized biopharma products including Anvoir, a flu vaccine. Anvoir in liquid form must be stored at 5±2°C. If Anvoir freezes, it precipitates and loses potency and higher temperatures will significantly shorten the product shelf life.

GTA Garrydaniel Factory 1 ships Anvoir in bulk to its sister plant in Denver USA, for filling and packing for the market. The Denver plant, known as Fortunestown Factory 2, receives up to two shipments a week from Garrydaniel Factory 1 to supply Anvoir for the American market. The production/shipping schedule is planned months in advance with up to 300 litres of Anvoir a week being supplied. The product from Garrydaniel Factory 1 is shipped by refrigerated container to Dublin airport where it joins a PAE (Penguin Air Express) cargo flight to London Stansted. From Stansted the container is transferred to PAE’s heavy freight partner, KHA (Kanga Heavy Air Cargo), on one of its bi-weekly flights from London to Atlanta, GA. The shipment then joins a connecting flight to Dallas, TX whereupon it is driven (under Customs bond) by refrigerated trailer to Denver, CO. The shipment is then Customs cleared in Denver and driven to GTA Fortunestown Factory 2, where it is ‘received’ back into GTA's systems and physical possession.

Observations of actual end-to-end shipments from IE to US were undertaken in an “AS-IS” study to highlight the key events in the physical movement and data flows of a cold chain

42 Pseudonyms have been used throughout to preserve the anonymity of individuals, organisations and corporations involved in this study.
biopharma shipment. Key actors are identified and will be used for later model based analysis are listed in Table 5.1 below.

<table>
<thead>
<tr>
<th>Name of the actor</th>
<th>Main activities/ roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTACo</td>
<td>Produce and export high value medicine from IE to US</td>
</tr>
<tr>
<td></td>
<td>GTA Fortunestown (US) Pack/refill medicine in US</td>
</tr>
<tr>
<td>Penguin Air Express (PAE)</td>
<td>Transportation of cargo from IE to US</td>
</tr>
<tr>
<td>Temp.ControlCo (PAE’s subcontractor)</td>
<td>Cargo temperature monitoring &amp; control</td>
</tr>
<tr>
<td>Insurance company</td>
<td>Provide insurance service to GTA cargo</td>
</tr>
<tr>
<td>Refrigerated container provider</td>
<td>Provide temperature controlled container for GTA cargo</td>
</tr>
<tr>
<td>Customs IE</td>
<td>Implement Customs &amp; Tax Law (IE)</td>
</tr>
<tr>
<td>Customs Broker US</td>
<td>Provide broking service to GTA (US)</td>
</tr>
<tr>
<td>Customs US</td>
<td>Implement Customs &amp; Tax Law (US)</td>
</tr>
<tr>
<td>USDA (United States department of agriculture)</td>
<td>Implement USDA legislation</td>
</tr>
<tr>
<td>FDA (US Food and Drug Administration )</td>
<td>Implement Food &amp; Drugs regulation</td>
</tr>
</tbody>
</table>

Table 5.1. Key actors and activities summary

Together with the GTA Garrydaniel (IE) group we studied the processes for intra-firm cold-chain shipments and identified the following two main opportunities for the shipping procedure:

- Improve Nominal Shipment Data and Action Points

The key issue here is that there is no real-time temperature monitoring facilitation for the current procedure. This issue introduces a technical problem, that dry ice which is used to cool down a container may need topping up during the journey. This action would arise after containers arriving at US Dallas airport are manually inspected by Temp.ControlCo. However, before action can be taken the shipment must first pass Customs clearance and FDA/USDA checking, which may take from 2-3 hours or up to 12 hours if verification problems arise.

Temp.ControlCo is responsible for the temperature monitoring and control provides an electronic update 2-3 hours after the cargo arrives at US airport. After physically checking the temperature (manual checking based on the sensors attached on the container), the temperature data is reported (by e-mail and phone) to GTA Garrydaniel (IE) and quantity calculation for dry ice top-up is provided. It sometimes takes over 4 hours for Temp.ControlCo to prepare and provide instructions for refilling dry ice. Even under the normal (smooth) situation there may be 6-7 hours action time lag during the logistic procedure, which may be significant for a time-critical 96-hour cold chain procedure. Unexpected clearance or delivery delays will further compound the nominal lags built into the current system, for example:
a) If cargo is stopped by either Customs or FDA/USDA for further investigation, Temp.ControlCo will have less time to access the container and replenish dry ice. GTA’s logistics manager at Garrydaniel (IE) referred to past incidents of “7 a.m. panic calls… where we need to deal with emerging situations on the ground.”

b) A truck driver may not have enough time to top up coolant at Dallas airport due to the tight logistic schedule. Shipments may be moved on without additional coolant. In this situation a shipment may experience temperature ‘excursions’ with implications for drug potency or shelf life. (If assumed at full disposal, the possible loss per shipment may exceed six figure sums).

c) Service charges by Temp.ControlCo for the basic temperature monitoring service are significant. It is hoped that technology innovation can improve the quality and timeliness of temperature data updates while at the same time delivering lower operating costs.

- Reduce Regulatory Clearance Delays

The key issue here is that while Customs clearance and FDA/USDA clearance is arranged by a licensed broker on the US side (Customs Broker US), there is limited direct communication between Customs Broker US and GTA Garrydaniel (IE). This can introduce delayed clearance: FDA clearance takes place after the goods arrive at the US airport whereas GTA IE arranges USDA clearance beforehand; however, multiple agencies are involved and confusion leading to compounded delays may occur. If US Customs or FDA is unable to clear the consignment, GTA Fortunestown (US) (and its supply chain partners such as Temp.ControlCo) has limited ability to manage the temperature status of the shipment. In this case, the whole logistic handling may be delayed, requiring a shipment to be moved into bonded (refrigerated storage) or requiring further coolant top-ups.

There are several challenges for cold chain system redesign:

- First, cold chain systems rely heavily on protective insulated containers for the shipment of temperature-sensitive supplies and products. Hence, protective package design and control is a significant determinant of cold chain performance.
- Second, supporting systems have to be able to handle unexpected situations like weather extremes, accidents, breakdown or hold-ups (e.g. aforementioned Customs and FDA delays).
- And third, while real-time temperature and location monitoring is desired and may perhaps be the key to addressing the above-mentioned problems, the involved actors do not yet understand what the practical implications are: new data capture possibilities, analytics interfaces for display and information systems integration, skills and knowledge, and impact on the air-freight logistic chain.

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43 Packaging design and validation is addressed by ISTA (International Safe Transit Association) packaging guidelines (ISTA, 2007).
5.5 Procedure redesign using the e³-control methodology

Our study investigates how to introduce a new supply chain solution for the temperature-sensitive, high-value pharmaceutical product (in this case, Anvoir) in cross-border trade from Ireland to the US (by air freight).

As a pilot of e-Customs redesign, our case study investigates:

1) Which control problems exist in the current scenario and how they can be addressed.
2) How to replace the paper-based/manual based solution with an electronic one for more effective control.
3) What are the effects of the ICT solution on future government (Customs) and business relationships?

As argued in Section 5.3, a satisfactory redesign requires four steps of analysis in both value and process perspectives. A preliminary description of this approach was given in Liu et al. (2007a). In following sections, we present step-by-step application of this approach in the Food Living Lab redesign.

5.5.1 Step 1. Value perspective: Preliminary analysis

As a starting point we take the current value-based business model that describes a common understanding among stakeholders regarding who is offering and exchanging what with whom and expects what in return. We interviewed domain experts to explore which value transfers in the business model may be violated, and what the severity of violations is. By doing so we identified critical value transfers: value transfers for which control problems should be tackled.

In Figure 5.1, actors (visualized as rectangles) exchange (visualized as solid lines) value objects with economic value (text labels) such that every actor gives something, and receives something in return. Follows the principle of reciprocity (Gordijn, 2002), which requires that if an actor offers something of value to someone else, this actor always gets in return something what s/he wants. Hence, it assumes an ideal situation that all actors behave correctly. However, in real-world situations system designs may not be ideal or are flawed, or organisations and people may act opportunistically. We identify such violations of the ideal business model in the AS-IS business model (indicated with red explosion mark, see Figure 5.1), which helps stakeholders identify problem areas for process redesign. The following violations are the core risks and issues that were identified in collaborative analysis and redesign sessions with the business experts (as introduced in Section 5.4):

1) Temperature of the cargo is not under good control and;
2) Possible FDA clearance delay and;
3) USDA clearance delays (for details refer to Section 5.4).

The AS-IS value model can be treated as a graphical representation of the primary analysis in Section 5.4. It provides analysis high level abstracts from the operational view, and makes it easier for stakeholders to brainstorm the redesign problems and identify critical issues. In order to see how controls are applied and problems are identified in an in depth level, we need
to move to the next step – a process level redesign.
Figure 5.1. The AS-IS value model of the Drug Living Lab
5.5.2 Step 2: Processes level control problem identification

In this step of analysis we first undertook detailed documentation analysis at the process level, from which we were able to see what documents are transferred where and to whom and what were the substantive critical issues on the data transfer and understanding. In the figure below (Figure 5.2) we provide a concise picture of the critical documents and responsible actors.

Together with business experts at GTA we identified the following three issues in the current process related to data/document interchange.

1) Data/documents transferred are still mostly paper-based and not electronic (e.g. Airway bill, FDA and USDA memo), which may cause lack of data inaccuracy, loss of data completeness and lack of interchange efficiency.

2) Duplication of the data/document transferred. While this creates redundancy, it may be inefficient and can give rise to version problems.

3) Origin (What, who, and where) of the data is not always clearly identified which may cause confusion during data tracking (exceptional events or situations, e.g. weather extremes, FDA & USDA checks).

5.5.3 Step 3: Process level control procedure redesign

To carry out process level redesign of control procedures based on the problems identified in the previous steps, we propose the following redesign solutions, requirements and potential benefits (if the solutions are adapted).

- Redesign proposal 1: Realization of real-time temperature visibility before landing, so that GTA can prepare for logistic and dry ice refilling in real time.
Requirements:
- Real-time communication on the flight via pilot or crews on board (only possible if hiring a private jet);
- Or with the RFID (Radio frequency identification) on containers, so that when cargo passes RFID reader portals, information will be sent immediately to GTA. After information is received into GTA’s ERP system a real-time calculation may be made for the timing and quantity of dry ice refilling. In this case a message can be sent out automatically to the logistic partner to carry out the required actions. This recommendation depends on an extensive network of RFID portals throughout the supply chain.

Potential gains: possible decrease of 4 hours delay in GTA logistics process

• Redesign proposal 2: Possible Customs and clearance simplification.

Requirements:
- Set up Unique Identification ID at the item level at GTA, which can be linked with GTA’s ERP system for certificate and clearance checking.
- If agreed, this Unique Identification ID shall be accepted by FDA/USDA and US Customs for simplified procedure and real-time approval of GTA cargo.

To fulfill the above mentioned redesign scenarios, additional device and IT services are required, which can be facilitated with a combination of improved air cargo box and IT services, including:
  - An information sharing model for Shipment Information Sharing (SISS) based on Service-Oriented Architecture;
  - Real-time monitoring through the deployment of GSM/GPRS modem-enabled temperature and GPS sensor devices;
  - Optimized process flow models and messaging processes; and
  - Use of standardized forms for message exchange informed by the single administrative document to facilitate eventual Customs/Taxation interoperability and/or reporting.

Potential gains: possible decrease of 2 hours in GTA logistics process.

Technological and organizational enabling of control and transparency may deliver direct and secondary side benefits and so the research team will consider business cases and models, which could support future investment in these systems. The status of relevant regulatory environments will be assessed for their compatibility with the EC’s stated desire to reduce cross-border trade complexity; for example will regulatory environment and practice actually allow (paper) document-free border crossings for trusted trader networks?

Findings and outcomes will, as far as possible – subject to disclosure permission – be reported to relevant open standards setting activities of UN/CEFACT groups, GS1 and the EC via the dissemination services of the EU’s IST programme and the ITAIDE project and its partners.

5.5.4 Step 4: Value based redesign evaluation

In step 4, we explored the business value models behind the proposed procedures. We drew the TO-BE value models in Figure 5.3. By comparing the redesigned model in Figure 5.3 with
the AS-IS value model in step 1 (Figure 5.3), the business value for performing the redesign becomes visible.

First, we can see changes in network actors and in linkages between actors: in the redesigned scenario we replaced the relatively high cost services of “Temp. control Co” and the traditional “refrigerated container provider” with an improved “air cargo box” as the new physical device for transporting temperature controlled high value drug, and introduced a new corresponding service/IT service provider. Implementation of the redesign will realize the following points of improvement:

1) Better and in real time temperature monitoring and control (improved drug quality and reduced drug failure shipment, saving around €2 million per year);

2) Less cost involved in renting and monitoring the new “air cargo box” (saving around €25,000 per year);

3) Due to enhanced cargo control in the TO-BE situation, the insurance premium is expected to be 40% lower than the current rate (saving around €200,000 per year);

4) Clearance facilitation functionality provided by the new IT service provider will interlink GTA with multiple government agencies as well as with Customs brokers and transporters, thereby enabling a fast verification/identification procedure; simplification and fast procedures shall be facilitated in the TO-BE scenario (saving around 6 hours in logistic process for each shipment).

Second, the model in Figure 5.3 also enables us to perform a profitability (cash flow) analysis\(^\text{44}\) and identify tangible and intangible values that redesign may bring to us. Earlier research (Liu et al., 2008) indicates that that the financial perspective has to be complemented by a social perspective, an operational perspective and a strategic perspective. Our future work will extend our understanding on these value categories, thus facilitating a broader value assessment than simple cash flow analysis provides.

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\(^{44}\) Due to confidentiality requirements exact cost figures cannot be shown in this section; however, indicative figures are provided for illustrative purposes.
Figure 5.3. The TO-BE redesigned value model of DLL
5.6 Drug Living Lab pilot solution

GTA’s logistics controls are in place and routinely monitored to ensure that bulk product shipments are performed in a regular timely fashion and that product temperature is maintained and recorded for pharmaceutical viability. However, over the two to three days duration of such movements, a shipment effectively goes ‘off the radar’. While service level agreements with partner firms provide a measure of comfort, accurate real-time or near real-time information obtained directly from a shipment is preferable. We concluded that opportunities exist for a product’s temperature data history to be enhanced by providing real-time temperature information electronically.

The situation faced by GTA’s bulk pharmaceutical product shipments is of interest at several levels because it involves:

- International heavy air cargo and multi-modal movements by road, ship and air;
- Desirability of real-time and/or periodic live updates of event records to ascertain product viability (e.g. core and ambient temperature, location, tamper and custody);
- Support for heavy/non-standard packing and irregular shipment configurations in the air cargo environment;
- Harsh environmental constraints (-20 C, air carriage, road & sea haulage)
- Potential for digital integration with other systems (e.g. Customs messages) and enhanced reporting demonstrating ‘in-control’;
- Feasibility/desirability of open standards-based data and message formats (non-proprietary) to facilitate commercial and regulatory interoperability;

The objective of the TO-BE Proposal is to develop a service demonstrating real-time or near real-time electronic temperature information which could also be used by GTA’s Logistics function to more closely monitor bulk cold chain shipments. To achieve this objective the following stepped approach is employed by the Cold Chain Pilot (see Figure 5.4): create a test device modelled on GSM modem linked to local sensors (temperature sensors and GPS location) and configure a pilot version of a prototype web service which merges multiple data feeds into a single analytics environment for real-time location & temperature monitoring. By employing off-the-shelf components in an innovative fashion the pilot aims to demonstrate the potential and feasibility of innovative system of usage modes and assess potential business cases.

The pilot project also included a clear objective to assess the economic case of technological innovation in the cold chain area. The business case included substitution costs, adaptation costs and innovative business models needed to operate and maintain remote sensor technology in best and worst case scenarios (i.e. high-volume, low-value shipping (express carrier market) and high-value, low-volume shipping (specialized and heavy cargo shipping). Initial
results are available which indicate potential operating savings using certain technology/service mixes if the technology they depend on achieves regulatory approval and industry acceptance over the next 12 months.

The To-Be case was to develop and prove the high-level integration of the future real-time cold chain monitoring data services with existing on-site enterprise systems at GTA in order to demonstrate a broader array of analytics and reporting capabilities. The analysis and the pilot were based on the trade lane between Ireland and the United States. Documents generated by GTA Ireland for shipments to the US post processing plant are being analyzed and adapted for possible inclusion in a web-based shipment tracking service. This service may possibly show message exchanges relating to temperature monitored shipments, with the designated logistics service provider, to US Customs and FDA. These messages may form part of an asset’s trip records to GTA’s US factory and may be accessed with other documentation to facilitate shipment clearance. The pilot service will also explore and demonstrate the use of business rules which will define which party will receive which documents based on the phase of the trip and upon certain events occurring.

![Figure 5.4. The TO-BE Pilot Solution](Source: Arviem AG, trade monitoring services, at www.arviem.com)

5.7 Conclusions

In the past, government regulatory and Customs controls were often enforced by the government agencies only, whereas nowadays businesses are seen as partners. A win-win situation can be achieved if businesses are responsible for their own supply chains and government
agencies can piggyback and rely on these controls. In this situation, Customs administrations can be relieved from redundant control tasks, businesses will be rewarded with simplified procedures and Customs administrations can focus their limited resources on other high-risk transactions.

In this chapter, using the case of the Drug Living Lab, we analyzed existing procedures of a company exporting high-value, temperature-sensitive drugs from Ireland to the US. We considered situations where cargo temperature monitoring data was delayed and logistics delays were caused by clearance holds. With the use of e\textsuperscript{3}-control redesign methodology, we proposed a new export procedure applying advanced container security and sensor technology and corresponding IT services, in which businesses can have (near) real-time temperature and location information of high-value cargo, while at the same time government agencies (FDA/USDA and Customs) can be linked to retrieve reliable certificate and clearance information. We anticipate the redesigned procedure will enable businesses to improve control of their supply chains, thereby becoming eligible for higher status as trusted traders and access to simplified clearance procedures.

So far, e\textsuperscript{3}-control methodology has been successfully applied as design artefact for control procedure redesign in the Beer, Food, Paper and Pharmaceutical industries (Baida et al., 2008; Baida et al., 2007b; Liu et al., 2007b). In interviews with domain experts we determined that e\textsuperscript{3}-control, as a methodology to support procedure redesign, is especially useful to address complex real-life inter-organizational problems. First, we make a distinction between the value-level and process-level analysis. The value-level analysis served as an eye-opener and helped experts focus on the question why control is needed, as opposed to the traditional operational viewpoint. Experts found the process-level analysis useful, in which they can suggest new application areas at this level with their specific domain knowledge. And the methodology as a whole has been found suitable for developing and assessing scenarios, because it facilitates the identification of different possibilities for doing business. It uses easy to understand visual models, and it offers two complementary abstraction levels, both of which are required for scenario exploration. Second, as visualization-based software tools support the methodology, models can be drawn with very little time investment, serving for discussions and then be changed. The methodology is a supporting tool for domain experts in achieving innovation, but innovative ideas remain the contribution of human experts.

Last but not least, the concept of value in our methodology needs to be extended to accommodate the missing value types that are relevant in a government-to-business setting. Therefore we are currently engaged in a preliminary study about the notion of value in the public sector and about models for value assessment for public sector organizations (Liu et al., 2008; Raus et al., 2010).
6. Trusted trade network forming: IT-based requirements for European businesses

Abstract

International trade is facing the paradox of increasing security and control to combat global challenges like terrorism and global epidemic spreading, while at the same time lowering the administrative burden for traders and governments in order to stay competitive. To solve this seemingly impossible dilemma European governments are moving away from the traditional transaction-based physical Customs controls to a trust-based systematic approach where governments can rely on the trusted (certified) traders themselves to take proper control of their own trading activities based on their information systems. By analyzing the recent government initiatives and based on our interviews with Dutch Tax and Customs administration (Dutch TCA), we extract the general concepts for European businesses to build up the future trusted trade networks. In particular, we specify the critical IT requirements for their future information systems and the opportunities open to them.

6.1 Introduction

“How to make the international trade more efficient and secure” has been a topic under the spotlight in recent years. Facing the threats from terrorism and global epidemics, there is an increasing need to enhance control and security in the trade lane. At the same time, in order to gain competitive advantage, trade also needs to be more efficient, meaning less administrative burden and more trade facilitations. “Increasing the control” and “decreasing the administrative burden” seems an impossible dilemma to solve, however the new developments for the EU governments towards building the collaborative relationship with trusted businesses have shed light on this issue. With this new initiative of building trusted networks with businesses, European governments will move away from the traditional Customs controls (control based on each physical transaction) to a systematic control approach based on trust, where governments can rely on the trusted (certified) traders themselves and the enterprise information system (EIS) deployed by the traders to ensure proper controls and to take responsibility for their own trading activities.

Possible “win-win” situations for both the government and businesses can be achieved by approaching this concept. For the government, piggybacking the existing EIS used by the businesses themselves enables near real-time monitoring and better control of business activities without creating extra business burden. For businesses, forming such trusted relationship with the government will minimize their administrative burden and save time for their import/export Customs procedures (with less physical check and fast procedure facilitation), and

Note: This chapter is adapted from Jianwei Liu, Stefan Heiningson & Yao-Hua Tan (2009), Trusted trade network forming: IT-based requirements for European businesses, in the Proceedings of the eChallenge 2009, Istanbul, Turkey, October 21-23, 2009.
in the meanwhile create better perception and control of their own supply chains. However, the “win-win” assumption can be built only if the meaning of the concept is not being confused and the proper selection criteria of trusted traders; in particular, the requirements of their information systems should be clearly understood by the businesses.

In this chapter, we discuss the key concepts around the trusted trade network: the “Trusted trader” and the “In control” statement, which build on ideas of system-based approach. Further, we discuss what are the desired IT and control requirements from the government towards the EU businesses to realize the above concepts. The results are generated from a case study involving Dutch Customs and Tax Administration. Lastly, we discuss how these concepts will affect the daily life of business organizations engaged in international supply chains and what the potential benefits and challenges are for businesses. This chapter provides an empirical investigation of the factors determining the organizations’ ability to create and maintain control over their enterprise information systems.

6.2 Objectives

We present in this chapter the recent European development for forming the “trusted trade network” with businesses. The core concepts of this new development, namely the “trusted trader” and “in control” statement are discussed in this chapter. By fulfilling these innovative concepts, facilitated with advanced IT, a “trusted trade network” can be built. The goal of this chapter is especially to discuss what the IT requirements are and how businesses will cope with the future EIS demand for more efficient and secure international supply chains under the concept of the “trusted trade network”.

6.3 Methodology

The case study method is used as our main research method for this chapter. Semi-structured interviews are used as the primary approach for the data collection. We conducted several interviews and workshops with Dutch Tax and Customs Administration (Dutch TCA) and corresponding companies. The duration of the interviews varied from 2 to 4 hours. Interviews were tape recorded with the informants’ prior agreement, then transcribed and summarized for participants’ feedback and our later analysis. The study was carried out using the method of (Yin, 2003).

6.4 Case description

The case study is part of the EU-funded research project ITAIDE on developing electronic Customs to facilitate and accelerate international trade (see www.itaide.org). The case study is about a petrochemical company (further referred to as PETRO) in the Netherlands that participated in an application procedure for the AEO certificate, which qualifies the company as a trusted trader for the Dutch Government. An AEO certificate offers a business the benefit of trade facilitation; i.e. fewer physical inspections by Customs of goods exported by the company. Part of the AEO application procedure is that a company has to do a self-assessment to what extent it is in control of its own business operations. PETRO applied to the Dutch Tax
and Customs Administration (Dutch TCA) for the AEO certificate in early 2008. The company experienced some difficulties during the application because it was not clear to them how DTCA evaluates the self-assessment, especially what “In control” means and how to measure it. The DTCA was hesitant to disclose all details of their evaluation of the self-assessment, because they felt that this might influence the objectivity of the assessment for the specific company. Yet it is essential to develop common norms and criteria between government and business on how to assess whether or not a company qualifies as a trusted trader. The main problems that were identified in the case study can be summarized as follows:

1) Clarify the concept of in-control for trusted trade networks
2) Define common norms for the in controlled trusted trade networks
3) Define critical IT requirements for the government towards the businesses for the future “trusted trade networks”

With our redesign experience within the ITAIDE project for the former three Living Labs (i.e., Beer Living Lab, Paper Living Lab, and Food Living Lab) [see (Baida et al., 2008; Liu et al., 2007a; Liu et al., 2007b)], we clarified these norms and summarized some basic requirements for the trusted trade network building, and in this case we verified these results with the Dutch TCA. Below we explain how these issues can be addressed for businesses.

6.5 Main concepts and findings

To overcome the barriers of understanding the concept of the “trusted trade network”, a clear definition needs to be given. There are two core ideas behind the “trusted trade network”, which are the “trusted trader” and the “in control” statement.

6.5.1 Trusted traders and Authorized Economic Operator (AEO)

A primary vehicle for the future more efficient and secure supply chains is built on the concept of the “trusted trader network” which is a network of “trusted traders”. Governments provide trade incentives (fewer physical inspections, reduced paperwork, expedited border clearance, etc) for traders who demonstrate that they are “in control” of their trade activities and supply chains. Instead of governments controlling the businesses, in this new model, companies accept responsibility to ensure and to prove to the government that they are in control of their own operations. In return, if the level of company control is satisfactory and certified, the government can provide such companies with a “trusted trader” status (e.g. Authorized Economic Operator (AEO) in the EU (European Commission, 2005b), or its counterpart C-TPAT in the US (U.S. Customs and Border Protection, 2004)), which allows for trade simplifications and fast treatments for border crossings.

An AEO certified company can be seen as a “trusted trader” in the “trusted trade network”. This means that governments will perform fewer physical inspections on that company, which results in faster logistics and reduced administrative burden. The idea of AEO is that each EU Member State Customs Administration can establish partnerships with private companies and certify them with AEO certifications and that these AEO certificates shall be accepted by all EU member states. The involvement of the companies in AEO will lead to a win-win situation
for the safety and security of international trade. On the one hand government can do fewer physical checks and use Customs personnel for more targeted inspection of non-trusted traders. On the other hand the certified AEO companies will enjoy benefits such as fast Customs clearance and simplified Customs procedures (e.g. containers of AEO companies will not be inspected by Customs when they pass the EU border) (2005a). The manufacture and shipment of a product is, however, rarely the responsibility of one single company, and therefore the “trusted trader” concept is necessarily being extended to encompass all of the partners and processes that make up the supply chain. The unity of trusted supply chain partners form what we called “trusted trade network”.

6.5.2 Being “in control”

Being “in control” is a new governance model that is currently being developed by EU member states in close collaboration with the European Commission. It can have a significant impact on cutting red tape and providing trade simplification for companies, while at the same time ensuring a high level of control and security.

What does being “in control” exactly mean? A company is considered to be in control when it has procedures in place to control its own business processes in accordance with government regulations on fiscal, security and safety matters. It can be viewed from several perspectives, ranging from managerial and economic to legal and social. “It is just as much about being certain that reported figures are accurate as it is about the desire to control external risks. It is a matter of tough measures and controls, but also of softer issues such as integrity, corporate culture and morals” (KPMG, 2008).

The “in-control” concept relies on a fundamental shift in the relationship between government and businesses. For Tax and Customs administrations in our study specifically, the concept of being “in control” is that Customs would rely on companies’ self-internal control and work on the basis of mutual trust between the companies and the Customs organization. The companies will be self-conscious about their own problems and risks, and instead of being audited in a traditional way they will enter an agreement with Customs that companies themselves will inform Customs about the problems and risks they may encounter. In line with this principle, the European Commission has developed the “System-Based Approach” (SBA), which is a holistic approach to supply management that introduces “trust” at transaction level based on enhanced control at the system level. However, this control is only possible if the companies have the right IT systems in place and an important part of the certification process is to evaluate the functionality of the company’s IT systems.

6.5.3 In control requirements for the trusted trade network

Being “in control” in a trusted trade network is fundamentally more complex than being “in control” of a single organization in the following two respects. First, in a trusted trade network companies must collaborate in order to prove the existence of end-to-end control over their trade network. This physical control is often referred to as a “Secure Channel”, where traders can prove full traceability and integrity from origin to destination of a shipment, as well as all the components involved in the manufacture of the shipment. Second, in a trusted trade
network traders must collaborate in order to demonstrate end-to-end information transparency in their operations, accumulating and aggregating information from all of their partners and suppliers, and making it accessible to any government organizations that need to see it (e.g. Tax and Customs office). Enterprise resource planning (ERP) systems are able to execute and integrate business internal applications that support finance, accounting, manufacturing, order entry and human resources (Davenport, 2000). These business information systems must be integrated to enable end-to-end information flows in the supply chain; hence it is a key capability for ensuring supply chain security. The concept of the “trusted trade network” is thus a logical requirement from the point of view of the government, since security makes sense only if the whole supply chain is taken into account. This can pose serious issues for companies, as they have to deal with issues that in many cases are beyond their reach and control.

In order for a trusted trader in a trade network to establish and assert the “in control” statement of both physical and information assets, the trusted traders’ enterprise information system (EIS) must possess a number of critical capabilities. Below we summarize five of them:

1) **Real-time monitoring of the physical goods and information flow.** The (near) real-time monitoring of the physical goods and information flow is essential for securing the international trade. The information deployed by the companies should be able to embed with the modern technologies (e.g. Radio Frequency Identification (RFID) technology with Electronic Product Code (EPC) or combined with GPS or with fully sensor-equipped “smart containers”) (see www.epcglobalinc.org) which can provide both business and government the ability to screen and track the cargo at the critical nodes of the supply chain through data acquisition, delivery and analysis (Baida et al., 2008). It also can provide certainty, through scanning and imaging of cargo at those nodes where multiple cargo flows join (e.g. at ports of departure and entry). Such information can be built into working business processes as detective/preventative measures or as corrective controls which can deliver recovery capabilities by providing necessary information to key decision makers on the safety, security and prioritization of cargo. This real-time information about the goods status, location and ownership makes it possible to trace and track almost all the transactions, if necessary. Moreover, as this monitoring information will be transparent to the government, the traditional physical Customs control is made redundant. If complete supply chain transparency is achieved, the fast and simplified procedure will be allowed to undertaken by the trusted trader.

2) **Embedding control into the business processes.** Embedding controls against supply chain vulnerabilities in goods, factories, supply chain providers and partners, supply chain facilities, freight carriers, people and information are of commercial importance for supply chains (Jüttner et al., 2003; Miller, 1992; Sarathy, 2006). As argued by (Eggers, 2004), the ERP system has been so integrated in the modern supply chains that if organizations want to protect customers, intellectual property, infrastructure, brands, and employees, they must embed control into their IT systems. In our case study, DTCA indicates that well integrated IT control should be tightly linked with PETRO’s business process and it is crucial that there is as little manual interference in the automation process as possible. For example, the standard measurement of petrol
volume for tax levying should be done under 15°C. Hence, in the IT system there should be a built-in converter calculating the volume measured under other temperatures back to the 15°C standard. However, this conversion should be fully controlled without any possibility of manual fraud and embezzlement, and the whole process should be logged. If this requirement is fulfilled, the information system is much more reliable from Dutch TCA’s point of view, with respect to both fiscal issues and security issues.

3) **Enhanced IT security.** Information systems security has been considered as one of the basic requirements of organizational systems (e.g., (Dhillon & Torkzadeh, 2006), (Baskerville, 1993), (Whitman & Mattord, 2008)). Facing the trusted trade network with multiple supply chain stakeholders, this requirement can only be emphasized. Information and system securities directly determine the success of the trusted trade network. Not only can the supply chain information be used by the government for control purposes, but it also contains a lot commercial value. If the information system is not secure enough that the information is misused or accessed by the wrong stakeholder, the related consequences can be disastrous. We combine two of the most influential IT security frameworks ISO 17799 / 27002 (ISO/IEC, 2005, 2007) and COBIT 4.1 (IT Governance Institute, 2008) frameworks, and identify three main groups of the IT security fields in our context, namely internal security, external security and IT alignment. The following table summarizes the results and describes the main goals of each security field.

<table>
<thead>
<tr>
<th>IT security field</th>
<th>Main goals</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal security</td>
<td>Human resource security</td>
<td>Security aspects for employees joining, moving and leaving an organization. Do only current employees have access to the information systems?</td>
</tr>
<tr>
<td></td>
<td>Access control</td>
<td>Restriction of access rights to networks, systems, applications, functions and data. Can you only access and alter the data which you are your job description requires you to?</td>
</tr>
<tr>
<td></td>
<td>Building security in applications</td>
<td>Are the applications properly secured in such a way that no errors or misuse can occur?</td>
</tr>
<tr>
<td>External security</td>
<td>Physical protection of computer facilities</td>
<td>Are all facilities properly secured against people with bad intentions?</td>
</tr>
<tr>
<td></td>
<td>Continuity management</td>
<td>Protecting, maintaining and recovering business-critical processes and systems. Is the system hacker-safe and is</td>
</tr>
</tbody>
</table>
the system properly backed up in case of an emergency?

<table>
<thead>
<tr>
<th>IT alignment</th>
<th>Comparing business needs with IT use</th>
<th>Does the current IT use comply with the business needs of the company?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource allocation</td>
<td>Are all resources properly allocated in order to reach maximum benefits of IT use?</td>
<td></td>
</tr>
<tr>
<td>Risk management</td>
<td>Are the risks properly managed?</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.1: Main perspectives for IT security in the trusted trade network

4) **Information-sharing.** We refer in particular to information sharing between businesses in the supply chain and the government agencies (e.g. Tax and Customs office). In ITAIDE this is typically fulfilled via service-oriented architectures, which can be implemented in such a way that it provides a secured direct access for the Tax and Customs Administration to the enterprise information systems of the companies. In return for this direct access, the companies are exempted by the Tax and Customs Administration from the obligations to send them their transaction-based tax and Customs-related data, which typically is quite an administrative burden (Baida et al., 2008).

5) **Collaboration capabilities amongst the supply chain partners.** Two cognitive prerequisites are identified by (Lu et al., 2006) for a successful inter-organizational system. These are willingness to cooperate and willingness to share data. As the international trade always involves multiple stakeholders, security can not be achieved by focusing on just a single trader. Information sharing and collaboration capabilities among the supply chain partners of the EIS thus become critical requirements for enhancing the supply chain security and efficiency. Particularly, with respect to the “in-control” statement, trusted businesses themselves can react to accidental situations (e.g. wrong goods/delivery destination) by responding rapidly to their supply chain partners and in near real time correct the mistake and minimize the business loss. In the meantime, the government does not need to interfere and deter the trade procedures in between. The trade efficiency can be greatly improved.

Figure 6.1 shows the IT-related capabilities that are required to build a trusted trader company and network.
To solve the dilemma of increased security and control and at the same time to decrease the administrative burden for the European governments, new EU initiatives have proposed the concept of forming "trusted trade networks". Revolutionary changes will be done under this new scheme, including changing traditional "command and comply" government to business relationships to more trust-based ones, thus lowering the administrative burden and increasing trade efficiency. In this chapter, we have sharpened these innovative concepts and analyzed the potential benefits it could bring to the government and businesses. We have also given recommendations on IT requirements for fulfilling the concepts.

Being "in control" of the businesses themselves is one of the core ideas behind the trusted trade network. In this chapter, we discussed the idea that being "in control" of a trusted trade network is fundamentally more complex than being "in control" of a single organization. It requires both end-end physical controls and end-end information transparency among the supply chain partners. In a trusted trade network, the information system and its corresponding IT support should be built upon the inter-organizational perspectives. Furthermore, we have used a case study to show that in order for a trusted network of traders to establish an "in-control" statement they must possess a number of critical capabilities, such as real-time monitoring of goods and information flows, embedding control into business processes, enhanced IT security, information-sharing and collaborations amongst the supply chain partners. Many actors in international supply chains do already have a good control of their
supply chains. The idea behind the “trusted trader” and the “in control statement” is that the companies should be able to prove to government that they themselves are in control with an objective framework and thus can receive facilitations from the government. In particular, the emergence of the trusted trade networks will raise new challenges for the network governance issue in general. The implications and influences of this issue will be further studied by future research.
Part II: Socio-economic reasoning and modelling of government-business relationships

In the first part of the thesis, we have presented four real-life procedure redesign cases (Chapter 2, 3, 4 and 5) applying our e³-control redesign methodology. Successful pilot applications and positive feedbacks from stakeholders for four Living Labs indicate that our proposed redesign methodology is a suitable and effective approach to carry out inter-organizational procedure redesign with multiple perspectives. A constructive framework, with a core of “in control” and its underlying IT capabilities for the future European businesses and governments, are recommended in Chapter 6. They are valuable recommendations for forming trusted trade networks. Results from part one also show that ICT plays a very important role in the G2B procedure redesign, not only in enabling fast information transformation among different organizations, enhancing controls and overall supply chain management, but also in the design phase for supporting better and smarter decision-making. Meanwhile, we have also noticed that even with the most advanced IT facilitation, seamless (near 100%) control is almost impossible to achieve and not desired by most organizations. Two major reasons identified are firstly, there are always human factors involved in the procedure handling, and even with 100% automation, there will still be probability for systematic mistakes; and secondly, control costs money and the higher the level of control, the more expensive it is to achieve. Thus, only an optimal level of control and governance is plausible.

To achieve this optimal level of governance, sound socio-economic reasoning and a proper policy design and evaluation method behind ICT-based redesign are of great importance. In the following part of the thesis, we argue that introducing trust between the government and businesses is a necessary way of lowering the transaction cost and conquering economic problems of moral hazard and adverse selection caused by the information asymmetry. We elaborate these issues in particular with a case study of the Authorized Economic Operator (AEO) in the Netherlands. Consequently, a multi-perspective evaluation framework is proposed at the end of this part to support evaluation of ICT innovations in a G2B context, not only in monetary terms but also with social, operational and strategic considerations, satisfying stakeholders from both public and private sectors.
7. Towards asymmetric information for the G2B inter-organizational networks

Abstract

With the emergence of innovative (networked) organization forms such as enhanced supply chain collaboration and modern forms of public-private partnerships (PPP), effective and efficient collaboration among network participants becomes crucial but often difficult to achieve. One of the leading factors which cause such defective collaboration is the asymmetric information issue among the network participants. Two identifiable problems resulting from asymmetric information are the moral hazard and adverse selection problems. Former studies mainly positioned asymmetric information problems within the context of traditional business environment; in this chapter we suggest that similar problems may also occur in the Government to Business (G2B) context. We discuss these issues via a collaborative pilot case study (referred to here as Beer Living Lab) between the Dutch Tax and Customs Administration (Dutch TCA) and a Dutch beer company (Beer Co.). The chapter reveals that both moral hazard and adverse selection problems may occur during the G2B interactions and thereby adversely affect the relationships between the two. In addressing these problems, we propose an advanced information technology (IT) solution, drawing upon an effective and efficient information-sharing scheme that can on the one hand minimize the moral hazard by enhancing supply chain management for the business and on the other hand prevent tax fraud for the government. Furthermore, we argue that the application of the advanced IT may serve as a strong signalling and screening tool for overcoming the adverse selection problem during the formation of the PPP and result in a win-win situation. The insights learned should benefit those involved in various inter-organizational business networks, partnerships as well as supply chain management settings.

7.1 Introduction

The emergence of new lateral organizational forms (e.g., Internet-based supply chain partnerships) has been a phenomenon for e-business over the last decade. Collaborative and networked inter-organizational forms have provided competitive advantages that a single organization can hardly achieve alone. Not only can industry benefit from such inter-organizational networks, the public sector can benefit from forming collaborative networks with businesses as well. Potential benefits are clearly identifiable, especially in the government tax and Customs domain. For example, the estimated annual savings of introducing electronic invoicing systems across the EU governments would exceed €50 billion (European Commission, 2006d). However, forming such G2B collaborations are often difficult. Facing the current situation in which the government procedures are mostly still paper-based and not

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46 Note: This chapter is adapted from Jianwei Liu and Yao-Hua Tan (2008), Towards asymmetric information for the G2B inter-organizational networks, in the Proceedings of the 21st Bled eCommerce Conference (Bled 2008), Bled, Slovenia, June 2-4, 2008.
necessarily harmonized, and different concerns between government and business (e.g., different value perspectives, legislation/political concerns), the problems caused by the information asymmetry are almost inevitable and will temper the effectiveness of the network collaboration.

within contrast to former studies, we expand the theory of asymmetric information to the IS network research and focus on the role of IT in solving the asymmetric information problems; in addition, we extend the analysis of information asymmetry from the traditional B2B environment to the G2B inter-organizational network settings. In this chapter, we provide clearer insights on: 1) how information may influence organizational behaviour and thus play an important role for setting up the inter-organizational networks; 2) what the special concerns of information asymmetry and its related problems are under the G2B context; and 3) in particular, we provide a case demonstration on how such problems can be identified in the real-world setting and how inter-organizational IT solutions should be conducted to cope with the asymmetric information problems.

With a current case study of the Beer Living Lab (Beer LL), we identify two typical asymmetric information problems, namely the moral hazard (happens when collecting business tax) and the adverse selection problems (happens when government selecting/certifying private partners). A modern IT solution (TREC with EPCIS, see Section 7.4) that may provide an effective and efficient information sharing schema is proposed. The solution mitigates the moral hazard problem by on the one hand enhancing supply chain management (SCM) for businesses and on the other hand preventing tax fraud for the government. We further argue that the application of advanced IT (e.g. TREC device) may serve as a strong signalling and screening tool in preventing the formation of the adverse selection problem for the PPP. The results from this chapter may provide EU governments more effective selection criteria for the AEO certification.

The rest of the chapter is organized as follows. First, In Section 7.2, we give a short introduction of the theory of asymmetric information and the two economic problems (moral hazard and adverse selection) caused by the information asymmetry. In Section 7.3, we focus on the asymmetric information problems in the G2B relationships and how this may influence the formation of the relationship. In Section 7.4, a case study of Beer Living Lab is introduced and recommended solutions are elaborated. Finally, in Section 7.5, conclusions and discussion about future research are presented.

7.2 Information asymmetry

The theory of asymmetric information has been actively developed in the field of economic research for the last two decades. The prominent foundations for this theory were established by George Akerlof (Akerlof, 1970), Michael Spence (Spence, 1973) and Joseph Stiglitz (Rothschild & Stiglitz, 1976). Information asymmetry occurs when one party has more or better information than the other party; it assumes that at least one party to a transaction has better relevant information than the other(s). Typically it happens in a transaction that the
seller who knows more about the product than the buyer (e.g., selling a second-hand car). However, it is also possible for the reverse to be true: the buyer knows more than the seller (e.g. buying certain type insurance policy based on own risk behaviour). Information asymmetry has mass effect on the business networks, e.g. supply chains. Fiala (2005) indicates that information asymmetry is a key source of supply chain inefficiency, and strategic partnerships and information sharing can help to cope with the “bullwhip effect” (see (Lee et al., 1997a, 1997b)) caused by the information asymmetry in supply chains. Because of in adequate information and information lagging among supply partners, the demand/supply in the supply chain cannot be well managed and the quality of the product is hard to maintain. Mishra et al. (2007) point out that information distortion may reduce the benefit levels or even stop information sharing in supply chains. There are two typical problems asymmetric information may trigger, namely moral hazard and adverse selection.

Moral hazard refers to “situations where one side of the market can't observe the actions of the other. For this reason it is sometimes called a hidden action problem” (Varian, 2002). In addition, it means the chance, or hazard, that a party in a transaction with more information about its intentions or actions behaves in a way that a party with less information would consider inappropriate or, in the extreme, "immoral". It arises because an individual or institution in a transaction does not bear the full consequences or can hide the consequences of its actions without the counterparty knowing, and therefore has a tendency or incentive to act inappropriately. An example of moral hazard is when people are more likely to behave recklessly if insured, for example by failing to renew the insurance, because the insurer either cannot observe this behaviour or cannot effectively retaliate against it.

Adverse selection generally refers to a market process in which bad results occur due to information asymmetries between buyers and sellers, where the "bad" products or customers are more likely to be selected and the “good” ones are driven out of the market. It has been discussed extensively in the fields of economics, insurance and risk theory. An example of adverse selection in the insurance market is that people who are a high risk are more likely to buy insurance because the insurance company cannot effectively discriminate against them, so the same premiums are set by the insurer for both high-risk and low-risk groups. The insurance company anticipates or learns that the cost of the combined policyholders exceeds that of the general population, and sets higher premiums accordingly. The result is that people with lower risk tend to go uninsured. Furthermore, as more low-risk people are leaving, the premiums have to be raised further, so even more people are driven away. Another famous example is illustrated by (Akerlof, 1970) for the second-hand car market, which is referred as the "lemon market"--people buying used cars do not know whether they are "lemons" (bad cars) or "peaches" (good ones), so they are willing to pay a average price that lies in between the lemons and peaches. As a result, the same situation as in the insurance market happens here: the “peaches” will be driven out and “lemons” will dominate the market. Similar findings are also supported by the recent e-commerce research of Liao & Cheung (2001) that the "poor

47 It describes growing variations upstream in a supply chain, which is one of the most poignant demonstrations that decentralized decision-making can lead to poor supply chain performance. For details, refer to Lee et al. [20, 21].
vendor quality, especially as regards 'lemons', is identified as a significant disincentive to virtual retailing over the Internet”.

Both moral hazard and adverse selection can be explained in the agency theory [related theory with asymmetric information, more details see (Eisenhardt, 1989a)] as agency problems, which comprise two forms that agency problems may take. Arrow (1984) equates these two terms with hidden action (moral hazard) and hidden information (adverse selection) respectively: moral hazard occurs when the action undertaken by the agent is unobservable and has a differential value to the agent as compared to the principal. Adverse selection problems arise when the agent has more information than the principal.

Recently, with the fast development of the IT (information technology), the theory of asymmetric information has been expanded in the field of economics of information technology and discussed by various researchers [e.g., (Garicano & Kaplan, 2001; Kauffman & Mohtadi, 2003; Stiglitz, 2000; Varian, 2002; Varian et al., 2004; Wigand et al., 1997)]. These papers however, mainly focus on the economic impacts of the information technology (i.e. the value of information, information goods and involving transaction costs etc.); very little insights have been given on how IT should be implemented to cope with various asymmetric information problems.

7.3 Asymmetric information problems between business and government

As discussed in the last section, former studies mainly focus on the effect of asymmetric information under the market-oriented (e.g. labour market, commodity market, insurance market and stock market) business context. Government, on the other hand, was perceived to be out of the scope of the free market, due to its traditional functions of rule setting, intervening and controlling. For this reason, very little attention has been paid to the asymmetric information issues between profit-driven businesses and public good-oriented government. However, the recent movement of the public sector transformation of forming the public-private partnerships (PPP), where a government and a private entity collaboratively undertake traditionally public activity (Naschold & von Otter, 1996), has blurred the boundary between the government and private business. In this section we put our focal point on this transforming regime and discuss whether asymmetric information problems of moral hazard and adverse selection can also be triggered during the business and government interaction.

7.3.1 Moral hazard in government control

One of the most important roles for government in the G2B relationship is the government control role. Such control is especially important for the Tax and Customs Administration, as it is directly related with the national tax revenues. EU governments have been experiencing severe loss from various tax frauds. According to European Commission (2006c), estimates of tax fraud of 2% to 2.5% of GDP are mentioned, which is about €200 to 250 billion per year at EU level. Such tax fraud is a fitting example and can be interpreted as the moral hazard problem caused by the symmetric information.
An illustrative example is VAT (Value Added Tax) collection. Only two parties are involved here: a private company which is obliged to declare VAT and pay the tax, and a Tax office as a government agency which audits the tax report and controls the VAT collection. Under perfect information, the tax office obtains complete information and knows about the company’s exact operation; in the meantime the private company reports and pays the full amount of VAT honestly to the Tax office (Figure 7.1a). However in the real world, the private company always knows better about its own operating details and the real value of transactions, whereas the Tax office does not. The private company has better information than the Tax office and thus has incentives to hide and even falsify certain information from the Tax office in order to get tax advantages. If such incentive is obvious and easy to achieve without the Tax office knowing, or the penalty of defaulting is not severe enough, the private company will choose to cheat --- a moral hazard problem is caused that the Tax office receives less VAT than it should (Figure 7.1b).

7.3.2 Adverse selection in formation of a G2B partnership

The second problem --- adverse selection is more complex than the first one. It happens often when government bodies select private partners and give certificates to these companies. The current in the spotlight Authorized Economic Operator (AEO) certificate may serve here as a good example.

The idea of AEO is that each EU Member State Customs Administration can establish partnerships with private sectors and certify them with AEO certifications. The involvement of the private companies in AEO will enhance the safety and security of international trade and the certified AEOs will enjoy tangible benefits such as fast Customs clearance and simplified procedures. According to the European parliament and the Council (2005a), “Customs authorities, if necessary following consultation with other competent authorities, shall grant, the status of ‘Authorized Economic Operator’ (AEO) to any economic operator established in the Customs territory of the Community. An AEO shall benefit from facilitations with regard to Customs controls relating to security and safety and/or from simplifications provided for under the Customs rules.”
A critical issue here is that the AEO certificate is quite unlike other governmental requirements; it is voluntary rather than compulsory. It requires “… no obligation for economic operators to become AEOs, it is a matter of the operators’ own choice based on their specific situation. Nor is there any obligation for AEOs to require that their business partners have also to obtain AEO status” (European Commission, 2007a). Companies are no longer obliged but can bargain and make their own decisions whether or not to qualify for the AEO certificate (at the same time also fulfilling the requirements). The increased bargaining power from the business side makes it rather difficult to promote the idea of AEO, as each individual company has its own concerns and specific reasons for joining or not. It would be convenient for the EU government to set a non-exclusive single policy for all the companies who are willing to participate. However, facing the divergences among multinationals and SMEs (small and medium-sized enterprises), such a single policy is very difficult to reach. Though a great effort has been made in developing the most recent AEO guidelines (European Commission, 2007a), the implementation of these guidelines still needs to occur.

A problem raised here is that if the government can not effectively differentiate companies and applies a single standard to all the companies in the certificate market, similar adverse selection problem like in the insurance market may occur: the “good” (compliant) companies tend not to join because the AEO requirement is too strict and they see no fair value for them to participate --- “We are compliant companies with a good reputation, and our current procedure is simpler than others anyway, so why should we invest more to get the AEO certificate?” (based on interviews with a Beer Co. compliance manager). On the other hand, the “bad” (cheating) companies may see more visible benefit (less checking and simplified procedure may create an easier way of making fraud) and are more willing to get the certificate (See Figure 7.2).

The original purpose of the government is to provide the compliant companies with minimal physical control and simplified procedures via the AEO certificate and to force the cheating companies to institute more controls. As indicated in the interview with the Dutch Tax and Customs Administration (Dutch TCA) --- “If companies are already in good control themselves, why should we (Dutch TCA) waste our resource to exert extra control on them?” However, the consequences of the adverse selection problem may reverse government’s expectation: as the “good” companies could not get enough incentive to join, they will be automatically driven out of the “certificate market” by the “bad” ones. And a continuous scenario is even worse: as more “bad” companies take the certificate and commit fraud, the AEO requirement will be set even stricter and it will become less desirable for any “good” companies to join --- a market failure is created. Nevertheless, there are remedies for the adverse selection problem. This issue will be further elaborated in later sections of this chapter.
Figure 7.2. Adverse selection caused during AEO certification procedure (Market failure)

7.4 Case study: The Beer Living Lab

To further elaborate the issues discussed above, we present a real life case study of a collaborative project (referred to as the Beer Living Lab) between the Dutch Tax and Customs Administration (Dutch TCA) and a NL-based international beer company (Beer Co.). The purpose of the Beer Living Lab (Beer LL) is to create a win-win situation between the business and government, in which on the one hand the administrative burden will be lowered for business and on the other hand the tax fraud will be minimized and better security and control can be facilitated for the government [the detailed discussion of the Living Lab concept itself is revealed by (Baida et al., 2007b; Tan et al., 2006)]. The Beer LL is a unique case study that provides researchers a great opportunity of carrying out multi-faceted research including an e-Customs study (van Stijn et al., 2007), control procedure redesign (Baida et al., 2007a; Liu et al., 2007a; Liu et al., 2006) and a collaborative network study (Frößler et al., 2007; Rukanova et al., 2007) etc. In proceeding with the research, we found that the informational aspect of the Beer LL is especially interesting, in that it influences not only organizational control procedures but also formation of an inter-organizational network. We link the underlying phenomenon in Beer LL with the theory of information asymmetry and discuss how it may play a role here. Further we show how advanced IT solutions (e.g., the Beer LL solution) may cope with the asymmetric information problems and create a win-win situation between the government and businesses.

7.4.1 Moral hazard in Beer LL

Beer Co. (NL-based, but has international subsidiaries like Beer Co. UK, US) as an international brewery company carries out a huge amount of trade everyday, involving multiple supply chain partners and government agencies. The moral hazard problem mainly appears in two places in its inter-organizational trade procedures, namely along supply chains and between business and government interactions. Along the supply chain, Beer Co. is involved with many suppliers and distributors around the globe. From raw material to the final product at the customers, the amount of information interchanged in Beer Co’s supply chain is consid-
erable. To minimize problems caused by the information asymmetry, Beer Co. would like to have an information sharing scheme that can provide full control and transparency of its supply chains. Such a scheme shall not only enhance the order-make management of Beer Co., but also safeguard its brand image and break down possible counterfeit that may be caused by the fraudulent supply chain partners.

The other place where moral hazard problem can be found is laying underneath the interaction between businesses and government, especially in the business tax reporting and Customs declaration procedures. As we discussed before, businesses always have better information than the government about their own operation. They may have an incentive to hide certain (fraudulent) actions to achieve certain benefits. According to our interview with Beer Co. and Dutch TCA, several frauds can be involved in the Beer LL trade procedure. However, the current tax and Customs control procedure is not effective enough to cope with these problems. The principal reason is that the current Custom control is based mainly on the paper-based AAD (accompanying administrative document), EW 48 (excise warehouse) and physical inspections. For example, in the Customs control procedures of Beer Co. exporting beer from NL to UK: the AAD performs an essential role in this Customs control procedure. Two roles are performed by the AAD, one as export evidence when stamped by EW and Customs UK, the other to identify the cargo in case of a physical cargo inspection en route. The AAD accompanies the beer from the Netherlands to the UK and is stamped by the EW, then by Customs UK, as a proof that the goods have arrived in the UK. Customs UK send the stamped AAD back to the EW who will forward it back to BeerCo NL. For control purpose, Customs NL periodically checks BeerCo NL’s excise declarations. For the beer that BeerCo NL sold outside the Netherlands, excise exemption is given by default and will be verified afterwards by comparing excise declarations with AADs. This procedure is shown in Figure 7.3.

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48 An excise warehouse is a warehouse which has been authorized by the authorities for the deposit without payment of duty of goods liable to excise duty.
This procedure has two major disadvantages. 1) Timeliness: transferring the paper-based AADs can take weeks or even months and the verification is done several months later. In practice, this checking is often not done at all because it is too labour-intensive. As a result, Beer Co. NL only submits AADs upon request of Customs NL; 2) Too many parties’ involvement: the AAD-based control relies on many commercial parties (e.g., Beer Co. NL and UK, EW, shipping company) who may have a direct interest in violating this control to reach their own financial interests. Each one of them (individually or in collusion) has the opportunities to alter or hide critical information/actions (especially, paper-based AAD can be easily falsified) from the other, which may result in moral hazard and possible control fraud. We interviewed these possible moral hazard problems and identify them in Table 7.1. According to the European Commission (2008), excise fraud for alcohol in the EU amounts to €1.5 billion yearly, approximately 8% of the total excise duties receipts on alcoholic beverages. Dutch TCA as a government control agency would like to detect and minimize all the possible tax fraud. It requires an information sharing system with control efficiency and effectiveness that on the one hand can minimize administrative burden and on the other hand may facilitate effective auditing control.
<table>
<thead>
<tr>
<th>Moral Hazard Problem</th>
<th>Possible fraudulent parties</th>
<th>Description of hidden actions</th>
<th>Current control mechanisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Single party defaulting</td>
<td>One of the parties along the supply chain does not fulfil (intentionally or unintentionally) its responsibilities and hides this from others</td>
<td>AAD, EW, Physical checks</td>
</tr>
<tr>
<td>1.1 Beer Co. NL</td>
<td>Beer Co. NL does not pay excise on beer within NL (Claims beer selling abroad but actually sells in NL)</td>
<td>AAD.</td>
<td></td>
</tr>
<tr>
<td>1.2 Beer Co. UK</td>
<td>Beer Co. UK sends falsified AAD back to Beer Co. NL, but does not register it in their administration nor reports to Customs. Beer Co. UK sells beer without paying excise</td>
<td>EW</td>
<td></td>
</tr>
<tr>
<td>1.3 Beer Co. NL/ Beer Co. UK</td>
<td>Beer Co. NL/UK presents a product as a product from another category (soft drink instead of beer)</td>
<td>Physical checks (Random checks on Beer Co. NL/UK)</td>
<td></td>
</tr>
<tr>
<td>1.4 Excise warehouse (EW)</td>
<td>EW does not pay or pay less excise (rarely)</td>
<td>EW certification</td>
<td></td>
</tr>
<tr>
<td>1.5 Retailer with EW</td>
<td>Retailer with EW does not pay excise or pays less excise</td>
<td>AAD.</td>
<td></td>
</tr>
<tr>
<td>E.g.</td>
<td>Virtual shipment</td>
<td>A party buys goods from Beer Co. NL and “virtually” ships the goods to a country with low excise percentages (e.g. Poland), but sells them in NL or UK.</td>
<td>AAD. Physical stop checks</td>
</tr>
<tr>
<td></td>
<td>Fake Beer Co. branding</td>
<td>Parties pretend to be trustworthy companies (like Beer Co.) by sending goods packed with the Beer Co. branding label and falsely stating that the product is made by Beer Co. By doing so, fake parties get less control than they should have and cheated payment of excise on these products, even can ruin the real Beer Co.’s reputation.</td>
<td>Physical stop checks &amp; Authorization (Possibly can be replaced by Beer Co. AEO certification in the future)</td>
</tr>
<tr>
<td></td>
<td>Smuggling</td>
<td>Carriers (criminal truck drivers) smuggle illegal goods (e.g., drug) within Beer Co. containers</td>
<td>Asset safeguard &amp; physical checks (Random checks on Beer Co. NL/UK)</td>
</tr>
<tr>
<td>2.</td>
<td>Multi-party collusion</td>
<td>Parties collude with each other in order to take advantage of the system (e.g. pay less excise)</td>
<td>Third party checking, and random physical checks</td>
</tr>
<tr>
<td>2.1 Beer Co. NL &amp; Beer Co. UK</td>
<td>Beer Co. NL &amp; Beer Co. UK collude with each other in order not to pay excise</td>
<td>EW</td>
<td></td>
</tr>
<tr>
<td>2.2 Beer Co. UK &amp; Retailer with EW</td>
<td>Beer Co. UK &amp; Retailer with EW collude with each other in order not to pay excise</td>
<td>AAD.</td>
<td></td>
</tr>
<tr>
<td>2.3 Beer Co.(NL+UK) &amp; retailer with EW</td>
<td>Beer Co.(NL+UK) &amp; retailer with EW collude with each other in order not to pay excise</td>
<td>Physical checks</td>
<td></td>
</tr>
<tr>
<td>E.g.</td>
<td>Black market</td>
<td>Beer Co. NL ships excisable goods to UK accompanied by an AAD, but Beer Co. UK (only assumption, but not likely in our case) sells the goods in the black market without excise payment. Customs NL will not receive AAD for the goods. The fraud will be finally revealed but too late—“3 moths – half year” period.</td>
<td>EW &amp; Reconciliation (Independent check of performance)</td>
</tr>
</tbody>
</table>

Table 7.1. Examples of possible moral hazard in the Beer LL.\(^*\)

\(^{49}\) All based on assumptions. In our case Beer Co. is a reputable company, so most of the frauds are unlikely to happen.
7.4.2 Redesign Solution: Effective information sharing scheme with embedded IT-based control

To cope with the problems identified above, Beer Co. together with Dutch TCA, academic researchers and interested technology providers designed an innovative TO-BE solution based on advanced IT. This solution has been piloted since year 2007 and has received quite positive feedbacks from various fields in and outside the project. The redesign solution sets up effective an inter-organizational information sharing scheme as well as embedding an IT-based control mechanism into the system.

1) First, the Beer LL solution provides an effective and efficient information sharing scheme that links Beer Co., its supply chain partners and Dutch TCA together. A simple but useful definition of inter-organizational information system (IOS) is given by Cash and Konsynski (1985) as "an automated information system shared by two or more companies". An IOS is built around information technology that facilitates the creation, storage, transformation, and transmission of information, which differs from an internal information system by allowing information to be sent across organizational boundaries. In their book, Wigand et al. (1997) discuss various organizational boundaries and information models for setting up IOS that can cope with these limitations. Setting up the Beer LL ISO relies on the Electronic Product Code Information Services (EPCIS) using Service-Oriented Architecture. Container Information Services (CIS) use the EPCIS non-proprietary standards of EPCglobal50. The data-sharing mechanisms use Service Oriented Architecture (SOA) to allow secure information sharing between supply chain partners as well as government agencies. All supply chain partners (e.g. seller, buyer and carrier) will publish their data regarding a shipment in the EPCIS databases; the data will then be available to other supply chain partners as well as to the government.

2) Second, the redesign procedure takes embedded control mechanism into account. The embedded control is realized via the application of the TREC51 smart seal technology for container security, which has the following features: (1) sensors to monitor parameters including humidity, temperature, shock and unauthorized container openings; (2) real-time container location traceability through continuous satellite connection; (3) connection to backend systems during transport; and (4) ability to send information and alerts in case of predefined rules (e.g. container arrives at or leaves a geo-zone; temperature lower or higher than predefined limits). According to the Beer LL vision, Beer Co. will ship its goods in TREC-armed containers. Being smart seals, the TREC devices can ensure shipment integrity, and enhance security. By means of using handheld devices, Customs officers can use TREC devices to obtain access to the EPCIS databases of all supply chain partners, where commercial data about shipments is available.

Instead of setting up separate direct links between each other, the above-mentioned organizations will set up an inter-organizational information system (IOS) based on the same EPC

50 For further details see http://www.epcglobalinc.org, last accessed on Oct 31, 2007.
standards. Each partner in the network will extract the data they would like to share from their own Enterprise Resource Planning (ERP) system to the client EPCIS, from which the shared data can be retrieved. And a central EPCIS is applied as an intermediate measure, which provides a directory service that collects, matches and submits information to the connected parties automatically or based on their query. TREC is used as an extra safeguard to ensure that critical information is achieved and sent in real-time without fraud. TREC information is sent to the central EPCIS that can be retrieved in real-time by network partners. If anything goes wrong (e.g. unauthorized opening of container or change of information), TREC will send an automatic alert to the relevant parties. Through such an information sharing scheme, real-time information sharing will be possible along the supply chains. And for Dutch TCA, it will get all relevant control information not only from Beer Co. but also from other supply chain partners and TREC as well, which will make the continuous auditing possible (See Figure 7.4). This IT solution of TREC (or similar technology), EPCIS and the service-oriented architecture replaces the current situation where the Customs data is sent from the business to Dutch TCA via paper documents. This electronic exchange of data is not only much more efficient than the paper-based exchange, but it also enables Dutch TCA to look for all kinds of additional business data that can greatly improve the quality of their risk analysis of a business.

![Figure 7.4. Beer LL information sharing scheme](image)

### 7.4.3 Adverse selection

As mentioned earlier, the second issue is the adverse selection problem caused by the information asymmetry during the formation of the public-private partnership (PPP). Typically, when government certifies businesses, such a problem often results in a market failure, whereby that the “peaches” are driven out and the market will be glutted with “lemons”. The adverse selection problem puzzles the earlier discussed AEO certification as well. As the introduction of AEO took legal effect in the European Community (EC) on 1 January 2008 (Joint Customs Consultative Committee (JCCC), 2007), further developing and guidelining the concept
becomes an exigent issue. By studying the Beer LL case, we figure out a way out of the AEO adverse selection problem. We find that the application of advanced IT may serve as a strong signalling tool for businesses to show their quality and types of control, which will enable the government to effectively differentiate “good” and “bad” companies for certification. “Signalling” has long been considered as one of the most important strategies for solving asymmetric information problems in the job market and capital market [e.g. (Gertner et al., 1988; Spence, 1973)]. The general idea behind signalling is that one party (informed party) conveys some meaningful information (signal) about itself to another party (under informed party); with this extra information, the under-informed party is able to differentiate different quality and types of control of the other party and make sensible selection decisions. O’Reilly (1983) indicates that the quality of decision-making increases with the decision-maker’s information level. However, if the quality of information itself is difficult or impossible to evaluate, a decision-maker’s visible information behaviour is often used as an evaluation substitute for the quality of information and therefore decisions (Feldman & March, 1981). They emphasize that information behaviour can have important signalling effects on observers. In the Beer LL scenario, good companies like Beer Co. positively signal themselves with the adoption of the EPICS and TREC and the government (Dutch TCA) will make the certificate procedure easier and more attractive for them. Meanwhile, for the “bad” company A, as the signalling cost of implementing the required IT solution will overcome the potential fraud benefit it can get, it will simply decide not to take the AEO certificate. Anyhow, if the “bad” company B would like to have simplified tax and Customs procedures and decides to take the AEO certificate, it needs to fulfil the IT requirement by either using TREC or other similar IT support. The implementation of the advanced IT solution itself will minimize the cheating possibilities of the “bad” companies and may finally turn the “bad” companies into “good” ones. At the same time, instead of passively receiving “signals” from applicants, Dutch TCA can also actively screen companies by embedding the application of advance IT in the AEO requirement that all applied companies should fulfil the IT requirement in order to get the certificate. The adverse selection problem is tackled by IT screening from the government side and positive signalling by using IT from the business side. The market will automatically correct itself so that “good” companies will join and stay and the “bad” ones will be kept out of the market (See Figure 7.5).

Screening is another way of combating adverse selection, different with signalling, which implies that the informed agent moves first, screening means that under informed party can induce the other party to reveal their information, for example by providing a menu of choices in such a way that the choice depends on the private information of the other party (Rothschild & Stiglitz, 1976).
7.4.4 Recommendations

By analyzing the Beer LL case with asymmetric information, we realize that procedure redesign is not as simple as process automation or mere replacement of paper documents with electronic ones. Especially when organizations work together and form an inter-organizational network, special concerns of information sharing need be taken into account: how the information can be shared effectively with the minimum asymmetry, how the “lemons” can be avoided. As long as these problems are addressed, solutions exist (or will exist) for each asymmetric information problem. Some of the requirements can be abstracted from the Beer LL case, i.e. (1) end-to-end security, (2) data sharing with the supply chain and Dutch TCA etc. We also suggest that AEO should be protected against the danger of “lemons” by adding IT requirements to help with signalling and screening.

7.5 Conclusions and future research

This chapter presents a linkage between the economic theories of information asymmetry and IS network and information flow research. Despite the asymmetric information problems in the business world, we find that such problems are also prominent in the G2B context, in particular for Tax and Customs offices. By studying a collaborative pilot between government and business --- the Beer Living Lab, we identify two asymmetric information problems, namely, moral hazard and adverse selection. We argue that application of advanced IT may effectively cope with the two above-mentioned problems: IT-based IOS enables network partners effectively sharing information with each other, thereby minimizing the moral hazard problem; and the application of IT itself may serve as a strong signalling/screening tool to help the network partners to make sensible selection decisions that overcome the adverse selection problem. The findings from this chapter may provide valuable knowledge for the EU governments to further develop the AEO certification guidelines.
At the current stage, the paper reveals only the phenomenon of asymmetric information during the formation of the G2B network, its applications and some recommended solutions. The scope of the chapter will be expanded by our future research, which will further develop the conceptual framework and validate it with both descriptive (case study) and quantitative (empirical research) methods. Furthermore, we will pay special attention to a dynamic network, in other words how changes to the IT strategy of one network partner may influence the behaviour and decision-making of other network partners; what the new equilibrium will be after this change and how this can be optimized. All in all, research of information economics in the IS field is still under development; this chapter serves as an explorative starting point and hopefully it can inspire others to pursue research in this field.
8. Realizing collaborative government-to-business business models: The case of the authorized economic operator

Abstract

Building collaborative relationships with trusted businesses is a long-term strategy for EU governments. Recently, the realization of this goal has become more visible with the emerging concept of the Authorized Economic Operator (AEO). Businesses in the member states can apply for the AEO certificate from their government. The aim of granting AEO is to create a possible “win-win” situation with increased trade efficiency and lower administrative burden. However, without a proper selection mechanism, this policy can be misunderstood/ misused due to asymmetric information between the government and businesses. In this chapter, we focus on modelling the cause and effect of the adverse selection in Government-to-Business (G2B) relationship building. We argue that an IT-enabled risk assessment approach can effectively eliminate the G2B information asymmetry and solve the adverse selection problem. The business model of AEO assessment has been built to give a real life example of how IT-enabled risk management approach can help with collaborative G2B relationship building.

8.1 Introduction

One of the key visions for e-government is to enhance government relationships with businesses and citizens: turning a government service into a self-service, for better participation, enhanced efficiency and lower administrative burden [e.g. (Economides & Terzis, 2008; Mofleh et al., 2009; Yadav & Yadav, 2009)]. Tax and Customs administrations facing the challenge of growing trade volumes and increased security requirements are now adopting this vision, by applying advanced information technology (IT) to achieve the objective of building new collaborative relationships with businesses. The collaborative relationship means to change the Government-to-Business (G2B) relationship from the traditional “control and command” to a more “trust-based” relationship, which includes replacing the traditional labour-intensive Customs controls with the businesses showing “self-control” on Customs issues. To realize this transformation, the EU Directorate-General of Tax and Customs has made a major effort to develop and promote the concept of the Authorized Economic Operator (AEO) for European businesses (European Commission, 2007a). The underlying idea is that if businesses can prove to the Tax and Customs Administration (TCA) that they are in control of the tax and security aspects of their own business processes, they will be AEO certified by the TCA. This brings them the benefits of fewer physical inspections, fast Customs clearance.

procedures and trade facilitation by the TCA. Positive and effective government strategies and policies can promote e-commerce development for businesses, as suggested by Lau and Kwok (2007). The aim of this policy is to achieve a “win-win” situation for both government and businesses, with trade simplification and lower administrative burden.

However, because businesses typically have better information about themselves than the government perceives them (information asymmetry), problems of moral hazard and adverse selection may occur. Moral hazard means that businesses tend to act opportunistically and inappropriately after achieving the AEO status; adverse selection indicates that during the selection procedures of AEOs, as the government lacks proper information, good companies are easily driven out of the market by bad ones [for details see (Akerlof, 1970), (Spence, 1973) and (Rothschild & Stiglitz, 1976)]. Failing to distinguish between these two types of information asymmetry problem may lead decision-makers to adopt policies that are ineffective or even harmful. Collaboration is one of the ways to enhance the successful adoption of e-government (Reddick, 2008). Thus, governments are looking for new business models to collaborate with their businesses.

Recent literature contains a wide variety of business model research [e.g. (Afuah & Tucci, 2000; Hedman & Kalling, 2003; Keen & Qureshi, 2006; Weill & Vitale, 2001)]; research on business models of e-government has shed particular light on business model research in the government field [e.g. (Janssen & Kuk, 2007; Janssen et al., 2008; Yu, 2008)]. However, earlier research focuses mainly on business models for web-based services provided by the government. Limited attention has been received in the field of strategic management for government policy making and implementation. The added value for such business models may help to understand and organize underlying logic for government policy making and implementation. It helps to build strategic links among government’s core motivations (i.e. increased trade efficiency and lowered administrative burden), economic reasoning (i.e. creating collaborative synergy with trusted businesses), major barriers (i.e. cause and effect of the adverse selection) and corresponding actions to deal with them (i.e. IT-enabled risk management). This research aims to create such a business model that may fill this gap.

In this chapter, business models of authorized economic operator (AEO) are investigated and policy recommendations are given. We have focused our research on the adverse selection problem during the AEO selection. The rest of the chapter is organized as follows. In Section 8.2, we investigate how adverse selection may have a negative effect on the AEO certification process in the sense that, due to information asymmetry between the government and businesses, the government could be misled and might thereby grant AEO status to companies that are actually not in control. If this happens, the good companies that are in control will perceive this as unfair competition and will leave the market, which might cause a so-called “lemons market” for AEO certificates, making the certificate virtually useless. In Section 8.3, we present our case study of AEO assessment in the Netherlands, and our research methodology, process and main findings. We argue that, by applying an IT-enabled risk assessment approach, the adverse selection problem in the AEO certification process can be effectively reduced, enhancing the trust relationship between government and businesses. Businesses can show the government that they are in control by sending a positive signal to the government based on their business information systems and internal control quality. Noticeably, there
exists a second role of IT: when businesses use IT-enabled decision support systems to perform the AEO self-assessment, the quality of the self-assessment increases, hence the strength of the positive signal can be further enhanced. Based on this, governments are better able to perform a risk assessment, to screen and differentiate trustworthy businesses from opportunistic ones and to grant the AEO certificate only to the good companies. In Section 8.4, a business process model for the Dutch TCA AEO certification procedure is given. We emphasize in particular the role played by IT in the risk management in the assessment procedure. Finally, we summarize the chapter and provide recommendations for EU policy making on how to enhance G2B relationships.

8.2 Asymmetric information problem in G2B relationship building

To form any kind of relationship, information sharing is essential. In an ideal world we assume information is shared equally and transparently among the parties. However, in the real world, due to lack of communication channels and hidden incentives for sharing or incomplete information between parties, information is normally spread in an asymmetric way. Information asymmetry occurs when one party has more or better information than the other party. Typically, two problems are triggered by asymmetric information, namely, moral hazard and adverse selection [e.g. (Akerlof, 1970), (Spence, 1973) and (Rothschild & Stiglitz, 1976)].

*Moral hazard* refers to “situations where one side of the market can't observe the actions of the other. For this reason it is sometimes called a hidden action problem” (Varian, 2002). It arises because an individual or institution in a transaction does not bear the full consequences or can hide the consequences of its actions without the counter party knowing it, and therefore has an incentive to act inappropriately. Tax fraud can be seen as a typical moral hazard problem in G2B relationships. For example, in VAT (Value Added Tax) collection, two parties are involved: a company that is obliged to declare VAT and pay the tax; and a tax office which audits the tax declaration and collects the VAT. Under the assumption of perfect information, the tax office obtains complete information and knows about the company’s exact operation; the company reports and pays the correct amount of VAT (Figure 8.1a). However, in the real world the company has better information about its own operating details than does the tax office, and thus may have incentives to hide and even falsify certain information from the tax office to get tax advantages. If such an incentive is present, or the penalty for defaulting is not severe enough, the company might choose tax evasion, thereby causing a moral hazard problem (Figure 8.1b). We discussed the issues of moral hazard in detail in a previous paper (Liu & Tan, 2008). In this chapter we focus on the second issue: adverse selection problem.
Adverse selection refers to a failing market due to information asymmetries between buyers and sellers, where “bad” products or customers are more likely to be selected rather than the “good” ones. A famous example of adverse selection is illustrated by (Akerlof, 1970) for the second-hand car market, which is referred to as a "lemon market". Buyers of second-hand cars typically do not have the expertise to know whether a car is a "lemon" (bad car) or a "peaches" (good car), so they are willing to pay an average price that lies in between the lemons and peaches. However, with such a price, the good car dealers are not willing to sell the cars with premium quality. As a result, cars with lower than average quality will be sold: the “peaches” are driven out and “lemons” will dominate the market.

In the G2B relationship, adverse selection can occur when government bodies select private partners and grant certificates. The Authorized Economic Operator (AEO) certificate may serve here as a good example. The idea of AEO is that each EU Member State Customs Administration can establish partnerships with private companies and grant them AEO status. The involvement of the companies in AEO will enhance a win-win situation for the safety and security of international trade: on the one hand government can do less physical checks and use limited personnel for other tasks, and on the other hand the certified AEO companies will enjoy tangible benefits such as fast Customs clearance and simplified procedures (e.g. containers of AEO companies will not be inspected by the Customs when they pass the EU border) (2005a). AEO can be seen as an extra Customs control instrument that enhances the Customs control while not introducing extra control burden for the government. More specifically, the government delegates certain control tasks to collaborative businesses and in return gives these businesses trade simplification.

A critical issue here is that the AEO certificate is quite unlike other governmental requirements. It is voluntary rather than mandatory: “It requires … no obligation for economic operators to become AEOs, it is a matter of the operators' own choice...” (European Commission, 2007a). Companies can make their own decisions on whether or not to qualify for the AEO certificate, based on company strategy. In addition, in spite of the facilitations AEO companies may have, the AEO certificate is not cost free. Companies have to make considerable investments (around 50K euros for small companies, up to a couple of million Euros for large ones) to achieve and maintain the certificate. Hence, we can see AEO as a free will certificate “market”, with entry cost and associated benefits.
The problem raised here is that if the government cannot effectively differentiate companies from the two streams, a similar adverse selection problem to that in the second-hand car market may occur. The “good” (trustworthy and compliant) companies are not willing to join when they see no fair value for them to participate; as one of the interviewed companies (a Netherlands-based international brewery) said, “We are already a compliant company with a good reputation, and our current procedure is simpler than that of others anyway, why should we invest more to get the AEO certificate?”. On the other hand, the “bad” (opportunistic and fraudulent) companies may see more benefits (less checking and simplified procedures may create an easier way of committing fraud), less cost (they can make a false report to show the fulfilment of the requirements), and thus are more willing the get the certificate (See Figure 8.2).

The original aim of the government is to focus control effort on potentially fraudulent companies, to limit the number of physical inspections and to simplify the procedures for trusted companies with an AEO certificate. As indicated in the interview with the Dutch Tax and Customs Administration (Dutch TCA), “If companies are already in good control themselves, why should we waste our resources to exert extra control on them?” However, the consequences of the adverse selection problem may differ from government’s expectation. The situation may even deteriorate; when more “bad” companies obtain the AEO certificate but commit fraud nevertheless, a market of “lemons” will be created and the public will lose their trust in the government. Nevertheless, there are remedies for the adverse selection problem. One possible solution is to apply an IT-based risk management approach for effective signalling and screening, which will be discussed in the next section.

**Figure 8.2. Adverse selection caused during AEO certification procedure**

### 8.3 Case study of the AEO assessment in the Netherlands

O’Reilly (1983) indicates that the quality of decision-making increases with the decision-maker’s information level. However, if the quality of information itself is hard to evaluate, information behaviour (information seeking and information encountering activities) can have important signalling effects on observers (Feldman & March, 1981). “Signalling” has been considered as one of the most important strategies for solving asymmetric information problems in the job market and capital market, (e.g. Gertner et al., 1988; Spence, 1973).
general idea behind signalling is that one party (the informed party) conveys some meaningful information (signal) about itself to another party (the under-informed party). Due to this extra information, the under-informed party is able to classify the counterparties as good or bad and make sensible selection decisions. "Screening" is another way of dealing with adverse selection, but in contrast to signalling, the under-informed party moves first. It means that the under-informed party can induce the other party to reveal its information, for instance by providing a menu of choices in such a way that the choice depends on the private information of the other party (Rothschild & Stiglitz, 1976). An example from the job market: a job candidate will send his CV with education level and working experience to the employer to signal that he is the most suitable candidate; at the same time, employers will arrange their own interviews and assessment procedure to screen the candidates and test their abilities.

### 8.3.1 Research methodology and process

In our case study we investigate a possible solution for the AEO adverse selection problem. We undertook in-depth interviews with DTCA on their general AEO assessment approach. Semi-structured interviews were used as the primary method for the data collection (Eisenhardt, 1989b; Yin, 2003). We conducted seven interviews with Dutch TCA and attended one auditing visit with Dutch TCA to an AEO applicant company (an international petrochemical company). In total we interviewed ten persons from DTCA and three from the company. The interviewees typically have an auditing or EDP auditing background. Interviews were tape recorded with the informants’ prior agreement, then transcribed for each participant’s feedback and our analysis. We discovered that IT-enabled risk management may effectively eliminate the information asymmetry for G2B relationship building. Dutch TCA has adapted risk management as part of their audit procedures. They view it “as a structured process, consisting of well-defined steps, according to which a systematic identification, analysis, prioritization and treatment of risks is taking place, so as to support improved decision-making” (European Commission (Fiscalis Risk Analysis Project Group), 2006). The so-called IT-enabled risk management has two meanings: first it means that information technology and information systems are the main focus for the assessment, and second it refers to automated IT support, in the form of decision support systems, for the general risk management approach. In this case, Dutch TCA assesses the IT maturity level of the companies, and uses it as one of their major decision criteria for AEO certification. Moreover, Dutch TCA deploys as much IT facilitation as possible to make the risk management more efficient and effective. The major findings of our case study are given below.

### 8.3.2 Research findings

#### 8.3.2.1 Finding 1: IT as an effective way of signalling for businesses

Application of advanced IT may serve as a effective way of signalling for businesses to indicate their types, which will enable the government to effectively differentiate “good” from “bad” companies for certification. One of the major concerns for the government in the AEO certification is the supply chain safety and security. Gutierrez and Hintza (2006) argue that
supply chain security can be implemented via facility management, cargo management, human resource management, information management, and business network and company management systems. IT facilitation can enhance all five perspectives:

1) For facility management, the use of IT has greatly improved inventory management and control. IT-based access control procedures and technologies (e.g. public key infrastructure (PKI) security and smart cards) enhance facility protection and monitoring functionality;

2) For cargo management, the use of cargo tracking and tracing and anti-tampering technologies (e.g. bar code, Radio-frequency identification (RFID), Global positioning system (GPS) tracking and smart container seals) and cargo inspection technical solutions have enhanced cargo management;

3) For human resource management, most modern organizations apply Enterprise Resource Planning (ERP) system for better HR management, information dissemination and responsibility assignment;

4) For information management system, real time information recording and secure data exchange have been adopted by many organizations;

5) For business network and company management system, most companies have already built up a company security management system and business partner evaluation system for better risk management.

IT-based control for supply chain security can significantly lower labour costs and data error rates associated with scanning items and extend identification to individual items. The systems can provide quality information that enables companies to track literally billions of objects across the value chain, increasing the efficiency of individual processes, improving asset utilization, increasing the accuracy of forecasts and improving the ability of companies to respond to changing conditions of supply and demand (Davenport & Brooks, 2004).

In our case study we find that there are two main signals that a company can send to the government to prove the company’s security status: 1) the use of integrated IT applications for supply chain management (e.g. properly implemented ERP system, just-in-time (JIT) programs, electronic data interchange (EDI) and point-of-sale data-sharing programs) and, 2) the use of IT applications for security control (e.g. application of GPS, Radio Frequency Identification (RFID) and smart seal technology). To apply for AEO status, companies must first do a self-assessment. Part of the self-assessment is a risk analysis, detailing the security threats and their impact for a specific company. In addition to the above-mentioned general IT systems, companies can also run the self-assessment via an automated toolset, which is yet another enhanced signal to the government. In our case, an automated self-assessment tool “Digiscan”, developed by Deloitte, was used. The Digiscan tool is an expert system that is based on the AEO guidelines and criteria issued by the EU. It is a rule-based system, helping companies to identify cases of potential Customs-related risks in their own organization. The system consists of facts, decision rules and a rule interpreter. All facts are stored in a database and the evaluated risks are described in abstract mathematical rules. A rule consists of one or more facts (preconditions) connected with each other and with actions. Rules in the form of IF “x” THEN “y” are particularly suitable. These rules are the basis for the computer-assisted analy-
sis of risk cases. Digiscan supports the company’s AEO self-assessment in an interactive question-answering style. The system generates, based on the AEO Guidelines, a sequence of questions that help the company to improve the quality of their self-assessment. As Digiscan supports a risk-based, systematic and objective description of the business, the quality of the business self-assessment can be perceived better when Digiscan is used. The end result of the Digiscan supported self-assessment is a summary result which ranks the company on a 1-5 scale for various risk indicators. This summary can be used by Dutch TCA for further evaluation. The value of automated tools to assist in self-assessment is currently being explored. Potentially, such tools could enhance the reliability of the self-assessment. Using the tool would then count as a signal that the company takes compliance seriously. However, the current version of the tool, an automated questionnaire, may not be sufficient for Dutch TCA to conduct a thorough risk analysis and self-assessment. Therefore, Dutch TCA and Deloitte are currently discussing adjustments, both to the tool and to the way its evidence is being used in auditing.

8.3.2.2 Finding 2: IT support for effective screening by the government

Instead of passively receiving “signals” from applicants, Dutch TCA also actively screen companies by including the specific IT requirements in the AEO selection criteria that all applicants have to satisfy in order to get the certificate. In our research project we discovered in various cases that two principles are essential for explaining the supporting role of IT for AEO self-assessment: (1) Real-Time Monitoring and (2) Information Sharing. Real-time monitoring means that IT is used to monitor continuously the location and state of the cargo. For example, in one of the pilot projects that are part of our research project, a smart container seal, TREC54 (Tamper-Resistant Embedded Controllers), was introduced. The TREC sends information via encrypted GSM or satellite communication about the precise location and unauthorized opening of the container (opening without proper digital certificate). This information is typically received by the owner of the container or the carrier who is transporting this container. However, if this TREC information can also be shared with the TCAs, the government will have most of the relevant information needed to execute its fiscal and security control tasks. Information sharing is done via a service-oriented architecture that gives the Dutch TCA direct access to the databases of the owner and the carrier, so as to read the stored TREC data about the container.

Hence, if this type of IT is referred to in the AEO self-assessment of a company, the government knows that containers from such a company are unlikely to be used to smuggle goods, hence they do not have to physically inspect these containers at the border. In this way, the right type of IT can support the AEO certification process. to avoid being biased towards specific IT vendors, Dutch DTA will not require specific IT solutions but they could recommend generic types of IT solutions, like smart container seals or service-oriented architecture. The adverse selection is tackled by means of risk-based and IT-enabled screening from the

54 Refer to: http://www.rfidjournal.com/article/articleview/1884/1/1/
government side and internal control signalling from the business side.

8.4 The business model and process for AEO risk management

It is agreed that a systematic and clear step plan is required for the auditors in the AEO certification process to make an un-biased professional judgment. Our findings from the interviews indicate that Dutch TCA relies mainly on a risk management approach for the AEO certification. The purpose of using a risk management approach is to focus Customs control activities and their limited resources on specific risks that are not sufficiently covered by measures taken by the businesses. Therefore, they have to assess the economic operator’s organization, processes, procedures, administration and so on. The main approach used by Dutch TCA is the AEO COMPACT guideline (European Commission, 2006a), which requires that the AEO applicants implement, in accordance with their business model and risk analysis, the systems, procedures, conditions and requirements established in the Community Customs Code and the AEO Guidelines (European Commission, 2006a).

However, the AEO certification is progressing rather slowly in the Netherlands, as it is in other EU countries. One of the major reasons is the lack of an explicit business model supporting the whole assessment procedure. There is an emerging need to build a well-considered business model that may indicate the underlying issues and show the strategic links of the TCA's key visions (enhancing government relationship with businesses and citizens), strategies (building collaborative relationships with trusted businesses) and strategic objectives (increasing trade efficiency and lowering administrative burden) and critical success factors/barriers (overcoming information asymmetry problems of moral hazard and adverse selection), as well as policies and actions (utilizing IT-enabled risk management approach and process for AEO assessment).

Based on the findings of the case study, together with the Dutch TCA we investigated relevant issues and built the business model and process for the AEO assessment, meeting the above requirements. Using Unified Modelling Language (UML) we present in Figure 8.3 the business model for risk management and the underlying AEO certification process, which we extracted based on our interviews. In our research model, we emphasize on the IT facilitated steps (steps with a * sign at the beginning), especially, we list specific IT enablers being utilized in each step to show on how IT enables signalling and screening for a more efficient and effective AEO assessment procedure55.

a) Determine fulfilment of formal (legal) conditions

As the first step of AEO assessment, DTCA have to determine whether the formal conditions related to the procedure or facilitation for the company have been fulfilled. If the applicant cannot fulfil the formal legal conditions, the application will be refused.

b) *Understand the business (of an operator) through examination of:

55 For more a detailed illustration of the approach please refer to our project deliverable (D3.3, pp 23-38) at www.ITAIDE.org.
• *Customs internal sources*

  ❖ **IT enabler:** primarily based on Dutch TCA’s own internal database (National Risk Database) and filing system (RBpro) for effective internal screening.

  ➢ *The National Risk Database (RDB)* is a computerized method for recording and considering risks in the fiscal process. The RDB application is accessible to all staff members of the Dutch TCA. In the RDB the whole ‘lifecycle’ of a risk is recorded (see Table 8.1).

<table>
<thead>
<tr>
<th>The name of the risk</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of the risk</td>
<td></td>
</tr>
<tr>
<td>Legislation related to the risk</td>
<td></td>
</tr>
<tr>
<td>The nature of the risk</td>
<td></td>
</tr>
<tr>
<td>How did the official find out about the risk?</td>
<td></td>
</tr>
<tr>
<td>Are there any indications that this risk often occurs?</td>
<td></td>
</tr>
<tr>
<td>In which sector was the risk detected?</td>
<td></td>
</tr>
<tr>
<td>Is there any information about the gravity and financial importance of the risk?</td>
<td></td>
</tr>
<tr>
<td>What is the best way to detect the risk?</td>
<td></td>
</tr>
<tr>
<td>What is the best way to cover the risk?</td>
<td></td>
</tr>
</tbody>
</table>

**Table 8.1. Detailed risk table in the National Risk Database**

After introducing the risk, the results of coverage are recorded in RDB in almost the same terms as used during the phase of the preliminary investigations. Every tax official can consult the risk database at any moment to see if a certain risk is already recorded, as well as what risks are recorded in the base.

  ➢ **RBpro** is an automated filing system which contains the entire AEO applicant’s existing Customs certificates, basic information of the company and its historic compliance record (e.g. whether the company has violated the law and to what extent). Information can also be retrieved from the company’s historic data profiles gathered from Customs import and/or export systems, VAT or other information from the tax services.

• *Customs external sources: via the Internet, companies’ annual financial reports, and auditors’ report on internal control, etc. and via communication with Chambers of*

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56 It was renamed “TOP” (Toezicht Ondersteuning Programma) in 2009 by Dutch TCA.
**Commerce and Central Statistics (under Dutch law, Dutch TCA has no right to access it)**

❖ **IT enabler:** Use of XENON web robot for effective external screening

➢ **XENON** is a business intelligence software tool, which has been used by Dutch TCA since 2004. It is an Internet (web) robot, which not only detects unknown tax evaders, but also other probable non-compliant events such as the unauthorized use of brand names or illegal diversion of trade.

XENON has three main components:
1) Basic Fiscal Search tool (Trainer): to set up company profiles (what to look for).
2) Web robot (Crawler): to search the Internet for sites which meet the profile set by the trainer according to various parameters. Parameters can be set to determine how deeply links have to be followed, the maximum number of sites that have to be found and how long XENON has to search the Internet. The results are filed and can be analyzed.
3) Web Identification Tool (WebID): to support the identification of the website’s owner.

c) **Clarify the Customs’ objectives**

General and specified objectives of the Customs need to be clarified and mapped with the company’s situation.
- **General objectives:** are the fiscal as well as the security requirements of the Community Customs Code implemented?
- **Specify additional objectives based on the type of AEO certificate**

d) **Identify risks (what risks might influence the Customs’ objectives)**

Determine which of the potential risks are relevant for the particular operator, its business processes and supply chain.

❖ **IT enabler:** deploy business signal based on automated self-assessment (Digiscan)

In this step, Dutch TCA mainly uses the applicant’s AEO self-assessment summary to compare with the actual information achieved from the “understanding business” step to address the risk indicators and corresponding points of attention. The self-assessment summary is based on the AEO guidelines, which can be automatically assessed by the Digiscan tool. Digiscan deploys a rule-based system, with which it is possible to identify cases with potential Tax & Customs risks using a rule-based decision system. Risk indicators, risk description and important features to guide the Customs officials, as well as the operators themselves, are indicated in the Digiscan. Under further development, the Digiscan may effectively reflect the company’s information systems and internal control
maturity level, and thus it can be used by Dutch TCA for further decision-making and evaluation.

e) Assess risks (what risks are the most significant). This has not yet been fully implemented by Dutch TCA.

This step in the risk mapping approach is described by the AEO compact model (European Commission, 2006a) as follows:

- Prioritize the risks identified in step 3 by evaluating the impact on Customs objectives and the likelihood of the risk materializing.
- Assess to what extent the operator himself has taken measures to cover identified risks and how the operator prioritized the different types of risks.
- Construct a risk profile to provide a comprehensive picture of all significant risks.
- Reflect on the constructed risk profile

It is desirable to perform two separate risk mappings: first perform the mapping internally (within Customs), then perform a common mapping (together with the operator). However, we find out that this step has not yet been fully implemented by the Dutch TCA because the required techniques and time have not been available.

f) Field auditing

The pre-auditing having now finished, in this step Dutch TCA undertakes field auditing at the company’s offices. The purpose of this step is for Dutch TCA to update the company information and to verify whether the self-assessment of business is sufficient and to complete and check the quality of risk assessment of company. During this phase auditors determine whether the controls identified during the pre-auditing are being operated properly and in the manner described by the client.

g) Respond to risks: what to do about the (remaining) risks

Evaluate whether the AEO status is to be rejected or whether adjustments or improvements are to be made by the operator to cover the risk or to reduce it to an acceptable level.

Four risk response strategies have been identified:

- TAKE within the acceptable materiality
- TREAT (change the likelihood and/or impact of a risk)
- TRANSFER the risk to another party
- TERMINATE (avoid the risks by intensive controls and/or regular audits or do not grant the AEO status)

It is desirable to perform two separate risk mappings: first perform the mapping internally (within Customs), then perform a common mapping (together with the operator). However, we find that this step has not yet been fully implemented by the Dutch TCA because
the techniques and time required to undertake this step have not been available.

h) **Granting AEO status**

In this step Dutch TCA make decisions to grant AEO status based on the results of the audits.

- **AEO status is granted if there are no remaining risks or if the remaining risks can be covered effectively and efficiently by additional control measures.**

- **If too many risks remain or the remaining risks are too big to be covered effectively and efficiently by additional control measures but it is possible for the operator to take action to improve the administrative organization and the internal control system, it will be impossible to grant AEO status at this time. However, it may be possible after the operator has undertaken improvement actions, which must be checked by Customs in a second audit.**

- **AEO status will not be granted if too many risks remain or the remaining risks are too big to be covered effectively and efficiently by additional control measures and the operator is unable or unwilling to take action to improve the administrative organization and the internal control system.**

i) **Implement additional control measures**

If there are too many remained risks or the remained risks are too big to cover them effectively and efficiently by additional control measures but it is possible for the operator (and the operator is willing) to undertake improvement. Realising collaborative G2B business models actions regarding the administrative organisation and the internal control system, in this case granting of the status is not possible at that time, but it may be possible after the operator has undertaken improvement actions. These improvement actions must be checked by Customs in a second audit (including the common risk mapping procedure) to establish if remained risks from the pre-audit are now covered in a sufficient way and action in the end the status might be granted.

j) **Evaluation, facilitation and monitoring**

Last but not least, the status of an AEO is regularly evaluated and monitored by Dutch TCA and relevant facilitations are given to the certified operator.
A) Determine fulfillment with formal (legal) conditions

B) Understand the business

C) Clarify the objectives

D) Identify the risks

E) Assess risks

F) Field Auditing

G) Respond to risks

H) Granting AEO status

I) Evaluation and facilitation and monitoring

Figure 8.3. Business model and process for the AEO risk management approach
With the above business model and a step-by-step risk management process, Dutch TCA can now undertake AEO assessment in a much clearer and more objective way. More importantly, the role of IT and techniques used to counter the information asymmetry problems are clearly indicated in the model, which will help both policy makers and business participants realize the importance of IT and actively adopt the new technologies for more efficient assessment and evaluation.

8.5 Conclusions

Governments are looking for new models to collaborate with their business partners. They are looking for ways to create win-win situation, on the one hand to reduce the administrative burden for government and on the other hand to improve customer (citizens and businesses) satisfaction (e.g. trade facilitation and fast trade procedure). However, one of the key barriers to reaching such win-win is the problems caused by information asymmetry. Information asymmetry has been studied extensively in economics research, but has received limited attention in the e-government field. Two types of information asymmetry problems identified are moral hazard and adverse selection. Failing to distinguish and react to these two types of information asymmetry problem may lead decision-makers to adopt policies that are ineffective or even harmful.

In this chapter we applied the concept of asymmetric information, focusing on adverse selection problem, to analyze the relationship building between businesses and government with regard to security and trade facilitation. In particular, we investigated the role of AEO certificates in building trust-based relationships between the Tax and Customs Administration and businesses where information asymmetry exists. We argued that the risk management approach can help to mitigate the problem of asymmetric information. In particular, we argued that IT plays an important role in this risk management in various ways to make the AEO certification process more efficient and effective. With effective signalling and screening, IT can mitigate the adverse selection problem for G2B relationship building. A real life case of the AEO assessment in the Netherlands is discussed in the chapter. Using the illustration of a business model and process for the AEO risk management, we showed how IT plays an active role in the general risk management of the Dutch TCA for overcoming information asymmetry problems. The findings from this chapter may provide valuable knowledge to enable EU governments to further validate the AEO certification procedure and achieve a better understanding of G2B relationship building.
9. Using trust and reputation in government-to-business relationships: The authorized economic operator (AEO) as an example

Abstract

This chapter regards the government-to-business (G2B) relationship as a principal/agent relationship with asymmetric information. It brings about monitoring costs for the government, bonding costs for the businesses and a residual loss for society. In the case of government regulation these costs can be seen as transaction costs, which can be minimized in a trust-based design of the regulation. We illustrate this in a case study of Authorized Economic Operator (AEO) certification in the Netherlands. Being certified reduces Customs costs for businesses and moreover enhances their reputation of being a trustworthy trading partner. The costs of the loss of such valuable reputation act as a trigger mechanism in the repeated game of trust which is the solution to the fundamental problem of exchange of information in this G2B relationship. Hereto it is essential that the AEO certification and its reputation effect are sufficiently valuable so that certified companies are not tempted to cheat and that there is no adverse selection where only ‘lemon’ companies become certified. That is why governments should strongly promote AEO certification in order to exploit the network externalities and make it a worldwide standard. The use of IT and risk assessments can be helpful in this institutionalizing of AEO certification.

9.1 Introduction

Implementing government regulation requires coordination between the government and the business sectors. Public sector economics distinguishes various aims of regulation. One prominent aim is to repair market failure and internalise externalities. Examples of regulation are prescriptions with respect to safety and environmental standards, and provision of subsidies. Tax collection in order to finance government expenditure for the provision of public goods, or for reasons of redistribution, will also bring about a G2B relationship, where coordination is formalized in a set of laws and rules the government imposes to the business sector. The common characteristic of all of these G2B relationships is information asymmetry between the government and the business sector. Through regulation the government aims at reaching specific targets, which are optimal from the perspective of social welfare, but the business sector has more information about the effects of the regulatory measures and about how to cope with the regulation. It implies that government regulation can be considered a

\[57\] Note: This chapter is adapted from Frank A.G den Butter, Jianwei Liu and Yao-Hua Tan (2010), Using trust and reputation in government-to-business relationship: the authorized economic operator (AEO) as an example, submitted to Government Information Quarterly, March, 2010.
principal/agent problem under information asymmetry, with the government as the principal and the individual businesses as agents. Two major issues are at stake in the case of information asymmetry, namely moral hazard and adverse selection. Moral hazard occurs when an insured party as agent has an opportunity to take hidden action once an insurance contract is in effect; adverse selection is the result of asymmetric information prior to entering into a contract. Failing to distinguish between these two types of principal-agent problems may lead decision-makers to adopt policies that are ineffective or even harmful.

This chapter investigates how regulatory measures can be properly designed and institutionalized so that the costs of regulation can be minimized. More specifically, this chapter examines how a proper institutionalization of the mechanisms of trust and reputation can lead to a considerable reduction of the transaction (or implementation) costs of government regulation. Based on the principal/agent model, we distinguish three types of costs associated with the principal/agent character of the G2B relationship, namely monitoring costs by the government, bonding costs by the business sector and residual loss when the targets of government regulation are not fully met. Using transaction cost economics for our analysis of these implementation costs in G2B relationships allows us to focus our analysis on institutional aspects of government regulation. A further focus of the chapter is to make as much use as possible of information technology (IT). It allows institutionalizing the G2B relationship as an economically feasible trust and reputation-based interaction instead of the traditional command and control-based regulation. This suggestion for trust and reputation-based G2B relationship is elaborated with the example of Authorized Economic Operator (AEO), a certificate granted by the custom authorities to trusted businesses. It may substantially reduce costs for both Customs – the principal and business sides – the agents in this case. This trust and reputation-based institutional setup of the AEO on the one hand enhances security and control with less physical checking for the Customs; on the other hand, it may reduce the administrative burden and facilitate trade for the business. In our case study we point out that the new developments in IT can be used to reduce both monitoring and bonding costs, and thereby total implementation costs of government regulation. The major feature is to set up the G2B relationship – in this case the design and implementation of the AEO certification – as a repeated game of trust where reputation is built up in such a way that the sustainability of the coordination equilibrium in the game of trust is guaranteed by the high costs of loss of reputation in relation with the gains of cheating.

The contents of the remainder of the chapter are as follows. The next section elaborates how information asymmetry occurs between the government and the business sector and how government regulation can be seen as a principal/agent problem. Section 9.3 discusses the roles of trust and reputation as mechanisms to reduce transaction costs; and we compare two types of government regulations (control vs. trust-based) in respect of their implementation costs. Section 9.4 zooms in on the problems for implementation of AEO; and we present findings of a case study for the AEO assessment in the Netherlands. Section 9.5 discusses policy recommendations in order to make AEO regulations which enhance the reputation effect and which minimize the principle/agent problems; more government involvement is needed for expanding the AEO concept and gives it an international scope. In this way, the gains of the network externalities of the trust and reputation mechanisms can be fully grasped. Section 9.6 concludes.
9.2 Principle/agent problem between government and businesses: Transaction cost perspectives

9.2.1 Principal/agent problem between government and businesses

A principal/agent problem arises when one or more principals engage another person/group as their agent to perform a service/action on their behalf. Performance of this service/action results in the delegation of some decision-making authority to the agent (Eisenhardt, 1989a). This delegation of responsibility by the principal and the resulting division of labour are helpful in promoting an efficient and productive economy. However, to form any kind of relationship, information sharing is essential. In an ideal world we assume information is shared equally and transparently among the parties. However in the real world, due to lack of communication channels and hidden incentives for sharing or hiding information between parties, information is normally spread in an asymmetric way, thus one party has more or better information than the other party. Typically, two issues triggered by asymmetric information can cause principal/agent problems, namely moral hazard and adverse selection (as indicated in Figure 1) [see, (Akerlof, 1970), (Spence, 1973) and (Rothschild & Stiglitz, 1976)].

Moral hazard refers to situations where one side of the market cannot observe the actions of the other [see e.g., (Varian, 2002)]. For this reason it is sometimes called a hidden action problem. It arises because an individual or institution in a transaction does not bear the full consequences or can hide the consequences of its actions without the counterparty knowing it, and therefore has an incentive to act inappropriately. Tax fraud can be seen as a typical moral hazard problem in G2B relationships. For example, in VAT (Value Added Tax) collection, two parties are involved: a company – the agent – who is obliged to declare VAT and pay the tax; and a tax office implement tax regulations and collects the VAT – the principal. Under the assumption of perfect information, the tax office obtains complete information and knows exactly about the company’s operation; the company reports and pays the correct amount of VAT. However, in the real world the company has better information about its own operating details than the tax office and thus may have incentives to hide and may even falsify certain information from the tax office to get tax benefits. If such an incentive is present, or the penalty of defaulting is not severe enough, the company might choose tax evasion, thereby causing a moral hazard problem. EU governments have been experiencing severe loss from
various tax frauds. According to the European Commission (2006c), estimates of tax fraud range from 2% to 2.5% of GDP, which is about 200 to 250 billion Euro per year at EU level. Such tax fraud is a fitting example and can be interpreted as the moral hazard problem caused by the asymmetric information.

Another well-known example of moral hazard occurs in insurance. Here the insurance company as principal has less information than the insured – the agent – so the insured may cheat or behave less prudently than if he or she had not been insured. Insurance companies try to deal with these problems of moral hazard by specific conditions in the insurance contract such as an own risk or a premium which depends on previous claims. The problem of moral hazard also emerged in the credit crisis where banks were taking too big risks with the expectation that there would be a bailout in the event of default.

Adverse selection refers to a failing market due to information asymmetries between buyers and sellers, where ‘bad’ products or customers are more likely to be selected rather than ‘good’ ones. In his seminal article on signalling problems with asymmetric information, Akerlof (1970) gives the example of the second-hand car market. This is referred to as the ‘lemons problem’. Buyers of second-hand cars – the principals – typically do not have enough expertise to know the quality of a car: whether a car is a ‘lemon’ (bad car) or a ‘peach’ (good car). As a consequence they are willing to pay an average price that lies in between the lemons and peaches. However, with such a price, the car sellers – the agents which have good information on the different quality of the cars – are not willing to sell the good cars. As a result, only bad cars will be sold: the ‘lemons’ are crowding the ‘peaches’ out and will dominate the market. In the case of insurance companies only bad risks will try to get insured when the insurance is voluntary, whereas the insurance companies will try to select only good risks when the insurance is mandatory. In the first case the insurance company is the principal and the customer the agent; in the second case the authorities that make the insurance compulsory are the principals and the insurance companies are the agents. In both cases adverse selection is prevented by special rules and regulations. In the G2B relationship, adverse selection can occur when government bodies select business partners and grant certificates, as we will see in the example of trust-based AEO certification in Section 9.4.

9.2.2 Transaction cost perspectives

The concept of transaction cost is a central theme in the New Institutional Economics and most associated with the work of Oliver Williamson [see (O.E. Williamson, 1979; Williamson, 1985, 2000) for the overview of this field of research]. Transaction cost can be defined as the friction costs that appear while pursuing the gains of trade (Williamson, 1985). Unlike production costs, which can be analogous to the cost of building and running an ‘ideal’ machine, transaction costs are those costs which are incurred by departures from perfection, such as friction. Transaction cost economics aims to find the most efficient form of governance, in a trade-off between different instruments, depending on the degree of asset specificity, uncertainty and transaction frequency (Williamson, 1985). Lack of information and information asymmetry are the major causes of transaction cost.

In the introduction we mention that the perspective of transaction cost economics will be taken
as the theoretical basis for our analysis of the design of government regulation. However, in order to make this transaction costs perspective operational we should be more precise about what costs to include as costs of regulation. In order to avoid risks and failure, and in order to meet specific quality standards, firms will make costs anyhow. These are business as usual costs and should, of course, not be counted as costs of regulation. The same applies to the sheer transportation costs of passage through Customs in the case of calculating the additional costs of custom regulation. Therefore a benchmark for the costs of regulation is the situation that the aims of regulation are met with business as usual costs only, for instance because the external effects are internalised automatically (Den Butter et al., 2009a). Here, there is a clear analogy with the traditional assumption of neo-classical theory that trade transactions are for free. In reality transactions may bring about all kinds of transaction costs, which distort efficient allocation in the ideal general equilibrium. The same is true when government regulation is costly. Therefore we consider all costs of government regulation in excess of the benchmark of no costs or in excess of business as usual costs, as the transaction costs of government regulation.

Because of the information asymmetry, where firms have more information about the effort and costs to comply with government regulation than does the government itself, the relationship between the government and the business sector in the case of regulatory requirements can be seen as a principal/agent relationship. Here the regulatory authority (government) is the principal and the businesses which have to comply with the regulations are the agents. In doing so, our concept of transaction costs of government regulation are equivalent to the vertical transaction costs within the hierarchy of the firm, considered by Coase (1937). The principal/agent relationship allows us to distinguish three types of costs which are all part of the total transaction costs of regulation.

The first type of costs is the costs for the government itself. These are, in the principal/agent terminology, the monitoring costs. Some of these are administration or enforcing costs, but there are also additional costs which come with the design of the regulatory measures. Therefore the implementation or enforcing costs for the government are generally considerably higher than the amounts which appear in the budget (payment of subsidies, receipts of levies). The additional costs include salaries of civil servants engaged in policy preparation, implementation of regulatory measures and other monitoring activities. Monitoring costs also relate to subsidies which are not granted, and allowances for tax exemptions. Whereas the costs that appear explicitly in the budget can be seen as ‘hard’ transaction costs, the other costs can be seen as ‘soft’ transaction costs. Hard transaction costs are relatively easy to quantify and calculate, but soft transaction costs are not. They may, however, also appear in the budget, but implicitly.

The second type of costs is the bonding costs for businesses. Here all compliance costs as a consequence of the government regulation should be taken into account. They are the direct financial costs such as levies, but also capital investments and all other remaining costs incurred when meeting the obligations of laws and legislation. These compliance costs also include the costs of informing the government (sheer bonding costs, e.g., sending document, data exchange). Calculating total compliance costs can, however, be rather complicated. For instance, when firms are to meet the requirements of environmental legislation or of safety
regulations, they have to make all kinds of investments in the production processes and management procedures of the firm. These costs can only be partly counted as transaction costs of government policy, as some of these investment costs would be made anyhow from the firm’s own commercial perspective. So there is a need to separate these kinds of compliance costs into *external compliance costs*, which are added to the transaction costs, and *internal compliance costs*, which are not transaction costs originating from government regulation. Of course such a split between external and internal compliance costs has, to some extent, an arbitrary character and requires a good insight into the management of the firm. There are some practical examples about how to calculate these various types of compliance costs for specific cases (Nijsen, 2008; UK Government, 2008).

The third type of costs is much more difficult to assess, namely the *societal costs of the residual loss*. These arise because the reaction of the agents to government regulation will never be in complete agreement with the objectives of the government. The difference is the residual loss. We include the residual loss in our concept of transaction costs, as in the benchmark with perfect allocation at no costs there would be no residual loss either. Principal/agent contracts should be designed in such a way that the total agency costs (monitoring costs, bonding costs and residual loss) are minimized. It implies that agency contracts should not focus on reducing only one particular type of costs, but there should be a good balance between all three types of costs.

The above discussion shows that the agency theory provides an adequate framework for a categorisation of the transaction costs of government regulation. Total transaction costs of government regulation consist of the *netted sum* of the three components. The expression ‘netted sum’ indicates that, for example, subsidies granted by the government to private agents are counted as costs for the government, but as benefits (or cost reduction) for the private agents.

### 9.3 Role of trust and reputation in G2B relationships

#### 9.3.1 The fundamental problem of exchange and the game of trust

Transaction costs are associated with what Greif (2000) labels the fundamental problem of exchange. This fundamental problem is whether “*one can ex ante commit to being able and willing to fulfil contractual obligations ex post*”. In other words, a necessary condition for exchange is that for each partner in the exchange transaction there must be certainty that the other partner will keep its promise and deliver what has been agreed upon. Greif approaches this issue by stating that “*one will not enter into a profitable exchange relationship until the other party can ex ante commit to fulfil his or her contractual obligations ex post*”. Only under that condition can the exchange be mutually beneficial for both parties. This required security is often difficult to obtain because of a typical feature of many exchange transactions: it is *sequential*. It means that contracts and promises about delivery are made in advance of actual delivery and payment. This gives the party that is last to fulfil his or her obligations the opportunity to behave opportunistically and benefit at the expense of the other party. This problem becomes even worse when specific investments are required in a particular exchange
relationship. In this situation there is the threat of a ‘hold-up’. Such a hold-up – which is named after a raid on a stagecoach in the Wild West – implies that the last party to meet the obligations misuses the opportunity to change the conditions of the exchange to his or her advantage. In the case of a labour contract a ‘hold-up’ may happen where a worker who has had high learning costs in order to get acquainted with the work and become productive, demands at that time a higher wage, so that his or her boss is unable to recover these learning costs. The threat of a hold-up constitutes an obstacle to entering into an exchange contract and should therefore be avoided. However, such a hold-up can only be avoided when for both parties the transaction costs associated with keeping the contract are lower than those associated with breaking the contract. As we will see, this is an essential element in setting up the trust-based relationship in the AEO certification.

The fundamental problem of exchange thus essentially boils down to avoiding the opportunistic behaviour associated with the sequential character of the exchange. In game theoretic terms the fundamental exchange problem can be understood as a form of the prisoner’s dilemma. The optimal solution in terms of welfare for both parties – the Pareto-optimal solution – implies that both sides behave cooperatively. However, each party separately thinks that it is rational not doing so, which in principle results in a non pareto-optimal outcome. According to Grief, the solution of this problem can be found in the game of trust. The key point is that the game of trust must be played within an institutional framework as the rules of the game are fixed. Given an example of legal institutionalization, if enforcement of the rules established by a legal system is guaranteed, that the parties can trust them then they will be willing to play under these rules accordingly. This can be done on a formal (penalty) control basis, with the threat of penalties, fines and imprisonment to reduce the incentives for opportunistic behaviour. That is why trade institutions/ governments are needed in order to ensure that there is an optimal solution in the prisoner's dilemma, for example through the enforcement of costly penalties if a party does not comply with the contract. However, this solution is often not optimal; when enforcing and closing contracts, high costs and great information problems may occur. Especially in the case of international trade this problem is worsened by unfamiliarity with the law and/or gaps between different legal systems in different countries. A different and less formal way is on a trust (confidence) basis: the transactions take place in (business) networks where experiences are communicated effectively with trade partners. Given this reputation mechanism in both business and social fields, opportunistic behaviour can be prevented. The members of such trusted trade networks are often from the same family, clan or region, such as still exists today in Chinese trade networks (Rauch, 2001).

The role of trust in facilitating transactions can be understood from the ideas of Greif (2000). Close to Greif’s perception, trust can be defined as a set of expectations shared by the parties involved in an exchange process (Zucker, 1986), which alleviates the fear that one’s exchange partner will act opportunistically (Bradach & Eccles, 1989; Mahoney et al., 1994). There are other different understandings of trust under different context [see, (T3-Group, 2010)]. According to Jøsang et al. (2007), two common definitions of trust which can be called as reliability trust and decision trust respectively. Reliability trust can be interpreted as the reliability of something or somebody, Gambetta (2000) provides an example of how this can be formulated: trust is the subjective probability by which an individual, A, expects that another individual, B, performs a given action on which its welfare depends. This definition
includes the concept of dependence on the trusted party and the reliability (probability) of the trusted party (agent), as seen by the trusting party (principal). The second definition of trust is the extent to which one party is willing to depend on something or somebody in a given situation with a feeling of relative security, even though negative consequences are possible (McKnight & Chervany, 2001). The relative vagueness of this definition is useful because it makes it more general. It explicitly and implicitly includes aspects of a broad notion of trust which are dependence on the trusted entity or party, the reliability of the trusted entity or party, utility in the sense that positive utility will result from a positive outcome and that negative utility will result from a negative outcome, and finally a certain risk attitude in the sense that the trusting party is willing to accept the situational risk resulting from the previous elements.

Greif has shown that institutions play a crucial role in solving the game of trust and satisfying the basic condition for exchange, namely to be able to commit to a trade contract. In the early Middle Ages Jewish merchants – the ‘Maghribi traders’ – were bound to keep their promises on trade agreements through family ties and other social networks, even though their deeds could only be controlled much later because of the large distances and time-consuming travel. This institutional system of using family ties was later replaced by legal systems as institutions.

In these institutional solutions to the game of trust, trust may be a substitute for extensive negotiations and drafting of contracts which can bring about a lot of transaction costs and which are, from the economic perspective, never ‘complete’. Trust can be seen as an expectation about the future behaviour of the trading partner, where a false expectation may bring about considerable costs. When both parties trust each other, it implies that both parties expect cooperative behaviour from the other party and explicit or implicit compliance with the agreements.

In fact, in many circumstances trust between trading parties can be seen as a cooperative solution to a prisoner’s dilemma where the trigger mechanism built into the repeated game does not completely exclude cheating. So placing trust is not a free lunch, there is a risk involved. That makes agents cautious, so they gather reliable information about potential business partners (contact), carefully formulate the agreement (contract) and adequately monitor and enforce it (control). What do people indulge to accept these risks and to trust the other, or how can this risk be contaminated so trust can develop? To answer this question, we distinguish two main types of trust generating mechanisms, respectively with a formal and an informal basis.

In the case of formal trust we can for instance think of legal protection with respect to agreements between parties, where fines, or even the prospect of going to jail, can prevent opportunistic behaviour. This ‘formal trust’ is related to the rational choice concept of trust (Coleman, 1994) and extrinsic motivation (Frey & Jegen, 2001). Formal trust is closely linked to what is known by other authors as instrumental trust, rational trust, calculative trust (Williamson, 1993), self-interested trust (Lyons & Mehta, 1997), synthetic trust (Putnam, 2000), fragile trust (Lindenberg, 2000), narrow trust or egoistic trust (Nootboomp 2002) and, to some extent, system trust (Bachmann, 2001; Luhmann, 1979). All these notions of trust are related to each other, in the sense that they see this type of trust as being about the calculation of selfish interests in pecuniary terms. It expects that people take into account all financial
incentives involved, use a ‘rational way of thinking’ and are not ‘hindered’ by emotions. So, if it is profitable to cheat, one will cheat without remorse. People will act trustworthy when it pays to act trustworthy. The main idea of this approach is that the trust problem can be understood as a social coordination problem. To prevent both players from ending up in the Nash equilibrium outcome of the prisoner’s dilemma (both players playing the uncooperative or untrustworthy strategy), there are two solutions.

The first is to play the game an indefinite number of times. In other words, a repeated game is needed to solve the game of trust. This allows reputation effects to emerge. Trustworthy behaviour in the past forms a valuable asset, because it enhances the chance of finding future business partners. The reputation mechanism works best when the time horizon of the players is large, when there are many potential partners, and when information about past behaviour is easily accessible to all players. This forms an important reason why trading networks exist, as they fulfil these requirements. The second solution is to change the outcomes of the game in such a way that it becomes favourable for the players to act in line with the agreement. On a bilateral level, this can be organised by promising bonuses for good compliance, or by taking ‘hostages’ which are returned when the agreement has been fulfilled. Another way to invoke trustworthiness is by using intermediaries, for example banks that issue letters of credit. The most important way of solving the trust problem is of course by relying on the judicial power to enforce legal contracts. Threats of fines and imprisonment scare agents away from untrustworthy behaviour. So, according to this second solution a kind of contract, which is hopefully self-enforcing and prevents cheating, should preclude the traders from ending up in the non-cooperative prisoner’s dilemma solution of no trade.

It should be noted that these trust mechanisms on a formal basis cannot take away all risk. In the first place, bounded rationality and incomplete information make it impossible to make all necessary calculations. Moreover, the behaviour of other people is guided by fundamental uncertainty called free will (Nootenboom, 2002). Good prior intentions can always change when unforeseen circumstances occur. It has already been noted that legal contracts can be expensive, inherently incomplete, and possibly unverifiable and subject to the particularities of the addressed legal system. On top of this, too much emphasis on formal trust might hurt informal trust. When relationships are guided by too much formal trust, based on extrinsic motivations, this can ‘crowd out’ informal trust which relies on intrinsic motivation (Benabou & Tirole, 2003; Frey & Jegen, 2001; Ostrom, 2000; Tyler, 1998).

Trust mechanisms with an informal basis cover the relational and social-cultural mechanisms that build trust. Informal trust is based on intrinsic motivations (Frey, 1993). This type of trust is closely related to the concepts of social trust, moral trust, personal or blind trust (Williamson, 1993), socially-oriented trust (Lyons & Mehta, 1997), resilient trust (Lindenberg, 2000), broad or altruistic trust (Nootenboom, 2002), generalised trust (RD Putnam et al., 1993) and social capital (Fukuyama, 1996). The advantage of informal trust mechanisms over formal trust mechanisms is that one does not have to pay to keep afloat an entire legal system with its lawmakers, lawyers, judges and police. However, building informal trust can be a very difficult and lengthy process, especially when one wants to enter a group or network of which the membership ties are based on kinship, ethnicity, religion or place of birth. Microeconomic game experiments in laboratories suggest that these informal forms of trust are relevant to
explain human behaviour in some economic situations. A common conclusion of those experiments – often shaped as social co-ordination problems – is that people are indeed inclined to behave trustingly and trustworthy (guided by norms such as reciprocity and fairness), instead of playing the ‘rational’ strategy of non-cooperation. A related informal form of trust is based on common values and norms. Being a member of the same cultural or religious society may induce people to trust and be trusted without any formal guarantee. This form of trust can primarily be found in homogenous communities with common values and norms where the ‘institutional setting’ assures that, in the case of cheating, the community will provide a costly punishment. These communities can consist of family, close friends, colleagues and members of the same profession, but also of citizens from the same village, region or country.

It is difficult to judge which one of these different types of trust has most practical relevance. First there will be a substitution effect: when the legal system is better developed, the effects of corporate reputation and social networks are less important. Furthermore, there is complementarity: without a reasonably functioning legal system, reliance on an informal form of trust may also become more costly. In most practical situations there is generally a combination of two types of trust and their relevance may differ from situation to situation. In this respect, the question also arises as to what extent both types of trust rely on rational behaviour or not. Here the distinction can be made in terms of calculative trust and moral trust. As mentioned before, formal trust can be associated with calculative trust and rational behaviour. But it may be true that reliance on informal trust can also be regarded as rational. Rationality, in this case, refers to a balancing of the benefits and costs of cheating. For instance, when it has been very costly to build up a reputation of trustworthiness, and when by cheating this reputation gets lost whereas keeping the reputation will considerably reduce future transaction costs, it becomes rational not to cheat. This is exactly the repeated game character of the institutions for informal trust where a high price has to be paid for being expelled from the family or community, or for a loss of face. This may even explain why altruism has been detected in laboratory experiments with one-shot games: the rationality for doing so may be found in an intrinsic drive to conform to social habits, or even in a fear of ‘God’.

Trust is related to various forms of transaction costs. These transaction costs both comprise the costs made in order to establish trust based on formal institutions (contract drafting costs, investment costs in knowledge of foreign law, costs of monitoring arrangements, costs of legal proceedings for non-compliance) and to transaction costs associated with informal or relational aspects of trust (building common bonds and friendships, learning foreign languages and about foreign cultures). In terms of calculative trust all of these costs made to establish trust should be recovered by the lower transaction costs brought about by the reputation of being trustworthy. It should be mentioned that this building up of trust for trade relationships brings about positive externalities. Not only do the traders themselves benefit from it in the negotiation of a transaction, but the social welfare will also increase due to the benefits of specialization and scale effects which result from the additional transactions. This emphasizes that the provision of an efficient working (international) legal system and education in foreign languages and cultures has the character of a public good and should be considered a reason for involvement of the government.

The same applies to the building of a reputation of trustworthiness in a trust-based G2B
relationship. Here the reputation of trustworthiness, e.g. because of being certified by the government, can have a value of its own for the firm that receives certification. The network externality is that the reputation becomes more valuable with the increasing number of firms that have been certified. That is because the information on the significance of the certification becomes more well-known. Not being certified will, in such cases, be seen as a negative signal, and will make it expensive for non-certified firms to solve the fundamental problem of exchange. So the value of keeping the reputation of trustworthiness can prevent firms from cheating in trust-based G2B relationships as the costs of losing this valuable reputation are higher than the gains that can be obtained by cheating.

All in all, the literature on trust provides insights into some general mechanisms, which govern the relationship between exchange, transaction costs and trust. It can be summarized as follows:

1. Two types of trust can be distinguished: formal trust and informal trust. Both types are important in solving the game of trust.

2. Another distinction is between calculative trust and moral trust. Although at first sight calculative trust, which is considered to stem from rational behaviour, seems to be linked to formal trust, whereas informal trust can be identified with moral trust, this may not be true. In fact, many types of informal trust also stem from rational behaviour in the sense that cheating brings about less gain than the cost of losing reputation. Here the solution of the game of trust is institutionalized as a repeated game.

### 9.3.2 Using reputation in solving the game of trust

The previous section already describes the important role reputation has in the game of trust. Reputation is considered as one of the sources of trust: someone who has a good reputation is very likely to be trustworthy (T3-Group, 2010). Reputation is defined by (Jøsang et al., 2007) as ‘what is generally said or believed about a person’s or thing’s character or standing’ and it can be considered as ‘a collective measure of trustworthiness (in the sense of reliability) based on the referrals or ratings from members in a community’. Kreps & Wilson (1982) point out that under imperfect information, reputation is a powerful tool to solve dilemma in the repeated games. Resnick et al. (2000) argue that reputation can reverse this flow and ‘unsqueeze’ a bitter lemon (corresponding to the lemon market of the adverse selection problem as we discussed before). With clear reputation markers, low-quality sellers get lower prices, leaving a healthier market with a variety of prices and quality of service. For example, sellers with stellar reputations may enjoy a premium on their services; some users may be willing to pay for the security and comfort of high-quality services.

Furthermore, Resnick et al. (2000) suggest that reputation systems can solve the problem of dealing with strangers in online environments. A reputation system collects, distributes and aggregates feedback about participants’ past behaviour. Reputation systems can be called collaborative sanctioning systems to reflect their collaborative nature, and are related to collaborative filtering systems (Jøsang et al., 2007). The reason why explicit reputation sys-
tems are so important for fostering trust among strangers are twofold. First, when people interact with one another over time, the history of past interactions informs them about their abilities and dispositions. Second, the expectation of reciprocity or retaliation in future interactions creates an incentive for good behaviour. An expectation that people will consider one another’s pasts in future interactions constrains behaviour in the present (Resnick et al., 2000). Though few producers or consumers of the ratings know one another, these systems help people decide whom to trust, encourage trustworthy behaviour and deter participation by those who are unskilled or dishonest.

However, the power of the reputation effect depends on the nature of one’s opponents: notably on whether they also seek to acquire a reputation. In the G2B relationship building, as there are different types of businesses (reputable and opportunistic) existing in the market, the government needs to take the trust-based interaction with businesses as a long-term repeating game and make sure that in equilibrium the gains of violation will be lower than the cost of losing their reputation, thus negative gains for cheating.

9.3.3 Different solutions to the game of trust: Control based vs. trust based governance approach

As described earlier, in modern government-to-business interactions trust-based regulation and relationship building can be much more effective and efficient than the traditional control-based regulations in minimizing the transaction costs. Moreover, deploying the instrument of trust is fundamentally important for building a more collaborative and friction-free G2B relationship. However, carrying out this concept is not as straightforward as one might expect. If it is not designed and implemented correctly, potential financial and social loss can be caused due to moral hazard and adverse selection problems caused by information asymmetry between the government and businesses.

In order to overcome the abovementioned problems, government can deploy mainly two types of governance approaches: one is via a more traditional approach of command & control-based regulation [also referred as hard law/regulation, see (Abbott & Snidal, 2003; Skjærseth et al., 2006)], and the other is via a much novel approach of trust-based regulation [also referred as soft law/regulation, see (Chinkin, 1989; Kirton & Trebilcock, 2004)]. Das & Teng (1998) did extensive literature review and suggested that control and trust are two key sources of confidence in building partner cooperation. Control is an important concept in management; essentially control can be treated as any process in which one party affects the behaviour of others. Control can be seen as ‘a regulatory process by which the elements of a system are made more predictable through the establishment of standards in the pursuit of some desired objective or state’ (Leifer & Mills, 1996). Besides control, trust can be seen as a second source of confidence in partner cooperation. As organizations developed close bonds over time and form a positive attitude regarding each other's reliability, trust can be considered as the degree to which the trustor (principal) holds a positive attitude toward the trustee's (agent) goodwill and reliability in a risky exchange situation. Obviously, in the G2B relationship, the more the government believes in the goodwill and reliability of the trustee (businesses), the more
confidence in cooperation will be harboured.

Gribnau (2008) argues that the heart of the governance approach is a shift away from hierarchy to networks with continuing interaction between interdependent actors in order to exchange resources and negotiated shared purposes, problems, and solutions. The collaborative nature of the new governance is conveyed in the move from command and control to negotiation and persuasion. Thus, a vertical command and control approach may not suit a world of horizontal network relationships characterized by pervasive interdependence, such as G2B interactions in international trade.

Given examples in the Tax & Customs Administration (TCA) domain, regulations such as ‘transaction-based auditing’ and ‘100% scanning’ can be seen as (strict) control-based regulation; while the emerging concept of the ‘system-based auditing’ and ‘horizontal monitoring’ (also referred as ‘horizontal supervision’ in the text before 2007) are examples of trust-based regulation.

- **Control-based regulation**

  *Transaction-based auditing* is a traditional approach to auditing that is highly dependent on physical checks. In the traditional way of import/export checking, the outgoing pallets are compared with the information reported by the company about the transaction. Thus the checks are made on the level of transactions. While reporting the results of a single business, separate data sets are generated to comply with a push-based method of reporting to governments and/or other parties. A hierarchical vertical comply structure is created using separate information systems for upstream reporting to various governmental agencies such as the TCA and statistics office. Traditional source documents such as purchase orders, invoices and checks are used to perform a manual audit, which is very time-consuming.

  *100% scanning* is an extreme example of transaction-based auditing. According to the World Shipping Council (2007), ‘100% scanning’, or ‘100% container inspection’ is required by the 9/11 Commission Recommendations legislation, effective since July 2012, that all maritime cargo containers being imported into the United States must be ‘scanned’ at foreign ports of loading or they will be denied entry into the country. The legal text is ‘A container that was loaded on a vessel in a foreign port shall not enter the United States (either directly or via foreign port) unless the container was scanned by non-intrusive imaging equipment and radiation detection equipment at a foreign port before it was loaded on a vessel.’ However, this requirement was opposed by the Department of Homeland Security (DHS), Customs and Border Protection, present and former government security experts, the U.S. Chamber of Commerce, all major cargo shipper organizations, the ocean carriers transporting the cargo, as well as the European Commission and the governments of America’s trading partners. The US Government Accountability Office (GAO) report criticized this legislation as ‘a global disaster’ and that blanket scanning is not only bad for trade but also hinders the ability of the international community to improve supply chain security worldwide (GAO (United States General Accounting Office), 2008).

- **Trust-based regulation**
However, if companies have self-consciousness about their own problems and risks, and instead of being audited in a traditional way at a transaction level, they can enter a trust-based agreement with the TCA that the auditing can be done on simplified way on system level. The European Commission has developed the so called System-Based Auditing (SBA), which is a holistic approach to supply management that introduces ‘trust’ at transaction level based on enhanced control at the system level.

System-Based Auditing involves the assessment of the adequacy of financial, management, ICT and legality controls in operation to mitigate the risk within the system and ensure best value. Typically, these controls are enabled by IT such as ERP, tracking and tracing systems, surveillance cameras etc. One way for companies to convince the authorities that they are in control is to show how IT is used by the company to control its operations. This has even led to a new approach in auditing, the so-called System-Based Audit approach. Based on observations of Ha (2005) and European Commission (2007b), we define the System-Based Auditing as: System-Based Audit is an audit that relies on an in-depth evaluation of the internal control systems (IT and management) of the audited company. It deploys a risk-based approach and applies extensively the information system and Computer aided auditing technique during the auditing process. Instead of control on individual business transaction, System-Based Audit applies control to the management and accounting systems of the company including assessment of the adequacy of financial, management, ICT and legality controls in operation to mitigate the risk within the system and ensure the best value. Contrasted with the traditional audit approach where each individual business transaction of a company is checked, in system-based audit the IT systems that enable business processes are checked. Nevertheless, a systems-approach is more than just the simple use of ICT systems. Integration of the IT into internal control and management system of a company is the key.

Horizontal monitoring is an on-going project of in the Netherlands to carry out of the trust-based control by the Dutch Tax and Customs Administration (Dutch TCA), which intends to carry out supervision based on the confidence it has in the businesses that are worthy of that confidence (Dutch Tax and Customs Administration, 2006). Horizontal supervision aims to reduce vertical supervision (transaction-based control) that available capacity can be deployed to deal with other, less compliant, taxpayers. This means that the Dutch TCA is aiming at achieving closer cooperation with enterprises, organizations and other non-governmental bodies. This form of cooperation is known as ‘horizontal supervision’ and it may be laid down in the form of mutual agreement, which may result in greater efficiency for all parties concerned. By concluding such agreements manpower can be released, which the Dutch TCA can then go on to use to reinforce the supervision of other groups of taxpayers. Horizontal monitoring entails mutual trust between the taxpayer and the tax administration, clearer articulation of each party’s responsibilities and means of enforcing the law, and the establishment of and compliance with reciprocal arrangements (Gribnau, 2008). Certification and the introduction of the AEO are currently considered as types of horizontal supervision, which we will give detailed discussion in the following sections.

As argued by Den Butter, Groot & Lazrak (2009b), control-based and mandatory standard/regulation can result in the removal from the market of all products that do not comply
with the minimum control requirement. This results in (if the requirement is set high enough) sufficient quality of supplied goods. Trust-based and voluntary adopted regulation in combination with effective (certification) labelling\(^5^9\) can provide buyers with sufficient information on quality differences in a situation where both low and high-quality products are supplied. Therefore, both control and trust-based regulations are required, in a vertical and horizontal way (like a jigsaw puzzle) of safeguarding our trade environment. Furthermore, proper designing and implementing regulations can make information more symmetric and less incomplete, which may take away the problem of asymmetric information identified by Akerlof (1970), thus reducing the transaction costs and facilitating high volume and better transactions.

### 9.3.4 Comparison of transaction cost: Control based vs. trust based regulation

By combining the perspective of three types of transaction costs from the principal/agent with our aforementioned two types of governance approach applied in the Dutch Tax and Customs Administration (namely control-based and trust-based regulation), we undertake a comparative analysis\(^5^9\) showing what the expected cost changes can be by shifting from control-based regulation to trust-based regulation. As shown in Table 9.1, trust-based regulation may have clear advantages\(^6^0\) over the traditional control-based regulation in minimizing the transaction costs.

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<th>Regulation costs</th>
<th>Control-based regulation</th>
<th>Trust-based regulation</th>
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<td></td>
<td>*Transaction-based auditing</td>
<td>*System-based auditing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*100% scanning</td>
<td>*Horizontal monitoring</td>
<td></td>
</tr>
<tr>
<td>Monitoring costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Government)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cost of administration &amp; control system building and implementation</td>
<td>++ (Building new administrative system &amp; scanning tunnel)</td>
<td>+ (Linking existing gov. system with business and rely on business’ own control system)</td>
<td>–</td>
</tr>
<tr>
<td>- Hours and salaries of government officers</td>
<td>++ (Massive 100% physical scanning of containers on transaction level and extensive data analysis)</td>
<td>- (Lightweight auditing based on system level, IT facilitation with manpower release)</td>
<td>– –</td>
</tr>
<tr>
<td>- Fraud misdetection</td>
<td>+ (Unable to detect opportunistic behaviour of businesses causing tax lost, and breaching of trade security)</td>
<td>- (Fraud behaviour is corrected by businesses themselves as driven by their self-consciousness about its internal control level)</td>
<td>–</td>
</tr>
</tbody>
</table>

### Bonding costs

(Businesses)

\(^{5^8}\) Negative labels can be made mandatory by the government for producers of goods that do not comply with a standard. Positive labelling is used by firms to enable the consumer to distinguish (often more expensive) products that comply with high standards.

\(^{5^9}\) With ‘+’ indicating potential increase for corresponding cost, and ‘-’ indicating potential decrease in the cost

\(^{6^0}\) Under the condition that it is well implemented without distortion.
- Business cost for compliance management
  ++ (Build new transaction-based administration & control system )
  - (Maintaining and updating existing business systems for in-control signalling & better government monitoring)

- Hours and salaries paid to handle administrative burden
  ++ (Information is obliged send to government on each transaction base, mostly by paper, much manpower required)
  - (Information can be sent before transaction and in patch audited every month, done electronically, minimum manpower required but need highly skilled personal)

- Financial cost due to failed compliance
  + (Retributions; taxes, premiums fines, legal dues; loss for losing reputation)
  - (Negotiable with government if intentions for future improvement)

**Societal cost of the residual loss**
( Residual loss for both government and businesses)

- Cost of losing competitiveness
  + (Worsened competitiveness comparing to international environment, due to high cost of strict control)
  - (Trust-based and low-cost environment enhance competitiveness for both national government and business)

- Cost of losing trust
  + (Distrust among parties, difficulties in negotiation and collaboration)
  - (Trusted and easy-going talk between parties)

- Costs of government policy mismatching
  + (Cost resulting from the difference between government regulation and the government’s targets)
  - (Negotiable and collaborative characters make the regulation a mutual task for both side and improving through time)

**Netted sum**
++

Table 9.1. Transaction cost comparison of trust base regulation and control base regulation

In table 1, we assess different cost perspectives to carry out both types of government regulations. The government can use this analysis as part of the operation management, design and execute policies bringing net social benefit far surpasses social cost (e.g. control and administrative burden), thus create a ‘win-win’ situation.

To sum up, trust and reputation play important roles in the G2B relationship building. A trust and reputation-enhanced G2B relationship can dramatically decrease the transaction costs of both government and business and can have a positive social impact. Nevertheless, trust shall not be given as default; trust can be seen as a game of coordination and with calculative
characteristics. If trust-based government policy is not designed and implemented properly, problems like adverse selection may occur, worsening the trade environment and even increasing the transaction costs. However, remedies and solutions exist. In transaction cost economics, governance can be based on private and legal ordering mechanisms (safeguards) to protect against opportunistic behaviour (Williamson, 1985), two types of regulations (control-based and trust-based) are being utilized by the government. The game of trust can also be tackled by enhancing the reputation effect of the policy, where in the repeated game the gains of cheating are lower than the cost of loss of reputation. In the following section we discuss these issues in detail with a real life case study of AEO certificate assessment in the Netherlands.

9.4 The case of AEO

Designing and implementing traditional control-based regulation is not an unfamiliar topic for European governments; however, the discussion of trust-based regulation with reputation as a median is currently under the spotlight: What are the costs and benefits of trust-based regulations in comparison with control-based regulations and how they can be carried out effectively? We elaborate these issues in this section with a case study of Authorized Economic Operator (AEO).

9.4.1 Authorised Economic Operator (AEO): What, how and why

The Authorized Economic Operator (AEO) certificate may serve here as a good example of the use of trust and reputation in order to lower the implementation costs of regulation in a G2B relationship. Over the last few years, especially in response to the terrorist attacks in the USA on 11 September 2001, there has been an avalanche of trade security motivated control regimes. For example, the US-led C-TPAT (Customs-Trade Partnership Against Terrorism) and CSI (Container Security Initiative) programmes; the European Union’s Security Amendment to the Customs Code (648/2005/EC); the ISO 28000 standard for supply chain security systems; and the standards to secure and facilitate global trade framework of the World Customs Organization (WCO). The aim of these supply chain security programmes is to identify security risks before goods move. Underlying them is the desire of government agencies (such as Customs administration) to make efficient use of limited enforcement resources, enhance controls at the border, ensure that wealth-generating trade continues while extending controls up and down the supply chain (Grainger, 2007).

However, such a high level of trade control entails a high level of cost. Transaction costs arising from Customs activities are enormously high, reaching as much as 15% of the total value of goods traded. It is estimated that 1% reduction in transaction costs related to Customs activities would yield gains of $ 40 billion worldwide (OECD, 2007; Willmot, 2007). Global governments are trying to figure out a way to tackle this paradox, with effective control but lowered administrative burden from Customs activities.

Under these circumstances, the concept of the Authorized Economic Operator (AEO) has been developed within the EU. The idea of AEO is that Customs Administration in each EU mem-
ber state can establish partnerships with private sectors and certify them with AEO certificates. The involvement of the private companies in AEO will enhance the safety and security of international trade and the certified AEOs will enjoy tangible benefits such as fast Customs clearance and simplified procedures (European Commission, 2007a). AEO is in fact a new, enhancing Customs control instrument (by applying risk-based pre-selection of trusted trade parties and IT facilitation) without introducing any extra burden (but rather giving relief from the existing administrative burden) for both business and government. More specifically, AEO reflects the ‘win-win’ philosophy that governments delegate major control responsibilities to the collaborative and trusted businesses themselves, while in return these businesses benefit from trade simplification.

The collaborative relationship means to change the G2B relationship from the traditional ‘control and command’ to a more ‘trust-based’ relationship, which includes replacing the traditional labour intensive Customs controls with businesses’ ‘self-control’ on Customs issues. To realize this transformation, the EU Directorate-General of Tax and Customs has made a major effort to develop and promote the concept of the Authorized Economic Operator (AEO) for European businesses (European Commission, 2007a). The underlying idea is that if businesses can prove to the TCA that they are in control of the tax and security aspects of their own business processes, then they will be AEO certified by the TCA, which brings them the benefits of fewer physical inspections, fast Customs clearance procedures and trade facilitation by the TCA. The aim is to achieve a win-win situation for both government and businesses, with trade simplification and lowered administrative burden.

The idea of AEO is that Customs Administration in each EU member state can establish partnerships with private companies and certify them with the AEO status. The involvement of the companies in AEO will enhance a win-win situation for the safety and security of international trade: on the one hand government can do fewer physical checks and use limited personnel for other tasks, and on the other hand the certified AEO companies will enjoy tangible benefits such as fast Customs clearance and simplified procedures (e.g. containers of AEO companies will not be inspected by the Customs when they pass the EU border) (2005a). AEO can be seen as an extra Customs control instrument that enhances the Customs control while not introducing an extra control burden for the government. More specifically, it is a form of government that delegates certain control tasks to collaborative businesses and in return gives these businesses trade simplification.

A critical issue here is that the AEO certificate is quite unlike other governmental requirements; it is voluntary rather than mandatory: ‘It requires … no obligation for economic operators to become AEOs, it is a matter of the operators’ own choice...’ (European Commission, 2007a). Companies can make their own decisions on whether or not to qualify for the AEO certificate, based on company strategy. In addition, in spite of the facilitations AEO companies may have, the AEO certificate is not cost free. Companies have to make considerable investments (around 50K Euros for small companies, up to a couple of million Euros for large companies) to achieve and maintain the certificate. Hence, we can see AEO as a free will certificate ‘market’, with entry cost and associated benefit.

The problem raised here is that if the government cannot effectively differentiate companies
from the two streams, a similar adverse selection problem to that in the second-hand car market may occur. The ‘good’ (trustworthy and compliant) companies are not willing to join when they see no fair value for them to participate: as one of the interviewed companies (a Netherlands-based international brewery) said ‘We are already a compliant company with a good reputation, and our current procedure is simpler than that of others anyway, why should we invest more to get the AEO certificate?’ On the other hand, the ‘bad’ (opportunistic and fraudulent) companies may see opportunistic benefits (with less checking and simplified procedure may create chance for easier way of committing fraud), relatively less compliance cost than ‘good’ companies (they can make a false compliance report to show the fulfilment of the requirements), and thus are more willing to get the certificate (See Figure 9.2).

![Figure 9.2. Adverse selection caused during AEO certification procedure](image)

The original aim of the government is to focus control effort on potentially fraudulent companies, to limit the number of physical inspections and to simplify the procedures for trusted companies with an AEO certificate. As indicated in the interview with the Dutch Tax and Customs Administration (TCA): ‘If companies are already in good control themselves, why should we waste our resources to exert extra control on them?’ However, the consequences of the adverse selection problem may differ from the government’s expectation. The situation may even deteriorate: if more ‘bad’ companies obtain the AEO certificate but commit fraud nevertheless, a market of ‘lemons’ will be created and the public will lose their trust in the government, thereby causing more societal loss.

### 9.4.2 Case study: AEO certificate assessment in the Netherlands

On April 16, 2008, the first AEO certificates awarded to 19 Dutch companies. The introduction of the certificate provides both Customs and businesses an opportunity to work more efficiently. Though a great effort has been made\(^{61}\), due to lack of experience in carrying out trust-based regulations and the vagueness assessment guideline itself, there is still a big gap of

\(^{61}\) Including developing the most recent AEO guidelines to assist the AEO certification procedure (European Commission, 2007a)
common understanding between businesses and government for AEO implementation. The Netherlands is one of the leading countries in international trade and the Dutch TCA is recognized as one of the most innovative ones in the world, especially in the field of trade facilitation. The Dutch AEO certificate assessment practice is perceived to be well-established and effective by European Commission.

In our case study we investigate the Dutch AEO assessment approach; concerns, problems perceived by both parties and plausible solutions for tackling the issues. We undertook in-depth interviews with the Dutch TCA on their general AEO assessment approach. Semi-structured interviews were used as the primary method for the data collection (Eisenhardt, 1989b; Yin, 2003). We conducted seven interviews with the Dutch TCA and attended one auditing visit with the Dutch TCA to an AEO applicant company (an international petrochemical company, referred as PETRO). As PETRO has a lack of knowledge about application procedures and requirements of the AEO, it hired a large consulting firm (Deloitte) to assist in the assessment. In total we interviewed ten persons from the Dutch TCA and three from the company. The interviewees typically have an auditing or EDP auditing background. Interviews were tape recorded with the participants’ prior agreement, then transcribed for participants’ feedback and our analysis. We discovered that IT-enabled risk management may effectively eliminate the information asymmetry for G2B relationship building. The Dutch TCA has adopted risk management as part of their audit procedures. They view it ‘as a structured process, consisting of well-defined steps, according to which a systematic identification, analysis, prioritization and treatment of risks is taking place, so as to support improved decision-making’ (European Commission (Fiscalis Risk Analysis Project Group), 2006). The so-called IT-enabled risk management has two meanings: first it means that information technology and information systems are the main focus for the assessment, and second it refers to automated IT support, in the form of decision support systems, for the general risk management approach. In this case, the Dutch TCA assesses the IT maturity level of the companies, and uses it as one of their major decision criteria for AEO certification. Moreover, the Dutch TCA deploys as much IT facilitation as possible to make the risk management more efficient and effective.

The key focus of our case study is to find out how the Dutch government carries out the AEO assessment regarding it as a novel trust-based regulation. To map our research findings in a theoretical framework, we adopt inter-organizational framework of trust defined by Sako & Helper (1998). Three types of trust are distinguished:

- **Contractual trust** refers to a belief in a partner’s willingness to carry out its contractual agreements.

- **Competence trust** is related to the perception that a partner possesses the capabilities of doing what it is intending to do, and requires a shared understanding of professional conduct and technical and managerial standards.

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• **Goodwill trust** refers to the assumption that the partner will make an open ended commitment to take initiatives for mutual benefit while refraining from unfair advantage taking.

We argue that in order to effectively deploy trust-based instrument of regulation (such as granting an AEO certificate), one needs to have a proper evaluation scheme on counterparties’ behaviour, competence and goodwill. The following major findings emerge from our case study.

### 9.4.2.1 Less focusing on the contractual context of AEO certification in the Netherlands

Christensen & Gressgård (2002) argue that governance of cooperative arrangements involving exchange of money and products/services has to be based on clearly defined contracts, and such relations are therefore more often regulated by detailed contracts than are other types of relationships. However, in the G2B relationship, if the government decides to adopt trust-based regulation rather than control-based regulation, the focus shall not be at the contractual level. In the traditional control and demand method of government regulation, companies place their emphasis on the contractual document and legal text to comply with the government. Each violation or even a slight (unintentional) infringement of the contractual compliance will result in a severe sanction/fine. Businesses are more sceptical about initiating any cooperative relationship with the government in such a case. On contrary, under the trust-based AEO certificate, companies will have their own autonomy in applying decisions and in compliance level. There have been three levels of certificate of compliance defined by the AEO guidelines [see, (European Commission, 2007a)]. AEO applicant companies can voluntarily apply for the suitable level of certificate according to their own circumstances.

Therefore contractual level trust building seems less important for AEO in the Netherlands. The Dutch authorities rely more on the other two types of trust for the AEO assessment, which we consider in the following sections.

### 9.4.2.2 Competence trust signalling and the use of IT

Competence trust refers to one’s perception of whether a partner is capable of performing the activities that it is responsible for according to the cooperative agreement. It is important to be well informed about the potential partners before entering into agreements. This is particularly true for companies that do not have a strong brand name and reputation (e.g., SMEs). It is argued that provision of information by either of the parties has a significant effect of enhancing trust and reducing opportunism (Sako, 1998). O’Reilly (1983) indicates that the quality of decision making increases with the decision maker’s information level. However, if the quality of information itself can hardly be evaluated, information behaviour (information seeking and information encountering activities) can have important signalling effects on observers (Feldman & March, 1981). ‘Signalling’ has been considered as one of the most important strategies of solving asymmetric information problems in the job market and capital market, e.g., (Gertner et al., 1988; Spence, 1973). The general idea behind signalling is that one party
(informed party) conveys some meaningful information (signal) about himself to another party (under-informed party). Due to this extra information, the under-informed party is able to classify the counter parties as good or bad and make sensible selection decisions. ‘Screening’ is another way of dealing with adverse selection, but in contrast to signalling, the under-informed party moves first. It means that the under-informed party can induce the other party to reveal their information, for instance by providing a menu of choices in such a way that the choice depends on the private information of the other party (Rothschild & Stiglitz, 1976). An example in the job market, a job candidate will send his CV with education level and working experience to the employer to signal that he is the most suitable candidate; at the same time, employers will arrange their own interviews and assessment procedure to screen the candidates and test their abilities.

Application of advanced IT may serve as an effective way of signalling for businesses to indicate their types, which will enable the government to effectively differentiate ‘good’ from ‘bad’ companies for certification. One of the major concerns for the government in the AEO certification is the supply chain safety and security. Gutierrez and Hintza (2006) argue that supply chain security can be implemented via facility management, cargo management, human resource management, information management and business network and company management systems.

IT-based control for supply chain security can significantly lower labour costs and data error rates associated with scanning items and extended identification to individual items. The systems can provide quality information that enables companies to track literally billions of objects across the value chain, increasing the efficiency of individual processes, improving asset utilization, increasing the accuracy of forecasts, and improving the ability of companies to respond to changing conditions of supply and demand (Davenport & Brooks, 2004).

In our PETRO case study we find that there are three main signals that a company can send to the government to prove that they are competent of being in control (see Figure 9.3):

1) The use of integrated IT applications for supply chain management [e.g., well-implemented ERP system, just-in-time (JIT) programs, electronic data interchange (EDI), and point-of-sale data sharing programs];
2) The use of IT applications for security control [e.g., application of GPS, Radio Frequency Identification (RFID) and smart seal technology];
3) To apply for AEO status, companies must first fill in a self-assessment. Part of the self-assessment is a risk analysis, detailing the security threats and their impact for a specific company. In addition to the above mentioned general IT systems, companies can also run the self-assessment via an automated toolset, which is yet another enhanced signal to the government.

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63 In our case, an automated self-assessment tool ‘Digiscan’, developed by Deloitte, was used. The Digiscan tool is an expert system that is based on the AEO guidelines and criteria issued by the EU. It is a rule-based system, to supports companies to identify cases of potential Customs-related risks in their own organization. The system consists of facts, decision rules, and a rule interpreter.
Via IT enabled system and implementation, businesses in the Netherlands can signal themselves as trustworthy and as the same time have the capability to carry out their own control, the Dutch TCA thus uses this criteria as one of the major judgement for the AEO assessment.

9.4.2.3 Competence trust screening through risk management by the government

Instead of passively receiving ‘signals’ from applicants, the Dutch TCA also actively screen companies by including the specific IT requirements in their risk management approach that all applicants have to fulfil in order to get the certificate. Das & Teng (2001) argue that risk is the variable that connects trust and control, that trust and control jointly determine one’s perceived total risk. The risk-based approach to trust has gained increasing acceptance in literature (Gambetta, 2000; Mayer et al., 1995). Williamson (1993) suggest that we can even treat trust as a subset of risk that trust is a balance of benefits / risks and the goal is to maximize profits and to minimize costs. Risk can be referred either specifically to uncertainty, which means the variability in outcomes around the expected values or to the expected value of losses, which means the expected value of losses to be paid by the insurer (the expected loss) is high (Harrington & Niehaus, 1999).

In our study the Dutch TCA expects major two supporting role of IT for the AEO applicant companies to eliminate risks; namely (1) Real-Time Monitoring and (2) Information Sharing. Real-time monitoring means that IT is used to monitor continuously the location and state of the cargo. Information sharing is done via a service-oriented architecture that gives the Dutch TCA (possible) direct access to the database of the owner and the carrier, to read the stored data about the container and relevant commercial information. With this type of IT application referred by a company, the government will have confidence that containers from such a company are unlikely to be used to smuggle goods, and hence they do not have to physically inspect these containers at the border.

The extent of controls and trust that the government give to the business should be proportionate to the level of the assessed risk. A well-defined risk management approach is important for the government to determine where the greatest areas of exposure to risk exist, and supports management decisions on how to allocate limited resources effectively. Combining with the risk management approach, the Dutch TCA can focus Customs’ control activities with their limited resources, in particular, on specific risks that are not sufficiently covered by measures taken by the businesses. Therefore, they have to assess the economic operator’s organization, processes, procedures, administration, and so on. The detailed risk management approach of
the Dutch TCA is discussed in (Liu et al., 2009). It includes the following steps: (i) Determine fulfilment of formal (legal) conditions, (ii) Understand the business, (iii) Clarify the Customs’ objectives, (iv) Identify risks, (v) Assess risks, (vi) Field auditing, (vii) Respond to risks, (viii) AEO status granting and (ix) Evaluation, facilitation and monitoring. The combination of specific IT requirements and risk management approach provides the Dutch government with a good screening mechanism for selecting the right companies in the pool, thus decreasing the chance of market failure caused by information asymmetry (see Figure 9.4).

![Diagram](image)

**Figure 9.4. Competence screening from Dutch TCA to PETRO to prove “in-control”**

With the IT-requirements and risk management based screening approach from the government side and internal control signalling from the business side, the adverse selection problem discussed earlier can be effectively tackled. Figure 9.5 presents such changes (compared with Figure 9.2). Now let us assume there are two types of the opportunistic companies, namely, A and B. The difference for A and B is that A is a real “bad” one that only wants to cheat for the certificate to get benefit in the short term and with no intention to improve; though B is opportunistic, it has good intension to qualify for the AEO and improve its future business operation. In this case, the ‘real bad’ company A will not invest further in its internal control and IT system, as in order to pass the government screening the signalling costs of implementing the required IT solution will outweigh the short-run benefit of frauds. In this situation, A will most probably give up applying for the AEO certificate. In comparison, the company B has good intension to improve and further expand its future business. If it wants to have simplified tax and Customs procedure and decides to apply for the AEO certificate, it will be compliant with the IT requirements of the government. Moreover, the implementation of the advanced IT solution itself will enhance the ethical business operation for the company B, thus minimize the fraud possibilities and may finally transfer the opportunistic companies to ‘good’ ones. The correction effect of competence trust signalling and screening drives the market to a healthier condition that ‘good’ companies continue to join and the ‘bad’ ones leave.

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64 The Dutch DTA will not require specific IT solutions, to avoid being biased towards specific IT vendors, but they could recommend generic types of IT requirements as we discussed above.
### Businesses in “certificate market”

**Good (compliant) companies:**
- Facilitate and integrate with IT in supply management and security
- Run self-assessment
- Effective signalling to show “in control”
- Benefit from simplification and facilitation

**Bad (fraudulent) company A:**
- Implementation cost of AEO outweighs short-term fraud benefits

**Opportunistic company B:**
- Benefit from long-run trusted relationship outweighs implementation cost of AEO

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**Government**

**DutchTCA**
- Apply risk management approach
- Specify IT req.
- Promise to create a fair “certificate market”
- Effective screening “good” and “bad” companies
- Enjoy benefits from less administrative burden and better tax control, as well as enhanced G2B collaboration

**Signaling**

- AEO offer + risk management + IT req.
- Join and with incentive to collaborate
- AEO offer + risk management + IT req.
- Give up application
- AEO offer + risk management + IT req.
- Join, and IT implementation will limit fraud possibility and improve operation

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**Figure 9.5. How do competence trust signalling and screening in AEO certification counter adverse selection effect**

### 9.4.2.4 Goodwill enhancing via collaborative and proactive G2B interactions

Signs of goodwill (moral responsibility and positive intentions toward the other) are also necessary for the trusting party to be able to accept a potentially vulnerable position (risk inherent). The goodwill dimension of trust includes positive intentions toward the other, and positive intentions appear as signs of cooperation and proactive behaviour. The important point is that, over time, it is the actual behaviour of the parties that determines their reputation of being trustworthy (Sako & Helper, 1998). According to the European Commission (European Commission, 2007a), in order to assess the AEO status the Customs audit will rely on the informational rather than physical activities to form the core of security assessment. Results from our case study indicate that the aforementioned information is mainly achieved via proactive interactions between the government (DTCA) and the business (PETRO) as described in Table 9.2. Via such close interactions, the actual behaviour of the business will be perceived by the government (T3-Group, 2010).
### G2B collaborative and proactive interactions

<table>
<thead>
<tr>
<th>Government (DTCA) requirement</th>
<th>Business (PETRO) initiatives and responds</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Show us your risks (risk source + drivers)</td>
<td>• Run self-assessment (in our case, based on automated tool set of Digiscan) to identify risks (risk source + drivers)</td>
</tr>
<tr>
<td>• Show us your risk mitigating strategies</td>
<td>• Identify and document existing risk mitigating strategies</td>
</tr>
<tr>
<td>• Show us how you apply IT and internal control procedure to operationalize your business process and mitigate your risks based on the AEO guidelines with regard to: (1) Facility management, 2) Cargo management 3) Human resources management 4) Information management and 5) Business network &amp; Company management systems</td>
<td>• Identify IT and internal control facilitation of the supply chain security based on the AEO guidelines with regard to: (1) Facility management, 2) Cargo management 3) Human resources management 4) Information management and 5) Business network &amp; Company management systems</td>
</tr>
<tr>
<td>• Show us your internal (internal control) approach and inter-organizational (with supply chain partners) approach for supply chain security</td>
<td>• Document procedures in internal control and supply chain partner management system with regard to supply chain security</td>
</tr>
<tr>
<td>• Show us the remaining risks</td>
<td>• Determine remaining risks</td>
</tr>
<tr>
<td>• Show us how you plan to deal with the remaining risks (indicate documented IT control application)</td>
<td>• Plan/implement additional measures for the remaining risks</td>
</tr>
<tr>
<td>• In the future, open your ERP system allow DTCA to extract data from it</td>
<td>• In the future, open part of ERP system or extract a sub-system (without confidential commercial info.) and allow DTCA to read from it.</td>
</tr>
</tbody>
</table>

### Table 9.2. G2B interactions during the AEO assessment procedure

Clearly, the government to business (G2B) interactions on the AEO auditing are in line with our earlier discussion of system-based auditing. The AEO interaction is different from the traditional relationship of government and business which is based on one-sided government
control. The AEO is oriented towards trusted relationship building, where businesses prove to be ‘in control’ by themselves. The self-assessment run by the company is of great importance for the AEO assessment, as the DTCA mainly relies on the self-assessment summary result to identify the risks from the company side. In this case, PETRO applied an automated self-assessment tool (Digiscan) to prepare their self-assessment report. Digiscan provides a detailed set of standardized questions and automated risk-based scoring to assist companies assess their risks. In the next two sections we will focus on the findings with regard to the important role that information technology (IT) plays in the AEO assessment. We find that the emerging information technology imbedded in the business processes as well as in the auditing procedure can be used to reduce monitoring and bonding costs for both government and business, thus to enhance the sustainability of the coordination equilibrium in the game of trust and facilitated international trade.

9.5 Policy recommendations: More government involvement in enhancing the reputation effect of the AEO

To enhance the reputation effect of the AEO, the government needs to make the AEO certificate as a kind of quality standard, in such a way that the AEO certificate can be seen as a positive signal for qualified management and trade procedure in the market. When companies do business with each other, the AEO certificate should be able to guarantee that each AEO-qualified company satisfies the criteria listed. As the AEO certificate shows that the Customs authorities can trust a company, this will also give a signal to other companies that they can trust each other with the same certificate.

Four factors may influence the reputation effect of AEO:
- The popularity (awareness) of the certificate in the market;
- The reliability of the certification authority;
- The effectiveness of the controls and
- The international recognition among Customs authorities

● The popularity (awareness) of the certificate in the market

When more companies choose AEO certification, there will be more awareness from businesses of the importance of the certificate, as well of what criteria they have to meet. This creates a restorative effect for the network externality of the certification. As an illustration, a certificate of which the assessment criteria are unclear will provide little information over the way in which a business should carry out its transactions, and thus give little information over the reputation of that business. However, when everybody is fully aware of the assessment criteria of a certificate, it will provide the desired trustworthy information over a business that acquires this certificate.

The government can play a role by leading this effect through information campaigns. In fact, the greatest benefit can be achieved if the certificate can be recognized by the entire industry. For the government, this forms a part of the utilization of the network externality of the certification, where the value is of such a certificate is greater if more businesses become
certified. More companies certified leads to more awareness in the market and will result in a stronger reputation effect for the certification.

**The reliability of the certification authority**

The reputation effect also depends on the reliability of the certification authority. In the case of the European-wide AEO certificate it is located at national level of the Customs authorities. If many corruptions and biased judgments are present at national Customs authorities, the certificate will become a less effective tool for businesses to estimate and carry out trustworthy transactions with each other. Reliable and unbiased certification procedures backed up by the authority are necessary to make the AEO certificate function as a quality standard.

**The effectiveness of the controls**

The same counts for the effectiveness of controls. If the conditions of an AEO certificate are not being controlled effectively, the ownership of such certificate will have less effect on the reputation of businesses. With effective control from the government side, it will be more difficult for the businesses to circumvent without being noticed. It is therefore also in the best interest of an AEO certified company to keep an eye on the trading conditions of their partners, as in the modern network society one violation of the standard in the chain will endanger the reputation of the whole network of certified companies.

**The international recognition among Customs authorities**

Last but not least, the more Customs authorities recognizing the AEO certificate, the larger the reputation effect will be on the businesses. Currently the AEO certificate is only an EU development, however, if it can be mutually recognized internationally (especially in the US, Japan and China), it will bring more value and benefit for the businesses. Not only will the reputation effect of the AEO be enhanced in the international scope, since more business operations will be covered by the certificate through mutual Customs recognition, but it will also increase the direct profit as a percentage of the total cost of applying for and maintaining a certificate. At the moment, it is still difficult to predict whether the AEO certificate will become a worldwide standard; if it does, it will reduce worldwide transaction costs significantly.

### 9.6 Conclusions

In this chapter we have discussed major issues for G2B relationship building. We focused on the problems caused by the information asymmetry between the government (principal) and businesses (agent). We link the principal/agent model with transaction cost economics and distinguish three types of costs associated with the principal/agent character in the G2B relationship, namely monitoring costs by the government, bonding costs by the business sector

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65 This is based on the assumption that the cost of obtaining and maintaining a certificate do not increase when the certificate is internationally recognized.
and societal costs of residual loss if the targets of government regulation are not fully met. We clarify why the trust-based approach for governance is more transaction cost-effective than the control-based approach. However, we argue that a trust-based approach must be properly designed and institutionalized to minimize problems that may be caused by moral hazard and adverse selection. Good institutionalization is also needed to allow the game of trust to bring about a cooperative solution to the fundamental problem of exchange in the G2B relationship.

This chapter elaborates these issues with an example of Authorized Economic Operator (AEO). On the one hand, a trust and reputation-based design of the AEO enhances security and control with less physical checking for the Customs; on the other hand, it may reduce the administrative burden and facilitate trade for the business. The major feature for designing and implementing the AEO certification is to institutionalize it as a repeated game of trust where reputation is built up in such a way that the sustainability of the coordination equilibrium in the game of trust is guaranteed by the high costs of loss of reputation in relation to the gains of cheating. We further point out in our case study that the new ways of implementing IT systems and risk management can be used to build competency, goodwill and trust that reduce both monitoring and bonding costs, and hence decrease the total costs of a G2B relationship. Lastly, in order to make the AEO certificate a real success, we recommend there should be more government involvement in enhancing the reputation effect of AEO by increasing the awareness of the certificate in the market, enhancing the reliability of the certification authorities, improving the effectiveness of the controls and pushing the AEO certificate towards an internationally recognized standard. This government involvement is warranted as it can help to internalize the positive network externalities of AEO certification with respect to the reputation effect.
10. Evaluating IT innovations in a business-to-government context: A framework and its applications

Abstract

This chapter highlights the challenges of assessing the value of business-to-government IT innovations for both private and public stakeholders. Due to the different backgrounds of inhomogeneous stakeholders, potential adopters of business-to-government systems have varying requirements. In particular, they address understandings of value attributed to the implementation and the usage of such systems. Incorporating specific perspectives of each stakeholder in its own domain for evaluation is vital for supporting diffusion of IT innovations. The main contribution of this chapter is the development of a value assessment framework that combines the value understanding from both public and private stakeholders. Applying this framework not only allows the value assessment of business-to-government IT innovations incorporating different needs and requirements of various current stakeholders, but it also provides common and objective evaluation criteria on similar business-to-government IT innovations for potential adopters from both domains. We discuss the application of the proposed value framework in the case of e-Customs systems redesign based on an example of the introduction of e-Customs IT solutions in a Finnish multinational company.

10.1 Introduction

Today the e-business concept is used by a vast scope of business types, from traditional business-to-business (B2B) and business-to-consumer (B2C) transactions to, most recently, business-to-government (B2G) transactions. The development and diffusion of information and communication technology (ICT) and the underlying information systems (IS) supporting these inter-organizational contexts increasingly incorporate stakeholders from private business as well as from the public sector. ICT innovations in the business-to-government context are primarily reflected under electronic government (e-Government) subjects, which require intensive interactions between government and businesses. Combining business and government perception, E-Government is defined as:

The application of information and communication technology to improve, transform and/or redefine any form of resource and information exchange (transacting and contracting) between involved actors like companies and governmental agencies and their customers, suppliers or other partners, by developing and maintaining dedicated inter-organizational systems, virtual organizational arrangements and (inter) national institutional arrangements (Wassenaar, 2000,

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Scholl (2003) argued that e-Government is a special case of ICT-enabled business process change. Hazlett & Hill (2003) further examined how e-Government is being used in the delivery and improvement of public services in the UK, and they argue that government's two central aims – high quality customer service and value-for-money – could potentially be in conflict. There is insufficient evidence to demonstrate that the use of ICT in service delivery results in less bureaucracy and increased quality. Furthermore, e-Government is seen as an innovation because it redefines and improves transaction processing via an IT platform (Esteves & Joseph, 2008).

With respect to business-to-government innovations in the e-Government context, current initiatives of the European Union aim at building a strong pan-European economic area with simplified community trade procedures by providing, for example, a common standardized e-Customs system. Although multiple efforts and initiatives at national level exist to enable electronic communication between companies and government bodies, there are still no common standards and unified processes in all member countries of the EU. Reducing the administrative burden related to these issues is one of the core European strategies to strengthen the European economy. It foresees a complete integration between all European countries in terms of import, export and transit (European Commission, 2007). The integration of stakeholders from both private (e.g. commercial companies or technology providers) and public sectors (e.g. Customs and tax authorities) in the development of this type of IT system elucidates the challenges of a broader set of IT innovations in business-to-government contexts.

Potential stakeholders may ask why they should adopt such IT innovations with cost and investment especially in the B2G context. Each of the two parties may have completely different understandings on what the value of these innovations may be. For example, the understanding of value in public administrations and the resulting requirements to the system may differ from the value which private companies expect from a new system. As a result of these different understandings of value, the contexts of potential adopters might also be different. Without such common understanding, further adoption and diffusion of the IT innovations may be hampered in the B2G context. Subsequently, one of the major challenges is determining how best to measure and assess the value with the same method covering stakeholders from both public and private domains. However, a review of the literature indicates (Section 10.2) that there is a lack of development on this issue. Therefore, in this section we propose a value assessment framework of business-to-government IT innovations, which is applicable in both private and public domains.

The framework we developed consists of two main parts. The first part provides a value matrix, which establishes a comparable structure of different assessment categories and grants flexibility on particular specifications by identifying stakeholder-specific goal areas, key performance areas and indicators. The purpose of this part is to establish a common understanding as to what has to be assessed. Since we recognize that the first part is high-level and needs to be filled with stakeholders’ specific information, the second part of the proposed framework consists of a five-step procedure model. The purpose of this five-step model is to
guide the stakeholders through the challenging tasks of deriving specific assessment criteria, fulfilling the practical value assessment, and elaborating and communicating the results. Combining the two parts enables the framework to be applied in an effective and efficient way.

The rest of the article is structured as follows. Section 10.2, a literature review, provides an overview of different perspectives on value in private and public domains; in this section we also present relevant assessment frameworks in both domains, with special focus on the e-Government evaluation. Section 10.3 explains the research methodology and the case background. The case study involves an EU-funded project and is presented in this section. In Section 10.4 we present an integrated value assessment framework for IT innovations in the context of business-to-government. It combines the two interpretations, providing the content of the value assessment conceptualization and practical guidelines on how to conduct the assessment. Next, in Section 10.5, we apply the proposed value assessment framework based on the case study of the implementation of e-Customs IT solutions in a Finnish multinational company. To conclude, in Section 10.6, we highlight strengths and weaknesses of the approach, set a research outline for future work and discuss possible improvements of the proposed value assessment framework.

10.2 Review of value understanding in private and public domains

In this section we provide a literature review of existing value propositions and current assessment frameworks in both private and public sectors. We aim to review different value understandings in the two different sectors. Based on our practical experience and review of the literature, we found that there is a notion and understanding difference of value between the private and public domains. However, with respect to the differences identified, we argue that is also a common understanding as to the value in both domains so that it is possible to build a common value assessment framework. While the notion of value for private companies builds on a very long tradition (Mukhopadhyay et al., 1995; Renkema & Berghout, 1997), the understanding of value in the public domain has not been discussed frequently. For this reason, after a review of value in private sector, we focus on elaborating and comparing different notions of value and their corresponding frameworks in the public domain.

10.2.1 Value in private sector

When talking about private sector value, we normally relate to business value or company value. Most people’s first reaction to business value is to link to financial terms, e.g. cash flow, earnings or turnover. Indeed, money is the main equalizer of private sector valuation. Businesses use a sophisticated set of techniques to measure and manage value. Profit, revenue (turnover), cash flow, economic value added (EVA), net present value (NPV), and return on investment (ROI) are possible forms of business valuation (Brewer et al., 1999; McDonald & Siegel, 1986; Pindyck, 1988; Rogerson, 1997; Young, 1997). In a private market, value is created when a business uses resources (labour and intellectual, physical and financial capital) to deliver returns to shareholders, as the ultimate goal of a business is profit/shareholder value maximization. Moreover, we know the way in which such goal can be achieved: by producing goods/services that can be sold above the cost of production. Thus, most private sector valuation forms are inevitably related to economic value and measured in monetary terms. In
general, the economic value of something is how much a product (interpreted as physical goods) or service is worth to someone relative to other things (often measured in monetary terms). It can be either an evaluation of what it could or should be worth, or an explanation of its actual market value (price).

In the management literature, e.g. Drucker (1995), Tapscott et al. (2000) and Tsai & Ghoshal (1998), a company is seen as part of a larger network consisting of intra-organizational and inter-organizational relationships. Especially in the commercial context, these networks are sometimes called value networks or value chains (Allee, 2002; Drucker, 1995; Porter, 1985). Within such a network context, a broader notion of value is required, expanding the original financial value and integrating, for example, employee value, customer value, supplier value, managerial value and societal value.

Recent and past studies emphasized the need to analyze different factors that may influence the overall benefits of a company, i.e. not only from the economical viewpoint but also considering other perspectives. For example, Aladwani (2002) proposed a model that examines the role of social integration in system development projects. With this model he empirically proved that social integration has a positive impact on system development and project performance. Therefore, this model analyzes the success of a project from the social point of view. In addition, other authors dedicated their studies to the evaluation of company benefits considering different types of value (Dyer & Singh, 1998; Knox et al., 2000; Murphy & Simon, 2002; Shang & Seddon, 2002).

Shang & Seddon (2002) aimed to assess and manage the benefits of business company systems from the business manager’s perspective. In order to achieve this goal, they classified the benefits in five dimensions and built a framework; the five dimensions represent the operational, managerial, strategic and organizational perspectives and the IT infrastructure. The authors empirically tested their framework, analyzing 233 cases that consider 42 industries in 61 countries; they classified their results, i.e. the benefits of the implementation of business company systems, using the above-mentioned five dimensions.

Another example is given by Murphy & Simon (2002), who studied the case of a large computer manufacturer that aimed to assess not only tangible but also intangible benefits of IT investments focusing on enterprise resource planning (ERP) systems. In their work, information systems benefits have been classified with respect to several frameworks: tangible vs. quantitative, temporal, external vs. internal, hierarchical (strategic, tactical, and operational) based on organization factors and technology infrastructure standardization. For the benefits classification, they took the five dimensions proposed by Shang & Seddon (2000) and added the categories ‘tangible’ and ‘quantifiable’.

Table 10.1 summarizes the three above-mentioned frameworks for private value assessment. Due to the long tradition of value studies in the private sector, more frameworks and classifications are available in the literature. We selected only these three as they cover a large variety of value notions and perspectives on value in the private domain and since they are the most recent and include old studies. The literature review shows that some authors have already aimed to propose a framework that may classify the value in private sector not only in mone-
tary terms. However, these valuable studies only considered the value from the business company perspective, i.e. they only consider the private sector perspective.

<table>
<thead>
<tr>
<th>Framework</th>
<th>Reference</th>
<th>Brief summary of main conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aladwani’s model</td>
<td>(Aladwani, 2002)</td>
<td>Social integration has a significant positive impact on system development project performance; management support strategies designed to promote social integration in the form of integration-oriented training; rewards are positively related to social integration.</td>
</tr>
<tr>
<td>Shang &amp; Seddon’s framework</td>
<td>(Shang &amp; Seddon, 2002)</td>
<td>Five dimensions are considered for the classification of company systems benefits: (1) operational, (2) managerial, (3) strategic, (4) organizational, (5) IT infrastructure.</td>
</tr>
<tr>
<td>Murphy &amp; Simon’s framework</td>
<td>(Murphy &amp; Simon, 2002)</td>
<td>Classification of information systems: tangible vs. quantitative, temporal, external vs. internal, hierarchical benefits based on organization factors and technology infrastructure standardization.</td>
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</table>

Table 10.1. Frameworks for private value assessment

10.2.2 Value in the public sector

The concept of public value is mostly discussed in the public management/administration literature. Traditional public administration provides a particular set of solutions to the challenges of governance. It relies heavily on Weber’s (1997) political thought: three institutions (political leadership, party and bureaucracy) are seen as essential to coping with the ever-growing complexity of modernity and delivering order to the governance process (Held, 1987). The attention of public value was first drawn in the 1980s during the worldwide wave of public sector reforms. Since then, a new management philosophy has been used by governments to modernize the public sector, which is referred to as the New Public Management (NPM). Hood (1991) defined NPM as a move to more hands-on professional management in the public sector, more explicit standards and measurement of performance, greater emphasis on output rather than input controls, a shift to disaggregation of units in the public sector, a shift to greater competition and contract-based delivery of services, stressing private sector styles of management practice and using resources more sparingly.

New Public Management, when compared to traditional public management theory, is more oriented towards outcomes and efficiency through better management of the public budget. NPM addresses beneficiaries of public services much like customers (or private sector) and conversely citizens much like shareholders. However, the practice of NPM often emphasizes narrow concepts of cost-efficiency over other considerations. Those elements that are easy to measure tend to become objectives and those that are not so easily measured are neglected or ignored. A common problem for NPM is that it usually measures public services’ ‘efficiency’ in terms of the average cost of processing a given output rather than an expected outcome that matters to the public (e.g. measuring how cost-effectively a government website provides a quantity of information rather than the usefulness and relevance of the information to the
citizen). In this narrow sense, the improvement in efficiency does not contribute to the increase in the public value. In general, NPM could be understood as the transfer to the public sector of private value understanding and the related controlling and measuring approaches.

The concept of public value was developed to cope with the limitations of NPM and give a better view of government performance. According to Moore & Moore (2005), three quite different conceptions of public value exist:

(1) One conception involves the standard proposed by utilitarianism and welfare economics: public value equals the sum of individual satisfactions that can be produced by any given social system or governmental policy. It is this standard that we apply when we size up public policies in terms of the greatest good for the greatest number.

(2) A second conception of public value is the idea that public value is whatever a duly constituted government acting as an agent of its citizenry declares to be an important purpose to be pursued using the powers and resources of government. This is the standard used when we claim that public officials ought to be concerned with achieving the purposes they have been mandated to achieve through legislative action.

(3) A third conception of public value lies somewhere between these first two. Public value consists of important purposes that can enhance the degree of individual satisfaction enjoyed by members of a policy that will not necessarily be achieved by competitive markets operating by themselves, and which the polity has assigned government to help them achieve collectively for their individual benefit. In this conception, government is specially authorized and required to deal with a particular set of conditions where markets will not function well to maximize the sum of individual satisfactions.

According to Moore & Moore (2005), the goal of private managers is to create private (economic) value, while the goal of government agencies is to create public (social) value. The authors argued that the strategic problem for public managers is to imagine and articulate a vision of public value that can command legitimacy and support, while still remaining operationally feasible in the domain for which you have responsibility. In order to determine what constitutes public value and to act to produce it, a concept of ‘strategy in the public sector’ is developed. This idea is presented in the diagram ‘the strategic triangle’, which consists of the following three factors: task environment, authorizing environment, and operating environment.

(1) Task environment refers to the social conditions managers seek to change. The strategy must be substantively valuable in the sense that the organization produces things of value to overseers, clients and beneficiaries at low cost in terms of money and authority.

(2) Authorizing environment refers to the actors from whom a public manager needs authorization and resources to survive and be effective. The public enterprise must be able to continually attract both authority and money from the political authorizing envi-
Operating environment refers to the assets and capabilities entrusted to a public manager plus those that the manager can influence and that are required to achieve the desired results. It must be operationally and administratively feasible in that the authorized, valuable activities can actually be accomplished by the existing organization with help from others who can be induced to contribute to the organization’s goal.

Besides Moore & Moore (2005), other authors have dedicated their research to value assessment in the public sector, such as Emerson Wachowicz, & Chun (2000); Foley (2006); Kelly, Mulgan & Muers (2002); Cole & Parston (2006); and Cresswell, Burke & Pardo (2006).

In 1996 the Roberts Enterprise Development Fund (REDF) published a retrospective cost benefit analysis of the social purpose enterprises run by a non-profit agency in the San Francisco Bay Area. The study introduced the SROI (Social Return on Investment) framework. REDF’s SROI framework was specifically designed for social purpose enterprises run by non-profit organizations. According to Emerson, Wachowicz & Chun (2000), the SROI framework looks at value creation from the investor’s perspective and assumes that value creation occurs simultaneously in three ways along a continuum, ranging from purely economic to socio-economic and social.

**Economic value** is created when there is a financial return on an investment. **Social value** is created when resources, inputs, processes or policies are combined to generate improvements in the lives of individuals or society as a whole. However, it is very difficult to agree upon or to quantify the actual social value created. **Socio-economic value** measurement builds on the foundation of economic value measurement by quantifying and monetizing certain elements of social value and incorporating those monetized values with the measures of economic value created. SROI framework incorporates measures of economic value with monetized measures of social value to calculate socio-economic value.

In 2001, the American Social Security Administration (SSA) and General Services Administration undertook the task of developing a methodology to assess the value of e-services. Their report (U.S. Federal CIO Council, 2002) built the foundation for the Value Measurement Methodology (VMM). VMM is based on public and private sector business and economic analysis theories and best practices, and provides the structure, tools and techniques for comprehensive quantitative analysis and comparison of value (benefits) cost and risk at the appropriate level of detail. Three elements – **value**, **cost** and **risk** – are analyzed from different perspectives in VMM. It provides a framework and information for making trade-offs among different alternatives and for striving to **optimize value**, **minimize costs** and **diminish risk**. Moreover, VMM identifies five essential value factors: direct customer value, social/public value, government financial value, government operational/foundational value and strategic/political value (Foley, 2006).

In the UK, to assess the success of public service reforms, the cabinet office developed an analytical framework. In this framework, Kelly, Mulgan & Muers (2002, p. 4) defined public value as ‘**the value created by government through services, laws, regulation and other actions**’. They argued that in a democracy this value is ultimately defined by the public
themselves. Value is determined by citizens’ preferences, expressed through a variety of means and refracted through the decisions of elected politicians. Three categories, services, outcomes and trust are addressed as main components of public value.

In 2003, a group of Accenture executives in cooperation with the Harvard Kennedy School of Government developed the Public Service Value model (PSV model) from the global government practice. The PVS model provides “a baseline for comparing performance of a particular government agency over time and/or compared to other agencies” (Jupp & Younger, 2004, p. 20). They consider public value in public service organizations as the public service value and suggest that

Public service value is about more than simply attaining outcomes or just reducing cost; it is about doing both in a balanced fashion, and understanding the strategic trade-offs available along the way (Cole & Parston, 2006, p. 63).

They suggest that government managers should look at value from the perspective of the citizen who is the primary stakeholder and most important beneficiary of government activities. According to them, the public value is created based on two criteria: the outcomes they deliver and the cost-effectiveness they achieve. By focusing also on cost-effectiveness, high-performance government organizations strive not only to do the right things but to do them in the right way.

Cresswell (2006) presented the Public Return On Investment (PROI) framework for evaluating IT investments of the government. Contrary to most methods for assessing return on investment that focus on financial or economic metrics, the PROI framework includes a much broader view of how IT investments produce results of value to citizens or to society as a whole. In this framework, the government is an asset to the community or nation that delivers a wide range of values. Two sources of public returns are mentioned: (1) value to the public that results from improving the government itself from the perspective of the citizens and (2) value that results from delivering specific benefits directly to persons, groups or the public at large. The framework thus presents a more comprehensive way of describing public value, compared to the previously analyzed frameworks. The public value proposition is composed of six parts based on different impacts that government IT can have on the interests of public stakeholders: financial, political, social, strategic, ideological and stewardship. Table 10.3 summarizes the frameworks described above.

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<tr>
<th>Framework</th>
<th>Reference</th>
<th>Brief summary of main conclusions</th>
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<tbody>
<tr>
<td>Moore &amp; Moore’s framework</td>
<td>(Moore &amp; Moore, 2005)</td>
<td>Six points for describing public value from a managerial point of view.</td>
</tr>
<tr>
<td>Social Return On Investment</td>
<td>(Emerson, Wachowicz, &amp; Chun, 2000)</td>
<td>SROI framework looks at value creation from the investor’s perspective and assumes that value creation occurs simultaneously in three ways along a continuum, ranging from purely economic to socio-economic to social.</td>
</tr>
<tr>
<td>Value Measuring</td>
<td>(Foley, 2006)</td>
<td>Five factors describe public value: direct customer value, so-</td>
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Methodology (VMM)  
UK Cabinet (Kelly, Mulgan & Muers, 2002)  
Public Service Value (PSV) Model (Cole & Parston, 2006)  
Public Return on Investment (PROI) (Cresswell, Burke, & Pardo, 2006)  
cial/public value, government financial value, government operational/foundational value, and strategic/political value.  
Public value is the value created by government through services, laws, regulation and other actions.  
Public service value is about more than simply attaining outcomes or just reducing cost: it is about doing both in a balanced fashion and understanding the strategic trade-offs available along the way.  
Framework for evaluation of government’s IT investment.

Table 10.2. Frameworks for public value assessment

From the six evaluation frameworks noted in Table 10.2, we can conclude three major points: (1) Similar to the private sector, the public sector can also be seen as a service provider to its customers: the citizens. Its ultimate goals are to satisfy the needs and demands of citizens and to increase the total social welfare in general. (2) The existing evaluation methods for the private sector can be applied by the public sector as well. While economic (i.e. financial) value is an important aspect for public value assessment, it is not the only concern. Other values such as social and strategic/political value need to be taken into account as well. (3) Rather than the direct input-output analysis that occurs within the private sector, value assessment in the public sector focuses on input-outcome analysis. Outcome differs from output (direct products) in that it focuses on the actual impacts/benefits/changes to the organization. However, outcome evaluation is abstract and often difficult. ‘Cost-effectiveness’ is one of the most important criteria for such evaluation.

10.2.3 Bridging the gap of value assessment between private and public sectors

The existing differences between private and public sectors (Halachmi, 1995; Lachman, 1985; Stewart & Ranson, 1988) limit the application of current business knowledge and best practices in the public sector. The pending issue is to build a bridge that can transfer knowledge across the two sectors, which would then enable us to apply business knowledge to improve public sector performance; in other words, to create value in the public sector.

In her work, Halachmi (1995) argues that it is wrong to apply a pure economic value view when redesigning processes of public sectors. Three reasons are described: (1) Value in the public sector is not simply the price of the service (many public services are exchanged at zero cost to clients in high need), nor is it the cost of the inputs (although this is how the value of the public sector services is accounted for in the national income accounts). If we accept the view that value is what is considered to be value by the stakeholder, i.e. what brings satisfaction to the stakeholder, we are faced with the reality that value in the public sector must be multi-faceted and must encompass elements never to be found in private sector value analysis. (2) Even when a definition of value has been agreed upon in the public sector, organizational functions and procedures that do not add to value when performed in the private sector may have an inherent legal or symbolic value in the public sector. (3) While in the private sector the only objects of consumption which are recognized as important by the dominant stakeholders are, in most cases, the outputs or the outcomes of a service, in the public sector some key stakeholders essentially derive their value from consumption of the processes (e.g. groups
representing minorities who wish to ensure equal opportunities at work in public organizations) or the inputs (e.g. professional associations which wish to maintain requirements for professional accreditation or qualifications in certain processes). It is necessary to pay particular attention to the widest possible definition of value when analyzing value added in procedure redesign effort.

As outlined in the introduction, e-Government is an application of ICT between actors like business companies and governmental institutions. Therefore, the notion of value of e-Government projects combines both the private and the public sectors’ perspective. In recent years, e-Government has become a topic of interest for many authors. Some researchers have dedicated their studies to the future of e-Government and its diffusion prediction. For example, Coursey & Norris (2008) compared five models of e-Government (Baum & DiMaio, 2000; Hiller & Bélanger, 2001; Layne & Lee, 2001; Ronaghan, 2001; Wescott, 2001) by conducting a study in the United States in 2000 and 2002. Based on this study, the authors affirmed that the proposed e-Government models do not accurately describe or predict the development of e-Government since they miss or ignore the fact that key barriers to e-Government adoption, such as lack of information, lack of collaboration among departments and security issues, exist. Furthermore, Dawes (2008) presented a study among 383 experts in 54 countries that aims to understand what the vision for future e-Government research and its investments is. As a result, Dawes categorized future themes in four main categories that are seen as key future e-Government fields: innovation, interoperability, confidence and relevance.

These two studies demonstrate how e-Government and its research gained importance. In addition, Lenk & Traunmüller (2002) stated that the evaluation of e-Government initiative is a significant topic of research. However, according to Kunstelj & Vintar (2004) the lack of formal methods for monitoring and assessing e-Government projects has led to a significant slowdown of country-level e-Government development.

Thus, establishing methods for e-Government evaluation are necessary in order to ensure its development. Several studies have already been conducted in the field of e-Government evaluation. For example, Gouscos, Kalikakis, Legal & Papadopoulou (2007) developed a conceptual framework for modelling quality and performance in the field of e-Government, combining private and public stakeholders. In this work the authors provided an overview of major stakeholders of e-Government services and modelled a framework for analyzing quality and performance dimensions.

Another example is the study performed by Jones, Irani & Sharif (2007). The authors studied e-Government evaluations, basing their findings on three case studies. They proposed an e-Government evaluation framework defining the following four themes as emergent in the provision of e-Government: decision-making, evaluation methods, performance assessment and practitioner concerns. The authors developed a diagram that relates the notions of the above-mentioned four themes to quantitative factors of responsibility, sponsorship, evaluation and prioritization; and to qualitative factors of ownership, adoption, evaluation and social factors. In addition, they affirmed that, in order to be appraised, evaluation should consider both direct and indirect assessment of the investment. The authors concluded with the affirmation that e-Government evaluation is an under-developed area and needs more research.
Finally, Esteves & Joseph (2008) presented a three-dimensional ex-post framework for the assessment of e-Government initiatives. The three dimensions are e-Government maturity level, stakeholders and assessment levels. The assessment levels consider the technological, strategic, organizational, operational, service and economic aspects.

All of these examples demonstrate that e-Government evaluation is a very complex process and depends heavily upon organizational and social dimensions. In the meantime, e-Government evaluation provides a natural bridge for ICT evaluation under the B2G context. This chapter aims to further contribute in this research area, by providing an integrated value assessment framework for ICT innovation evaluation involving both private and public sectors.

10.3 Research method and case background

According to Dedrick & West (2003), in order to understand the decisions involved in the adoption of e-Government, it is helpful to develop a framework through a qualitative study of a specific adoption case. In addition, Eisenhardt (1989) argues in her work that building theories from a limited number of cases is effective. According to these assumptions, we used a case study approach in order to collect qualitative data. The case study is based on the European-funded project ‘Information Technology for Adoption and Intelligent Design for e-Government’ (ITAIDE, IST-027829). In this project, many diverse stakeholders from academic, industrial and governmental institutions are involved. The main goal of ITAIDE is to provide a concept for a new e-Customs system, contributing first to the Single Window Access (SWA) (United Nations Economic Commission for Europe, 2005) and second to the Authorized Economic Operator (AEO) (European Commission, 2006). Both topics are addressed by the EU initiative ‘Electronic Customs Multi-Annual Strategic Plan’ that aims to reduce the administrative burden of trade transactions and increase security and control mechanisms (European Commission, 2007). ITAIDE considers the Customs situation in four different European countries, namely Finland, Netherlands, Denmark and Ireland, analyzing it from both governmental and business viewpoints. In each country, ITAIDE set up a Living Lab:

Living labs are a situated research methodology for sensing and prototyping at various different scales in real life contexts (Souminen, 2005, p. 1).

Living labs focus on ICT innovative services creation and involve stakeholders from both the public and the private domain (Shamsi, 2008). The scope of the ITAIDE Living Labs is to provide a concept for a new e-Customs system.

We based our work on the Finnish (Paper) Living Lab, which took place from January 2006 to July 2007, considering it as single case study. The main stakeholders of this Living Lab are a Finnish multinational company (MNC) and the Finnish tax and Customs authority. The MNC operates in the pulp and paper industry with production sites in 14 countries, 26,000 employees and a turnover exceeding €10 billion in 2007. The MNC and tax and Customs authority reflect the private and public sectors respectively. The focus of this Living Lab was on the redesign of solutions for business-to-government and domestic e-Government integration. These consisted of business processes, electronic documents, administrative processes and organizational
structures. The primary goals were to facilitate cross-border trade and to reduce administrative burden for the paper industry domestically. The investigations considered information accuracy and security of information from both stakeholders’ perspectives in order to meet, for example, the control requirements of Customs declarations. The Living Lab resulted in a complete redesign solution, including the implementation of different business processes (quotation, order, delivery and invoice) and the incorporation of the needs of the MNC and the public administrations.

During the redesign process, the benefits that the new e-Customs system can deliver to the two main stakeholders were a main topic of research. In this work we therefore aim to answer the following research question: ‘How do private and public sectors benefit from a business-to-government IT innovation such as a new e-Customs system?’ In order to answer this question, we conducted a literature review (Section 10.2), developed a value assessment framework (Section 10.4) and applied the developed framework to the Finnish case as a single case study (Section 10.5). The application of the developed framework consisted of the elaboration of data collected during six workshops and eight semi-structured interviews conducted between June 2006 and December 2007.

10.4 Integrated value assessment framework

In general, there are four identified categories of e-Government, which are based on the entities involved: government-to-citizens, business-to-government, government-to-government and intra-government (Evans & Yen, 2006). In order to focus our work, we concentrated on e-Government evaluation for business-to-government innovations. Business-to-government is currently defined as:

A category of delivery that focuses on the ability to reduce cost and gather better information. This allows the government to purchase items, pay invoices and conduct business in a more cost-effective method. This also assists the government in obtaining data to analyze to assist in decision-making. Some of the goals for this quadrant are the availability of online regulations for agencies and increasing electronic tax capabilities for business (Evans & Yen, 2006, p. 209).

Based on the literature study described in Section 10.2 and on our experience in the research project, in this chapter we present the value assessment framework that we developed for the assessment of IT innovations in the context of business-to-government systems. This methodology can be used by experts who are going to assess the value for stakeholders of private or public organizations created by the implementation of new IT solutions, which are promoted by a business-to-government collaboration. The proposed framework aims at combining both notions of value in the private and public sectors.

In Subsection 10.4.1 we introduce four different value categories based on the literature review presented in Section 10.2. In Subsection 10.4.2 we present the three levels we use in

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67 More detailed discussion of the integrated evaluation framework has been discussed in a previous paper [see, Liu et al. (2008)]; interested readers can also refer to the Appendices (a & b) we have provided at the end of this chapter.
order to arrive at the stakeholder-specific value assessment analysis: goal areas, key performance areas and key performance indicators. These two foundations result in the value matrix, which is the first constituting part of the value assessment framework (Subsection 10.4.3). In the last subsection, the second constituting part of the framework, the procedure model, is presented, and a detailed ‘guideline’ on how to establish the value assessment within the framework of the structure of the value matrix is provided.

### 10.4.1 Value categories

The literature review on value assessment in both private and public sectors provides us with a rich resource of perspectives on value categories to formulate an integrated framework that is applicable under the business-to-government context. Based on our research, we can see a great deal of overlap between various frameworks and definitions of value propositions, although different frameworks use different value compositions. The common denominator of various approaches is the following set of value categories for value assessment: financial value, social value, operational value and strategic/political value. These four categories represent a common view across various researchers and practitioners. In particular, Shang & Seddon’s framework (2002), Murphy & Simon’s framework (2002), VMM (Foley, 2006) and the PROI framework (Cresswell, Burke & Pardo, 2006) provide the foundation for these four value categories. Table 10.3 maps the relation between the proposed value categories and the studied nine frameworks; it specifies which value categories are considered by the frameworks.

<table>
<thead>
<tr>
<th>Framework</th>
<th>Social value</th>
<th>Financial / Economical value</th>
<th>Operational value</th>
<th>Strategic / Political value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aladwani’s model</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shang &amp; Seddon’s framework</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Murphy &amp; Simon’s framework</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Moore &amp; Moore’s framework</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Social Return On Investment (SROI)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value Measuring Methodology (VMM)</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>UK Cabinet</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Public Service Value (PSV) Model</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Public Return on Investment (PROI)</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**Table 10.3. Frameworks for private and public value assessment linked to the value categories**

Table 10.3 shows that none of the studied frameworks have included all value categories. However, for a comprehensive and accurate value assessment framework that takes into consideration both private and public sector, we argue that it is necessary to include all of them. We arrived at this statement based on the literature review provided in this work and the experiences gained in the Living Labs: stakeholders showed interest in all these value aspects with regard to e-Government.
Thus, the value categories we consider contain financial, social, operational and strategic/political perspectives and reflect the value of ICT innovation. In other words, we do not add a separate category of ‘ICT innovation’ for the evaluation, but we argue that ICT innovation drives the realization of the four value categories we propose in the framework. The categories aim to combine different values that may arise in both a public and a private context, especially in inter-organizational contexts such as business-to-government collaborations. Therefore, we think that the proposed value categories are adequate to cover most of the concerns: strategic planning for the business and political challenges for governments (strategic/political value), operational benefit from the procedure/process redesign in case of the implementation of new business-to-government solutions (operational value), social consideration of the public sector (social value) and private and public financial interest (financial value).

**Strategic/political value** implies impacts on personal or corporate influence on government actions or policy, or influence on political parties or prospects for current or future public offers, including impacts on political advantage or opportunities, goals and resources for innovation or planning. **Operational value** improvements realize operations and processes and lay the groundwork for future initiatives. **Social value** implies impacts on society as a whole or community relationships, social mobility, status and identity. Social and psychological returns include increased social status, relationships or opportunities, increased safety, trust in government, and economic well-being. Social value also includes typical issues from the private sector such as employee satisfaction. And finally, **Financial/economic value** implies impacts on current or anticipated income, asset values, liabilities, entitlements and other aspect of wealth or risks to any of the above.

We believe that these categories are able adequately to capture and combine both public and private understandings of value and their meaning in business-to-government contexts. The four value categories we identified reflect the theoretical understandings of public and private value. For the practical application of the proposed framework, we suggest extending these categories by using a second dimension containing goal areas, key performances areas and key performance indicators. The hierarchical structure of the goal areas, KPAs and KPIs is detailed in next section (10.4.2).

### 10.4.2 Three levels of analysis

The values to assess are identified done top-down by going through three levels of granularity. First, goal areas, the key goals of the stakeholders, have to be identified. Next, key performance areas (KPAs) have to be defined for each goal area. Finally, every KPA can be measured (on a quantitative basis) or assessed (on a qualitative basis) by one or more key performance indicators (KPIs). These goal areas represent the stakeholder perspective and are the basis for the assessment. Companies and public administrations, managers and employees are much more used to thinking in goals and business areas. Projects and assessments are typically done by measuring the level of fulfilling particular goals using performance areas and indicators. While the goal areas (and the related KPAs and KPIs) reflect the single stakeholder assessment of the project, assigning them to the value categories makes them comparable among multiple stakeholders and multiple projects. The basic idea of this three-level approach is first to
provide a value matrix that is comparable among different settings and second to give an assessment with key performance indicators that facilitates stakeholder-specific considerations of value for each organization. The three levels of analysis have to be seen as a pyramid (see Figure 10.1): at the top there are goal areas and at the bottom very specific key performance indicators that are used to assess the value.

Figure 10.1. Three levels of analysis

Goal areas (GA) are areas where key goals of the stakeholders are described in a generic way. The reason why we begin with the GA is that, based on our project experience, most of the IT innovations under the B2G context are driven by specific business objectives as well as government strategic goals and initiatives. This finding is in line with former research on objective oriented evaluations, e.g. Goethert & Fisher (2003) and Evans, Roth, & Sturm (2004). As IT innovations under the B2G context require a lot of involvement from both the business and the government, to reach a common understanding in the initial stage is of great importance for further collaboration between the two parties. The scope of the definition of these goal areas is therefore to provide a top level of analysis. These areas help the assessment keeping in mind the ultimate goals of the stakeholders. For each goal area the four value categories presented before are analyzed and a set of key performance areas and further key performance indicators are provided.

Key performance areas (KPAs) are areas for business success factors and improved performance of an organization. A KPA can be assessed by providing one or more key performance indicators (KPIs) which are all related to this specific area. This hierarchy enables a transparent and aggregated view of a large number of KPIs especially for big organizations with complex structures and heterogeneous business. For a strategic organization planning, the first step is to define goal areas and success factors on KPA level. Subsequently, goals and factors can be defined and refined by different KPIs.

Key performance indicators (KPIs) are quantitative or qualitative measurements which reflect business success factors and strategic performance of an organization. While the KPI concept stems from finance, where KPIs are quantitative and measurable, we found in case studies involving public sector organizations that KPIs can also be qualitative, e.g. acceptance of
standards (Burke & Cresswell, 2006; Cresswell & Burke, 2006a, 2006b; Cresswell, Burke, & Pardo, 2006; Dawes, Burke, & Dadayan, 2006; Pardo & Dadayan, 2006). Often more than one KPI is related to the same success factor. In that way different areas of interest can be evaluated to achieve specific organizational goals. KPIs may differ, depending on the character of the organization, i.e. public or private. They are usually long-term considerations or refer to a specific period during which their values will be collected, measured or assessed. To get comparable results, the way KPIs are assessed and measured has to be kept the same during the period of analysis.

10.4.3 Value matrix

Four value categories (strategic, operational, social and financial) and three levels of granularity in value assessment (goal areas, key performance areas and key performance indicators) have been presented in the foregoing sections. The aim of this section 10.4.3 is to illustrate how these concepts can be combined together creating a value matrix. The value matrix clarifies the understanding of the complexity of value assessment aiming to give a comprehensive overview of potential benefits derived from a new IT solution.

A value matrix has to be created for every stakeholder for whom value is to be assessed. The matrix is structured as follows: the columns represent the goal areas of the stakeholders and put them in relation to the value categories (rows), giving an overview of the key performance areas for each stakeholder (per combination of row and column, see Table 10.4). Once the matrix has been created, key performance indicators for key performance areas are defined in the matrix. As an assessment of the full value matrix may be very time consuming, stakeholders can define KPAs and KPIs that they wish to prioritize.

<table>
<thead>
<tr>
<th>Value categories</th>
<th>Goal areas (GA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>GA 1</td>
</tr>
<tr>
<td>Operational</td>
<td>GA 2</td>
</tr>
<tr>
<td>Social</td>
<td>GA …</td>
</tr>
<tr>
<td>Financial</td>
<td>GA …</td>
</tr>
</tbody>
</table>

![Table 10.4. Structure of the value matrix](image)

It is important to notice that the value matrix has to be created for every stakeholder, i.e. for private and public sectors. The goal areas may not be the same since different stakeholders can have different goals. Therefore, for a valuable and accurate analysis it is important to consider the diverse nature of the stakeholders with their different requirements.
10.4.4 Procedure model

The value assessment framework proposed in this section combines the strengths of different existing frameworks. The content of this value assessment is given by different frameworks and integrated in the value matrix. The guideline on how to carry out the assessment is presented in the procedure model, the second part of the value assessment framework. The five-step model is the result of the combination between Cresswell, Burke & Pardo’s approach (2006) and Value Measuring Methodology (VMM) (Foley, 2006); both frameworks provide a systematic application approach. The procedure model is the method which has to be followed in order to apply the first part of the value assessment framework. The procedure model aims to guide step-by-step the stakeholders in assessing value derived from the introduction of new IT business-to-government solutions that result from collaboration between private and public sector.

The proposed model is composed of five phases which build up a chronological and methodological approach:

1. Definition of value assessment scope
2. Definition of value assessment criteria
3. Development of case-specific assessment frameworks
4. Assessment
5. Conclusions and communication of results

In the graphical representation (Figure 10.2), the five phases are listed following the chronological and sequential order.

![Figure 10.2. Value assessment approach: A procedure model](image-url)
10.4.4.1 Phase 1: Definition of value assessment scope

This five-phase approach begins with the definition of the value assessment scope. To define the scope it is necessary to understand for whom the value has to be assessed and which goal areas they are interested in. Therefore, the specific stakeholders and the relevant goal areas have to be identified. Since it is not always clear which goal areas cover which notion of value, it is necessary to set up interviews and workshops in order to get in contact with the stakeholders and to find out their business areas of interest. After of setting up a project plan and conducting the interviews with the stakeholders, the scope of the value assessment is clear and it is possible to move to the second phase.

10.4.4.2 Phase 2: Definition of value assessment criteria

The criteria for the particular value assessment categories are defined in the second phase. As a basic framework we have identified four value categories; for each of them a set of value parameters (KPAs and KPIs) related to the goal areas will be specified. Value categories reflect four types of value: strategic, operational, social and financial value. KPAs and KPIs have to be defined as an initial set. In phase 3, initial value assessment criteria are further validated and updated. KPAs relate to the four value categories and to the earlier defined goal areas (phase 1) and result in a value matrix. The matrix aims to give an overview of goal areas, value categories and a first set of KPAs which are applicable in this context. It is used as a starting point for subsequent phases.

10.4.4.3 Phase 3: Development of case-specific assessment frameworks

Data collection is necessary in order to validate the initial set of KPAs and KPIs and to sharpen case-specific KPAs and KPIs. Interviews and workshops have to be conducted to understand whether the already defined KPAs and KPIs are applicable or whether changes are needed. To derive case and stakeholder-specific KPIs, the framework developed in phase 2 is used as a template. It has to be customized for the particular context and stakeholder. In order to achieve this goal, it is necessary to conduct interviews and workshops so that a set of final and case-specific KPAs and KPIs can be established. The output of this phase is a value matrix that is specific to every stakeholder, thereby building a case-specific framework.

10.4.4.4 Phase 4: Assessment

In Phase 3 case and stakeholder-specific value assessment matrixes were established, indicating relevant goal areas of the stakeholders and a set of KPAs and KPIs. The value assessment for each stakeholder is carried out by measuring quantitative KPIs and assessing qualitative KPIs. The value assessment of Phase 4 requires detailed knowledge of the stakeholder at hand.
and it requires close interaction with the stakeholders in order to extract knowledge from them. The goal is to strongly collaborate with the stakeholders, thereby giving them active guidance not only in identifying KPAs and KPIs, but also in assessing their value. Benefits of the to-be situation (the new IT solution) can be assessed by comparing KPIs in the to-be situation with the same KPIs in the as-is situation (the current situation). The assessment of the to-be situation might require further techniques like scenario development to assess different potential outcomes or, as an ideal way to assess the effects, an assessment of the context before and after implementing the proof-of-concept.

10.4.4.5 Phase 5: Conclusions and communication of results

The last phase is dedicated to the conclusions and the communication of the results. The conclusions consider the value for every stakeholder related to each value category and the specific goal areas that the experts have assessed. In particular, communicating on a higher level is an important part of the value assessment framework. The value assessment framework also enables comparison among similar but different contexts, for example by considering goal areas or KPAs in particular settings. This type of assessment might be of interest to planners and developers who could use this assessment as the basis for wide-scale regulative changes (e.g. on European level).

10.5 Application and results

The value assessment is composed of two main building blocks: a generic value matrix and the procedure model. Figure 10.3 illustrates the relationship between the two building blocks. Based on the value matrix elaborated in phases 1 and 2 of the procedure model and in collaboration with the particular stakeholder, a stakeholder and context-specific value matrix is elaborated (phase 3). This customized value matrix contains a set of KPAs and KPIs which are relevant to the stakeholder. Within this given structure, the assessment can be conducted utilizing different methods that depend on KPAs and KPIs, e.g. with different modelling techniques, measuring process improvement or interviewing techniques (phase 4). The results from the assessment are then summarized into conclusions and communicated among the partners involved (phase 5).

![Figure 10.3. Conceptual relationship of the building blocks in the value assessment framework](image)
We applied the proposed framework to the case of the implementation of an e-Customs system in Finland based on the case study of the ITAIDE project, with the aim of assessing the value for two stakeholders: a Finnish multinational company and the Finnish tax and Customs authority. It was not possible to measure the assessment using key performance indicators since concrete data and figures were not available. However, a first step towards the value analysis of such IT change in the Customs field took place giving a categorization of potential benefits. Interviews and workshops’ results led to the expectations further presented.

10.5.1 Phases 1 and 2: Definition of value assessment scope and value assessment criteria

Together with the interviewed stakeholders, we defined the scope of the value assessment as the identification of potential benefits that the implementation of an IT innovation such as e-Customs can bring. The workshop participants representing the private and public sector identified one common goal area as area of improvement: reduction of administrative burden. Furthermore, the MNC and the tax and Customs authority recognized other goal areas: respectively, compliance and security.

Additionally, the stakeholders defined the value categories proposed in Subsection 10.4.1 as the most relevant aspects that they want to analyze: strategic, operational, social and financial perspectives. Based on participants’ statements, literature reviews, case studies, such as Baida, et al. (2007), Bjørn-Andersen et al. (2007) and Henriksen & Rukanova (2008), and ITAIDE reports (www.itaide.org), a set of potential key performance areas was developed (Table 10.5).

<table>
<thead>
<tr>
<th>Value category</th>
<th>Key performance areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>Policy, governance, strategic position, fulfilling the organization’s mission, public opinion.</td>
</tr>
<tr>
<td>Operational</td>
<td>Productivity gains, service quality, improved infrastructure, convenient access, governance, compliance.</td>
</tr>
<tr>
<td>Social</td>
<td>Safety, health, environment, increased confidence in government, increased trust in government, employee satisfaction.</td>
</tr>
<tr>
<td>Financial</td>
<td>Cost savings, cost avoidance, budget increase, cost effectiveness.</td>
</tr>
</tbody>
</table>

Table 10.5. Key performance areas

10.5.2 Phase 3: Development of case-specific assessment frameworks

In this phase, two specific assessment frameworks were developed: one for the MNC and one for the tax and Customs authority. The MNC stated that the implementation of an e-Customs system is very important in order to reduce all the bureaucracy related to Customs documentations and to be compliant with EU regulations. As mentioned in phase 1, MNC representatives identified two goal areas as key objectives of the implementation of an e-Customs system:
**reduction of administrative burden** and **compliance**. The value matrix for MNC is based on the suggested KPAs proposed in Table 10.5. The main focus was to reduce the administrative burden of a complex supplier network; most of the chosen KPAs fit this goal area.

Regarding the **strategic** perspective, **strategic position** is an area for assessing the value. This KPA can be also applied in the goal area of ‘compliance’. Process automation improves the relationship of the MNC to its supplier network. This can have two impacts on its strategic position: to tighten the existing relationships and to react more flexible on strategic impacts from the industry sector (e.g. high pressure from new entrants). This has a significant influence on its position not only in the supplier network but also in the global paper industry. Additionally, by participating in the project, which also aims at reducing the red tape in international trade, the strategic position for establishing links to foreign suppliers can improve. Developed in collaboration with Finnish tax and Customs, the initial solutions of innovative business-to-government process handling can therefore be considered valuable for MNC in terms of being compliant with the requirements of cross-border electronic trade.

As far as the **operational** value is concerned, three KPAs were recognized by interviewees. **Productivity gains** is a performance area that stems from process automation and is located in the area of ‘reduction of administrative burden’ in a business-to-business context. **Convenient access** to the suppliers is another area where the value for MCN can be assessed.

The third area is **improved infrastructure**. The term infrastructure is interpreted not just from a pure engineering perspective but also from a business perspective. The supplier network is considered as the required infrastructure for successful economic handling. By tightening the relationship with the suppliers and increasing the potential number of suppliers, this type of required infrastructure can be improved. Potential KPIs to assess this perspective include the potential number of suppliers and the time needed to connect electronically to a new supplier.

In the context of **social** KPAs, the automation of standardized business processes can enrich the jobs of employees. If they do not have to handle all these process manually, they can spend more time on more interesting tasks. Increased **employee satisfaction** is therefore the main KPA from the social category.

**Financial** KPAs consider the automation of multiple processes among stakeholders. Two KPAs have been identified by MNC: **cost savings** and **cost avoidance**. From the perspective of handling multiple processes automatically, the realization of cost savings might be one of the most important goals for MNC. **Cost avoidance** is also suitable, especially for the proposed e-Customs solution. By establishing an interoperable platform to connect a multitude of suppliers that differ in size and in the services/products they provide, costs in terms of establishing single solutions for each supplier or each sector can be avoided.

The remaining KPAs, budget increase and cost effectiveness are not relevant to the MNC. Table 10.6 outlines the value matrix indicating the specific KPAs for each goal area and value category of the MNC.
### Goal areas

<table>
<thead>
<tr>
<th>Reduction of administrative burden</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic position</td>
<td>Strategic position</td>
</tr>
<tr>
<td>Productivity gains, convenient access, improved infrastructure</td>
<td></td>
</tr>
<tr>
<td>Employee satisfaction</td>
<td></td>
</tr>
<tr>
<td>Cost saving, cost avoidance</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Goal areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of administrative burden</td>
</tr>
<tr>
<td>Strategic</td>
</tr>
<tr>
<td>Operational</td>
</tr>
<tr>
<td>Social</td>
</tr>
<tr>
<td>Financial</td>
</tr>
</tbody>
</table>

#### Table 10.6. Finnish MNC value matrix

The public sector, represented by personnel from the tax and Customs office, identified two goal areas as areas of improvement: *reduction of administrative burden* and *security*. Strategic KPAs are relevant especially by increasing security, e.g. for cross-border trade with Russia. Further parts of the mission statement, related for example to taxations, can play a role but they do not constitute a primary focus of the strategic value category. The Finnish tax and Customs authority has been interested primarily in promoting different e-Government services to reduce their own administrative burden and the administrative burden of the companies.

From the operational point of view, automating and reorganizing companies’ administrative services, such as for declaring VAT import or export-related taxes, can imply an improvement in service quality, giving the users – in this case the companies – a more convenient access to the system. Additionally, productivity gains can be realized. Considering the social aspect, being able to spend more time on sophisticated tasks can increase employee satisfaction. As with the previous stakeholder, cost avoidance and cost savings are two financial key performance areas where the value of the solution can be significant. Handling the services automatically can reduce many manual checks and also avoid costs related to increasing security standards. Table 10.7 represents the value matrix of the Customs and tax authority.
### 10.5.3 Phase 4 and 5: Assessment, conclusions, and communications of results

Because of lack of information the assessment was conducted only partially, so a detailed assessment is not presented in this work. However, both sectors answered a series of questionnaires during face-to-face interviews. For example, the MNC gave a detailed description of various processes, such as ordering, delivering, invoicing and indicating the differences between manual and automated scenarios in terms of cost, time and employed personnel. The goal of phase 4 is to compare the as-is and the to-be situations based on the key performance areas defined and described in phase 3.

Both sectors identified one area as primary area of improvement: reduction of administrative burden. In the case of the private sector, e-Customs, as a business-to-government innovation, leads to the reduction of administrative burden improving the strategic position of MNC, its productivity gains and its infrastructure. Additionally, it provides a better access to the Customs system improving the employees’ satisfaction and reducing costs. The stakeholders stated that e-Customs can benefit by improving its quality of services, fulfilling the organization’s mission and, as in the case of the private sector, improving its productivity gains and its employees’ satisfaction. The financial aspect is also affected since an automated system can reduce the costs of the Customs declaration process.

### 10.6 Conclusions and limitations of the study

The topic that has been studied in this work concerns the value assessment of business-to-government IT innovations. We have proposed an integrated value assessment framework that first aims to identify goals areas, key performance areas and indicators and to map them into their corresponding value categories creating a value matrix for different stakeholders. The second part of the framework provides a step-by-step guide to help the stakeholders go through the whole evaluation procedure. The goal of the framework is to facilitate value assessment of new IT systems for both the public and private sectors in a business-to-government context. We applied the proposed methodology to the case study of e-Customs system implementation in a Finnish multinational company.

Although the application of the framework presented in the case study has taken place successfully, the approach still has some limitations. Although we aim to attract and sustain stakeholders in order to develop and test new IT systems in a business-to-government context by presenting a way to assess their benefits, the assessment is based partly on the scenarios analysis and only within a limited time frame. Therefore, the results could be biased. In addition, the assessment of qualitative indicators and areas might be difficult to carry out, particularly in terms of assessing them in a comparable way among different stakeholders. The existence of a vast variety of stakeholders, and therefore an equally vast multiplicity of goal...
areas, makes it difficult to analyze and negotiate among different stakeholders in order to find a common solution to fulfil all these areas. However, the aforementioned limitations also provide further space for improving the proposed assessment framework and opportunity for future studies.

Despite these limitations, we see advantages for potential stakeholders applying this framework. By extending the classical methods of financial assessment, new benefits and evaluation criteria are integrated into the assessment framework, which makes the decision to adopt new IT innovations under the B2G domain more sensible. Additionally, under the proposed common framework, after assessing the value for early adaptors of the system, users can get easily comparable results from the assessment and can thereby evaluate their redesign procedure. In the context of e-Customs as business-to-government innovation, further applications can deliver a more detailed set of generic KPAs as well as more methods to assess the quantitative and qualitative set of KPIs. Finally, an extension to other business-to-government contexts builds a broader basis for conducting assessment of innovative IT systems. The general pattern of the value assessment framework introduced in this work provides a structure for application in other further contexts.
Appendices: Value Cube and a “step-by-step” evaluation method

The following appendices serve as additional reference to section 10.4

Appendix a. Value Cube: Stakeholder-specific and network-related assessment

The realization of any e-government project requires a cooperative effort from both public (e.g. government authorities) and private sectors (e.g. IT service providers). Stakeholders with different interests, such as commercial interest of service providers and legal interest of governments, perform different functionalities to provide benefits for the end customers. One of the challenges associated with analyzing potential successes or failure of an initiated e-government project is, however, that stakeholder benefits have a broad interpretation due to the diverse interests of stakeholders. Thus, to find a way to assess the ‘real value’ of an e-government project is not straightforward, as it should be done from the viewpoints of multiple stakeholders. In the private sector value is measured mainly in financial terms, in other words a solution is proved to be beneficial if it results in financial advantages. Issues like security, trust or improvement in social efficiency, which are of great importance for public sectors, cannot be easily measured in terms of money, adding another complexity to our task. The challenge with these emerging conflicts is to find an acceptable networked value constellation, consisting of stakeholders from both the public and the private sectors, which realizes the initiatives of an e-government project, and where each stakeholder can find its own benefit. To this end, we studied the notion of stakeholder value and we formulated a value cube that we further use to guide our evaluation process (see Figure 10.4).

The value cube is structured as follows. First, it shows the goals of the analyzed project (columns) and relates them to the value categories (rows), giving an overview of the Key Performance Areas (per combination of row and column, see Figure 10.4). Once the matrix has been drawn, we define Key Performance Indicators for the KPAs that are initiated in the matrix. As the assessment of the full value matrix can be very time-consuming, stakeholders can prioritize the KPAs and KPIs that they wish to assess. The value matrix is stakeholder-specific. As the KPAs and KPIs of various actors may be inter-related, to emphasize the network perspective on value assessment, vertical layers of the matrix are plugged in according to the number of stakeholders involved.

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Figure 10.4. The “Value Cube”
Appendix b. “Step-by-step” evaluation method approach

Our “value cube” is a lightweight approach to summarize the different concepts that are essential for exploring stakeholder value. However, it does not give any suggestions on how to assess the value impacts that are embedded in the execution of e-government projects. In addition, it does not assist in measuring different cross-cutting impacts on stakeholder value caused by common interests among different stakeholders. To do so, we further detail our value assessment and introduce a step-by-step approach (Figure 10.5) that guides us to achieve this goal.

![Class diagram of Value assessment framework components](image)

**Figure 10.5. Model based method for deploying the value assessment**

The method is described using a UML class diagram (Fowler & Scott, 1997) in Figure 10.5. First, there are certain strategic initiatives of any e-government project, such as security, reduction of administrative burden and compliance, which call for an alternative, IT-intensive solution. In order to achieve these goals, stakeholders from both public and private sector form a networked constellation to execute different activities that fulfil various busi-
ness/government functionalities. In other words, they operationalize the strategic goals by activating value-creating functionalities. KPAs stands for key performance areas, which originate from these business/government functionalities and are the focal areas that we need to pay special attention to in the value assessment. These KPAs are measured by selected indicators (KPIs). They can be either quantitative or qualitative measurements, which reflect the successfulness of the focal functionalities: the KPAs. Furthermore, these business/government functionalities (presented as KPAs in the framework) and their measurements (KPIs) provide reliable assessment of the various value impacts perceived by different stakeholders. In the meantime, these value impacts also reflect to the strategic level and assist in exploring what goals are fulfilled and to what extent. The task of measuring and/or assessing the particular KPI is still challenging. Whilst we assume that the companies have some methods of measuring (especially financial) KPIs, we also aim to provide support for developing a method of assessing the indicators of improvement in collaboration with the companies/administrations.
11. Conclusions and future research

This chapter summarizes the key findings linked to the research questions addressed in the introduction (Chapter 11.1) and we provide a future outlook, discussing the future research directions (Chapter 11.2).

11.1 Key research findings

The thesis provides an in-depth analysis of underlying issues for G2B relationship in the information era. To solve the current dilemma of increased security and control requirements and at the same time to reduce the administrative burden for the government, we recommend mainly two approaches: IT-enabled procedure redesign and socio-economic reasoning & modelling of better policy design & implementation for trusted G2B relationship building.

Under the umbrella of an EU funded ITAIDE project, this research is set to develop a systemic approach for control procedure redesign and study the interactions and relationship changes between Customs administrations and trading companies, to help the government tackle the confronting issues of providing competitive trade facilitations (releasing administrative burden) and at the same time to take a better overall control of businesses.

Two key research questions were raised:

1. How to reach a sound design/redesign of control procedures with ICT as an enabler?

2. How to effectively build trust-based relationship between government and business to enhance supply chain governance?

To give answers to these research questions, two lines of research are undertaken:

First, the e³-control methodology, initiated by Kartseva (2008), was further developed and applied in four real-life redesign cases (Living Labs) in different industries located in four EU member states. The e³-control methodology supports the redesign in identifying control problems and providing solutions at both value and process levels. With its systematic approach and software support tool facilitating domain experts, the complex redesign is now much easier to undertake. The final result of the redesign thus becomes more efficient and effective. In the meantime, experience gained from the Living Labs helps to validate and improve the methodology itself and give a better understanding in the enabling roles of ICT facilitation in the redesign.

Second, though ICT plays a very important role in the G2B procedure redesign, even with the most advanced IT facilitation, 100% control is almost impossible to achieve. A desirable level of governance should be at an optimal level. To achieve this, sound socio-economic reasoning and a proper policy design and evaluation method behind ICT-based redesign are important. We argue that introducing trust between the government and businesses is a necessary means to lower the transaction cost and deal with economic problems of moral hazard and adverse
selection brought by the information asymmetry. We elaborate these issues with the AEO certification case in the Netherlands. Together with the Dutch Tax and Customs administration (Dutch TCA) and involved companies, we define the requirements for building trusted trade networks and propose socio-economic mechanisms/models to enhance such trust-based relationship between the government and businesses.

11.1.1 Towards the role of IT in Customs control procedure redesign

In this thesis, we first looked into innovative IT applications in four big international companies in their Customs-related supply chain procedures. We showed that there are two major roles of IT in enabling Customs control procedure redesign: first, its facilitating role in companies’ supply chain management, especially in supply chain security control and risk management that to a large extent will enhance Customs-related control (Chapter 2-5, 8); and second, the supporting role of IT-based design tools/software for better procedure redesign and decision making, where we applied the e³-control methodology in Customs procedure redesign with four real-life cases as illustrations (Chapters 2-5).

11.1.1.1 IT application of Customs control in supply chain management

The role of IT in supply chains has been discussed in many previous studies. In their empirical study, Lancioni et al. (2000) showed that the application of the Internet in B2B supply chains greatly benefits companies in managing the major components of supply chains including transportation, purchasing, inventory management, customer service, production scheduling, warehousing and vendor relations. IT-based supply chain programmes - e.g. just-in-time (JIT) programmes, electronic data interchange (EDI) and point-of sale data-sharing programmes - have provided enormous cost-saving opportunities and enhanced efficiency of the supply chain (Closs & McGarrell, 2004). Development of IT at the same time stimulates the use of enterprise resource planning (ERP) systems. ERP systems are able to execute and integrate business internal applications that support finance, accounting, manufacturing, order entry and human resources (Davenport, 2000). In particular, as ERP systems have been so well integrated in modern supply chains, if organizations want to protect customers, intellectual property, infrastructure, brands and employees, they must carry out programs embedding control into their IT systems (Eggers, 2004).

In our research, we focused on the interactions between major trading companies and their national Customs in Europe. We reached a similar conclusion to Fiala (2005), namely that unsatisfactory information flows, such as information inaccuracy, lagging and distortion, can be seen as a key source of inefficient interactions between companies and Customs. A key capability for ensuring control and better communication is to integrate various business components that will enable companies to link end-to-end information flows in the supply chain and can be shared even further with other government authorities, such as Customs. With the help of IT applications and information systems the loss of control can be greatly reduced and even eliminated, as suggested by (Mishra et al., 2007) & (Lee et al., 1997a). On the one hand, with all the information integrated, companies involved in the movement of goods can make decisions based on the latest and best information from both upstream and downstream and thus manage their supply chain in the least amount of time at the lowest cost;
on the other hand, the government can rely on the in-time and accurate information applying corresponding control mechanism and give possible simplifications to the businesses. Two aspects of IT application need to be specially emphasized, namely in supply chain security control and in risk management.

- **Security control**

IT plays an important role in enhancing the supply chain security. Closs & McGarrell (2004) defined supply chain security (SCS) as “The application of policies, procedures, and technology to protect supply chain assets (product, facilities, equipment, information, and personnel) from theft, damage, or terrorism and to prevent the introduction or unauthorized contraband, people or weapons of mass destruction into the supply chain”. Williams et al. (2008) indicate that IT has become an inseparable part of modern supply chains and plays a particularly important role in safeguarding the supply chains. Embedding controls against supply chain vulnerabilities in goods, factories, supply chain providers and partners, supply chain facilities, freight carriers, people and information are of commercial importance for supply chains (Jüttner et al., 2003; Miller, 1992; Sarathy, 2006). For the supply chain security, the application of information systems among supply chain partners has made businesses think beyond their own organizations and apply a more and more inter-organizational and combined approach.

Results indicated by our case studies of Beer, Food and Drug LLs, IT-enabled control for supply chain security has made a substantial step forward with the development of technology and standards such as Radio Frequency Identification (RFID) technology and the Electronic Product Code (EPC)69. These innovative applications significantly lowered labour costs and data error rates associated with scanning items and extended identification to individual items. The systems can provide quality information that enables companies to track literally billions of objects across the value chain, increasing the efficiency of individual processes, improving asset utilization, increasing the accuracy of forecasts and improving the ability of companies to respond to changing conditions of supply and demand (Davenport & Brooks, 2004). With respect to security, the application of advanced IT (e.g. GPS together with fully sensor-equipped “smart containers” – see applications of TREC device in the Beer LL and improved air cargo box in the Drug LL) can also give both business and government the ability to screen and track the cargo at the critical nodes of the supply chain through data acquisition, delivery and analysis. It also provides certainty, through scanning and imaging of cargo at those nodes where multiple cargo flows join (e.g. at ports of departure and entry). Such information can be built into working business process as detective/preventive measures, or as corrective controls which can deliver recovery capabilities by providing necessary information to key decision makers on the safety, security and prioritization of cargo. Lee & Whang (2005) argue that by using the right management approach, new technology and re-engineered operational processes, a higher supply chain security level can be achieved at lower cost.

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69 An Electronic Product Code (EPC) gives each object a unique serial number, each individual object can be tracked, and fine-grained real-time information about each object can be collected, stored and acted upon. See http://www.epcglobalinc.org/
Risk management

Previous research has indicated that information systems (IS) can lower the uncertainties of network risks by: 1) facilitating information sharing along supply chains, which enables supply chain partners to work in tight coordination to optimise the chain-wide performance (Lee & Whang, 2000); 2) providing better network management and a Just-In-Time inventory management system that minimises the bullwhip effect (Lee et al., 1997a); and 3) lowering the coordination cost without increasing associated transaction risks, thus firms are more likely to coordinate with each other without requiring ownership to reduce their risk (Clemons et al., 1993; Malone et al., 1987). However, even with the most advanced IT-embedded control and well-implemented information system, facing the imperfect real life with limited resources it is scarcely possible to achieve 100% security and control in the supply chain. Though extreme initiatives like the “100 percent container scanning”70 in the US exist, these are perceived as lacking cost efficiency and are very difficult to implement [GAO (United States General Accounting Office), 2008].

We argue that in the trade-off between maximum security and trade facilitation, the risk management approach provides a way to achieve the maximum security coverage in the supply chains without sacrificing limited resources. IT-embedded control procedures can greatly mitigate potential risks without creating an extra burden on the business. Well-implemented IS can facilitate more transparent and reliable information exchange, and supply chain partners and government organizations can rely on and therefore trust each other better than before, thereby enabling better cooperation along the supply chain.

Findings from Chapter 8 indicate that the application of the risk management approach provides on the one hand a more effective way of allocating resources with focused risks to achieve the best efficiency and effectiveness of the government-business collaboration; on the other hand, as IT has become an integrated part of the supply chain, it continuously interacts with the company’s risk management approach. IT therefore enables a shift of supply chain strategies from hostile product/partner avoidance and heavily transaction-based control strategy to more cooperation-based and flexible strategies. Both IT and risk management enable a better supply chain security. We argue that the two enablers, IT and risk management approach, complement each other and together can create optimal efficiency and effectiveness in the secure supply chain management. IT mitigates and absorbs the risk consequence from risk sources and drivers and it enhances risk mitigation strategies by embedding control and facilitating inter-organizational collaboration.

11.1.1.2 Applying e³-control support tool in control procedure redesign

In order to further help domain expert carry out step-by-step control procedure redesign, in Chapter 1-4, a software-supported systematic approach called “e³-control” has been intro-

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70 “A container that was loaded on a vessel in a foreign port shall not enter the United States (either directly or via a foreign port) unless the container was scanned by non-intrusive imaging equipment and radiation detection equipment at a foreign port before it was loaded on a vessel also mandate scanning.” (US congress, 2006: SAFE Port Act, Section 1701)
duced and applied in case studies. We argue that even the most profitable business models will not be adapted if the core values and interests in the business model are not properly safeguarded and if there are no proper control mechanisms in place to guarantee a fair share of the profits or benefits.

The \( e^3 \)-control has been improved as a conceptual modelling methodology for analyzing and designing control procedures. It provides sustainability of value co-creation by focusing on the design of inter-organizational controls. It captures knowledge on internal and inter-organizational control from academic research [e.g. (Arens & Loebbecke, 1999b; Bons et al., 1998; Bons et al., 1999b; Kuo-Tay Chen & Ron M. Lee, 1992; Romney & Steinbart, 2006)] as well as industry best practices [e.g. (COSO, 1992a, 2004b)]. The \( e^3 \)-control methodology builds upon the following key ideas: (1) structured modelling approach; (2) process-based analysis; (3) value-based analysis; and (4) a combination of the three.

First, \( e^3 \)-control uses a structured modelling approach. The structured modelling approaches can be used as a means to solve complex inter-organizational problems. We use such structured models to facilitate knowledge elicitation, communication between stakeholders and scenario exploration.

Second, \( e^3 \)-control uses a value-level analysis to reason about controls issues. As suggested by Kartseva et al. (2005), we adapt value-based business models focusing on the exchange of objects with economic value between actors, so as to understand the values that can be lost if control is absent in a business model. Value models are drawn using the \( e^3 \)-value notation (Gordijn & Akkermans, 2001).

Third, \( e^3 \)-control uses a process-level analysis to identify and redesign control procedures. It follows ideas of researchers who have been deploying process-level analysis to reason about control procedures and best practices that view control as a process element. As controls are commonly defined in the literature as processes and value models do not provide enough details to reason about operational (i.e. process level) solutions for fraud and opportunistic behaviour, we propose to complement the value modelling with (business) process modelling (Liu et al., 2007a; Liu et al., 2007b). Typically, controls consist of checking procedures that are based on the exchange between business partners of documents like contracts, inspection reports, invoices, bank statements etc. By applying control principles from auditing and accounting literature to process models [e.g.(Romney & Steinbart, 2006; Starreveld et al., 1994) ], we are able to identify control flaws and to propose control mechanisms to handle these flaws.

Fourth, \( e^3 \)-control combines these three ideas: modelling, process-level analysis and value-level analysis. Our argument is to combine models with both a value perspective and a process perspective, because value models and process models provide complementary viewpoints, both of which are required (Weigand et al., 2006). The combined approach includes four-step iterations. In step 1 we focus on understanding the logic behind business networks, i.e. identifying actors, their value propositions and how network sustainability can be put at risk due to fraud or opportunistic behaviour of an actor. Next, business process models provide the
operational details required for reasoning about how such threats can occur (control problems, step 2) in business processes and be handled (control mechanisms, step 3). Finally, in step 4 we investigate the implications of changes in the new business value model, as a result of introducing new controls in step 3. If the evaluation shows a positive result, the redesign is acceptable. Otherwise we can go back to step 3 and even step 1 for a new iteration. In the section below we provide further details about the four steps.

To sum up, the “e³-control” is a self-contained redesign methodology with a systematic approach. It also provides software supported redesign interface, concrete visualization to support value-based scenario development, which can be easily applied in various redesign situations. The e³-control methodology has been successfully applied in four different industrial cases (Beer LL, Paper LL, Food LL and Drug LL). It helps the domain expert identify control problems and provide sound and innovative IT solutions. Our experience of working in the Living Labs shows that e³-control methodology worked well with the control procedure redesign and received positive feedback from domain experts on its usability.

11.1.2 Towards trust-based relationship between government and business for better supply chain governance

In the first part of the thesis we focused mainly on the control redesigns from the business side; in the second half we put more emphasis on the other side of the story: the government, which actively interacts with businesses in control, trade facilitation and ensuring supply chain security. The role of government in the supply chain to a large extent determines the efficiency and effectiveness of the supply chain operations. Nevertheless, this side of the story was mostly omitted from previous research. In the second half of the thesis we focus on government involvement in supply chain governance and discuss how government, especially the Customs and Tax Administration, perceives and handles supply chain governance issue together with businesses.

Motivated by the new governmental security requirements in the last few years, especially in response to the terrorist attacks in the USA on 11 September 2001, there has been an avalanche of trade security-motivated control regimes. For example, the US-led C-TPAT (Customs-Trade Partnership Against Terrorism) and CSI (Container Security Initiative) programmes; the European Union’s Security Amendment to the Customs Code (648/2005/EC); the ISO 28000 standard for supply chain security systems; and the standards to secure and facilitate global trade framework of the World Customs Organization (WCO 2005) (Grainger, 2007). The aim of the above-mentioned programmes is to identify security risks before goods move. Underlying them is the desire by government agencies (such as Customs administration) to make efficient use of limited enforcement resources, enhance controls at the border and ensure that wealth generating trade continues while extending controls up and down the supply chain. To meet these objectives, enforcement agencies (e.g. Customs) aim to become an integral thread within the supply chain (Grainger, 2007). However, the supply chain is an operational arrangement that government agencies do not own. Effective control cannot be
achieved without collaboration with businesses. Consequently, the concept of the Authorized Economic Operator (AEO) has been developed within the EU. The idea of AEO is that each EU Member State Customs Administration can establish partnerships with private sectors and certify them with AEO certificates. The involvement of the private companies in AEO will enhance the safety and security of international trade and the certified AEOs will enjoy tangible benefits such as fast Customs clearance and simplified procedures (European Commission, 2007a).

Our analysis in Chapter 6 and 9 indicates that AEO is in fact a new, enhancing Customs control instrument (by applying risk-based pre-selection of trusted trade parties and IT facilitation) without introducing extra burden (but giving relief from existing administrative burden) for both business and government. More specifically, AEO reflects the “win-win” philosophy that governments delegate major control responsibilities to the collaborative and trusted businesses themselves, while in return these businesses benefit from trade simplification. Further, based on the AEO case study in the Netherlands and experience learnt from the Living Labs, we argue that the trust-based governance policy (e.g. AEO) can become a key to solving the current dilemma of increased security and control requirements and at the same time to reducing the administrative burden for both European governments and businesses. However, revolutionary changes have to be made in this new scheme, replacing the traditional stiff “command and comply” governments to business relationships by more trust-based ones enhanced by the reputation effect. Developing the concept of trust between the government and businesses is necessary in order to lower the transaction cost and can push supply chain governance to a new level (Chapter 9). However, trust should not be granted by default, otherwise economic problems of moral hazard and adverse selection may occur (Chapter 7). For this purpose, this thesis first clearly identifies the benefits of the trust-based system and further recommends an implementation method for effectively carrying out trust-based policies.

Being “in control” of the businesses themselves is one of the core ideas behind the trusted trade network. If businesses can prove themselves “in control” and establish an “in-control” statement, government may grant them a trust-based certificate such as AEO. A number of critical IT capabilities must be possessed by the businesses, such as real-time monitoring of goods and information flows, embedding control into business processes, enhanced IT security, information sharing and collaboration amongst the supply chain partners (Chapter 6). Findings from the AEO case study indicate that government can better carry out trust-based regulation based on three criteria, namely contract, competence and goodwill.

Furthermore, the emergence of IT innovation and the formation of a trusted network between government and business will raise new challenges for the government-to-business (G2B) governance issue in general. The different backgrounds of inhomogeneous stakeholders, in particular their difficulty in understanding value perspectives, raise challenges in terms of assessing the value of G2B IT innovations for both sectors. This thesis contributes to the development of a value assessment framework that combines the value understanding from both public and private sectors, incorporating different needs and requirements of various stakeholders, as well as providing common criteria for a comparative evaluation (Chapter 10).
11.2 Future research directions

11.2.1 Expanding the application scope of the e³-control methodology

Although the e³-control methodology developed in this research has been successfully applied in the e-Customs domain with four cross country Living Lab studies (see Chapters 2, 3, 4 and 5), it is still questionable whether we can successfully apply the e³-control for redesign in a larger scope. Future research will discover other potential applications in different domains. For example, the application of e³-control methodology can be of great value for business network and social network redesign as well. Some explorative studies using a control pattern approach have been done in the Dutch public health care network (Kartseva et al., 2010) and renewable electricity network in UK (Kartseva, 2008). However, the e³-control methodology itself has not been applied fully in these studies and no cross domain comparisons have yet been made by any studies. Furthermore, the usability of the e³-control methodology can be greatly enhanced if experience learnt from the e-Customs domain in current study can be transformed to other domains as well. Knowledge mapping and transformation work undertaken by future studies is expected to create greater value for the organizational redesign.

11.2.2 Embedding broader value perspectives in the redesign and evaluation

Future development of broader value perspectives and evaluation method embedded in the redesign methodology is needed too. In the current work, our major focus is on the monetary value behind the redesign. However, experience from four redesign cases has shown us that financial-based evaluation alone is insufficient, especially under the G2B context where stakeholders from the public sector do not focus primarily on the monetary issues. Value differences between the public and private sectors have been taken into account in our research; for example, we have thought about using multiple value perspectives (with social, operational and strategic value categories rather than with financial value only) for redesign evaluation (see Chapter 10). Nevertheless, our proposed evaluation framework (see Chapter 10) is detached from general e³-control methodology. If future research is able to embed the broader evaluation framework with the e³-control methodology itself and propose a lean application method, greater benefits can be generated, especially in the situation of multiple stakeholder involvement.

11.2.3 Quantitative measurement of costs and benefits of regulations

This thesis presents some initial results of costs and benefits of different governance approaches (control-based vs. trust-based regulations) linking with transaction cost economics, and recommends some preliminary approaches to how government can effectively change its way of governance to lower these transaction costs (see Chapter 9). However, the current analysis is still at a qualitative level. The future research can further move along this line of research by proposing quantitative models linking the results with the work of the Standard Cost Model (SCM) and study of transaction management. The Standard Cost Model is a
quantitative methodology for determining the administrative burdens for businesses imposed by regulation at different levels (SCM Network, 2006). It is used for measuring simplification proposals as well as the administrative consequences of a new legislative proposal. Interested researchers can also try to link the SCM with redesign methodologies, for better quantitative measurement in the future. Furthermore, four areas of research in which transaction management focuses on may also be interesting for future research: (i) industrial organization with a focus on the determinants of the boundaries of the firm, (ii) international trade with a focus on the multiple dimensions of transaction costs distinguishing between transport costs, institutional costs and cultural costs of exchange (iii) foreign direct investments with a focus on outsourcing and the organization of the firm in a globalizing market, and (iv) networks with a focus on the role of social and regional networks, and on standards such as institutionalized settings that facilitate exchange of goods, ideas, etc [From website of Research Institute for Trade and Transaction Management (RITM)71].

11.2.4 Cross country/culture comparison for different redesign and governance approaches

The current research has been undertaken in the European culture and geographical background. The findings indicated in this study might not be suitable under the international scope for countries with a more distinctive background (e.g. social, culture, legislation and historical difference). Although our cases have been selected in four EU member states (the Netherlands, Finland, Denmark and Ireland) that stand on the same level of economic development and share similar social/cultural understandings, we still found differences among the attitudes towards redesign methods and inhomogeneous beliefs in governance (trust-based vs. control-based) approaches. For example, the Dutch TCA shows great enthusiasm for IT innovations for the redesign and is in favour of trust-based policies, whereas the Danish TCA is more reluctant to adopt innovations and redesign proposals and the Irish TCA thinks more traditionally, preferring control-based governance approaches. However, these findings are not further elaborated by this thesis, but they are definitely an interesting subject for future research. We recommend future study to carry out comparative research on the countries with greater cultural differences, for example comparisons between EU, US and China or India. The expected testing results from future research may indicate strong correlations between certain culture types and redesign/governance approaches and may help us find the best method of redesign and governance mapping appropriate to specific countries and cultural backgrounds.

To summarize, researchers are encouraged to undertake future developments of the current work in the directions of expanding the application scope of the study, embedding broader value perspectives in evaluation and redesign, and undertaking other quantitative measurements, as well as cross-country/cultural comparison for different redesign and governance approaches. The close academic and practical relevance, as well as the expected social influence on the new government-business relationships proposed by this study, makes it an exciting and promising field of research.

71 RITM is a research initiative of VU University Amsterdam, for details see http://www.feweb.vu.nl/en/departments-and-institutes/ritm/index.asp
Some concluding words

Now I have reached the end of this thesis, I ask myself, “What do I believe in the most? ‘Control’ or ‘Trust’?” My answer is neither; the key word is actually “Balancing”. Just like “Yin” and “Yang” in the Chinese philosophy, “Control” and “Trust” can behave like two completely contrasted concepts; however, with good balancing in between, they will supplement each other. Conclusion: with good balancing and self-control and at the same time giving trust to others, the foundations will be laid for a better future network.
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Final%20Report%20Food%20Living%20Lab.pdf


# Appendices

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II. List of Acronyms

<table>
<thead>
<tr>
<th>Acronyms</th>
<th>Full name and description</th>
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<tbody>
<tr>
<td>AEO</td>
<td>Authorized Economic Operator</td>
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<tr>
<td>Beer LL</td>
<td>Beer Living Lab</td>
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<tr>
<td>G2B</td>
<td>Government to Business, the concept that businesses and government agencies can use central Web sites to exchange information and do business.</td>
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<tr>
<td>C-TPAT</td>
<td>Customs-Trade Partnership Against Terrorism</td>
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<tr>
<td>COBIT</td>
<td>COBIT (Control Objectives for Information and related Technology) is an IT governance framework and supporting toolset that allows managers to bridge the gap between control requirements, technical issues and business risks.</td>
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<tr>
<td>COSO</td>
<td>COSO, the Committee of Sponsoring Organizations of the Treadway Commission, is a voluntary private sector organization dedicated to improving the quality of financial reporting through business ethics, effective internal controls, and corporate governance.</td>
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<tr>
<td>CSI</td>
<td>Container Security Initiative</td>
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<td>Digiscan</td>
<td>An automated self-assessment tool of AEO developed by Deloitte</td>
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<td>DFFE</td>
<td>The Danish Food Industry Agency</td>
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<td>DTCA</td>
<td>Dutch Tax and Customs Administration</td>
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<tr>
<td>Drug LL</td>
<td>Drug Living Lab</td>
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<td>EC</td>
<td>European Commission</td>
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<td>EDI</td>
<td>Electronic data interchange</td>
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<td>EMCS</td>
<td>Excise Movement and Control System</td>
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<td>EPCIS</td>
<td>Electronic Product Code Information Services</td>
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<td>ERP</td>
<td>Enterprise resource planning system</td>
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<td>EU</td>
<td>European Union</td>
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<td>FDA</td>
<td>US Food and Drug Administration</td>
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<td>Food LL</td>
<td>Food Living Lab</td>
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<td>GAO</td>
<td>United States General Accounting Office</td>
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<td>JIT</td>
<td>Just-in-time (logistic/inventory system)</td>
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<td>GOST</td>
<td>GOST certificate: is a quality certificate only applicable in the case for exporting to Russia.</td>
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<td>GC</td>
<td>Green corridor</td>
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<td>GPS</td>
<td>Global positioning system</td>
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<td>GSM</td>
<td>Global System for Mobile</td>
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<td>IC</td>
<td>Internal control</td>
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<td>ICT</td>
<td>Information and Communication Technology</td>
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<tr>
<td>KPA</td>
<td>Key performance area</td>
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<td>KPI</td>
<td>Key performance indicator</td>
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<td>LL</td>
<td>Living Lab</td>
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<tr>
<td>Paper LL</td>
<td>Paper Living Lab</td>
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<td>PCAOB</td>
<td>Public Company Accounting Oversight Board: an organization that oversees auditors of public companies in the US</td>
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<td>PKI</td>
<td>Public key infrastructure</td>
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<td>RFID</td>
<td>Radio-frequency identification</td>
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<td>SCS</td>
<td>Supply chain security</td>
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<td>SOA</td>
<td>Service Oriented Architecture</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>TCA</td>
<td>Tax &amp; Customs administrations</td>
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<td>SW</td>
<td>Single Window</td>
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<td>TREC</td>
<td>Tamper Resistant Embedded container</td>
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<td>USDA</td>
<td>United States Department of Agriculture</td>
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<tr>
<td>WP</td>
<td>Work Package (of the ITAIDE project)</td>
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<td>WCO</td>
<td>World Customs Organization</td>
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III. Curriculum vitae

Name: Jianwei Liu
Date of Birth: 1 March 1981
Place of Birth: Dalian, Liaoning province, P.R. China
Nationality: Chinese\(^2\)
Address: Leerdamhof 102
1108BJ Amsterdam
The Netherlands
E-Mail: jliu@feweb.vu.nl
Telephone (mobile): +31-(0)6-46635893
Telephone (office): +31-(0)20-5982732

Educational background:

 Degrees  
  PhD in information systems & logistics  
  Vrije Universiteit Amsterdam (VUA), the Netherlands, June 2010 (to achieve)

  M.S. in accounting  
  Tilburg University (UVT), the Netherlands, 2005

  Dual B.S. degrees in International Business (IB)  
  & in International Economics & Finance (IEF)  
  Tilburg University (UVT), the Netherlands, 2004

Others  
School of Architecture  
Shijiazhuang Railway Institute, P.R. China, 2000

Professional experience:

Expertise  
  ◦ Expert and experienced in business process reengineering and international supply chain management
  
  ◦ Specialized in Customs procedures, government-to-Business information systems designing, control problems identification (both IT and organizational) and providing innovative redesign solutions
  
  ◦ Knowledge of EDP auditing and IT governance

\(^2\) Holder of permanent resident permit of the Netherlands and permitted to work freely within EU.
Skills
Scientific research – Undertook excellent scientific research during the PhD study at VUA. Published dozens of quality research papers in various Journals and top ICT conferences. Specialized in e-Customs procedure redesign, business process reengineering and process modelling.

Teaching and tutoring – Lecturer in Master course on Inter-organizational Systems at VUA. Supervisor/Co-supervisor of three master students since 2008.

Professional Networks – Built up extensive professional networks including many leading ICT and consultancy companies, top universities and various government organizations (e.g. United Nations, European Commission and Tax and Customs Administration).

Working experience:

01/2007 – 05/2010
Vrije Universiteit Amsterdam (Amsterdam, NL)
Lecturer and supervisor of Mater students
Lectured and tutored in the Master course on Inter-organization Systems at the Faculty of Business Administration and Economics, VUA.

Under my supervision, three master students accomplished their master thesis related to topics of business process reengineering and control procedure redesign since 2008.

03/2006 – 05/2010
Vrije Universiteit Amsterdam/ IBM (Amsterdam, NL)
PhD researcher
Worked on the ITAIDE\textsuperscript{74} e-Customs project for the last four years at Vrije Universiteit Amsterdam. My research focused on the IT-enabled redesign of control procedures, business processes reengineering, study of new forms of government-to-business relationships and novel governance approaches.

During these years I was also half contracted by the IBM (under Global Business Services) to do information system and redesign-related research. Undertook major business redesign projects with four of the Fortune 500 Companies in Europe. Took a major role in developing the key dataset for the future information system between Dutch Tax and Customs Administration and an international brewery company (Heineken) in the Netherlands (2007); redesigning export procedures for one of the world's leading forest industry groups (UPM-Unit Paper Mill) in Finland (2008); collaborating with SAP in redesigning export procedures.

\textsuperscript{73} See list of publications.

\textsuperscript{74} Project ITAIDE (Information technology for adoption and intelligent design for e-government) is funded by the 6th Framework IST programme of the European Commission (Project nr.027829). ITAIDE's goal is to develop a procedure redesign methodology, supported by an intelligent software tool, to improve the efficiency and simplification of e-Customs procedures. (For details, see www.itaide.org).
procedure for a leading dairy company (Arla Food) in Denmark (2008); analyzing and redesigning for an international pharmaceutical company in Ireland for their temperature-controlled high-value drug logistic procedure (2009).

07/2008 – Heathland - Recyclables and thermoplastic resins BV (NL/HK)
07/2009 Far East sales & logistics manager (part-time)
Was responsible for handling export procedure and logistics in a large region of China; weekly management for customer relationship with South China region.

Achievements and honours:

2007 - Best paper award at 20th Bled eCommerce Conference (Bled 2007), Bled, Slovenia.
2008 - Best paper nomination at 7th international EGOV conference (EGOV 2008, within the DEXA conference cluster), Torino, Italy.

Languages:

Chinese (Mandarin) : Native
English : Fluent
Dutch : Intermediate

Hobbies:
Travel, photography, painting, badminton, basketball
IV. Tinbergen Institute Dissertation Series

The Tinbergen Institute is the Institute for Economic Research, which was founded in 1987 by the Faculties of Economics and Econometrics of the Erasmus University Rotterdam, University of Amsterdam and VU University Amsterdam. The Institute is named after the late Professor Jan Tinbergen, Dutch Nobel Prize laureate in economics in 1969. The Tinbergen Institute is located in Amsterdam and Rotterdam. The following books recently appeared in the Tinbergen Institute Research Series:

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437. R. LORD, Efficient pricing algorithms for exotic derivatives.
439. Y.-Y. TSENG, Valuation of travel time reliability in passenger transport.
440. M.C. NON, Essays on Consumer Search and Interlocking Directorates.
441. M. DE HAAN, Family Background and Children's Schooling Outcomes.
442. T. ZAVADIL, Dynamic Econometric Analysis of Insurance Markets with Imperfect Information.
443. I.A. MAZZA, Essays on endogenous economic policy.
444. R. HAIJEMA, Solving large structured Markov Decision Problems for perishable-inventory management and traffic control.
446. R. SEGERS, Advances in Monitoring the Economy.
448. L. PAN, Poverty, Risk and Insurance: Evidence from Ethiopia and Yemen.
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