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20th Bled eConference
eMergence
Merging and Emerging Technologies, Processes, and Institutions
June 4 - 6, 2007; Bled, Slovenia

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Abstract
The EU is currently reshaping its customs legislation and practices. Main pillars in the new vision are an intensive use of IT (Customs becomes e-Customs), partnerships between Customs administrations and businesses, and collaboration between national Customs administrations. These concepts should support coping with the dilemma of on the one hand increasing security, safety, financial and health requirements, and on the other hand the need to reduce administrative burden, to keep the EU a competitive economic zone. Two main concepts in coping with this challenge are Single Window and Authorized Economic Operators. The EU is investigating how to transform these abstract concepts into a tangible reality. The Beer Living Lab is an EU-funded pilot research project that implements this EU vision in the beer industry. In this paper we provide results from the Beer Living Lab and we introduce the fourth step in e^3*-control, a theoretical framework for procedure redesign. We discuss the application of* e^3*-control in the Beer Living Lab, where modeling is a means to facilitate innovation and network transformation.*

Keywords: *e-Government, e-Customs, inter-organizational control, G2B collaboration, public-private partnership*

1 Introduction

Two important foci in the EU electronic customs *Multi-Annual Strategic Plan* (MASP) are the implementation of Authorized Economic Operators (AEO) and Single Window (SW). The MASP aims "to make customs clearance more efficient, to reduce administrative burdens, to combat fraud, organized crime and terrorism,… to increase the safety of goods and the security of international trade, … and to allow for a seamless flow of data…" (DG/TAXUD, 2006). The idea of AEO is that each EU Member State Customs administration establishes a partnership with the private sector in its country in order to involve the private sector in ensuring the safety and security of international trade supply chains. Certified AEOs will enjoy tangible benefits as fast customs clearance and simplified procedures. The objective of Single Window is "to enable economic operators to lodge electronically and once only all the information required by customs and non-customs legislation for EU cross-border movements of goods" (DG/TAXUD, 2006). Single Window will replace the current *silo solutions* in January 2013 (DG/TAXUD 2006).

However, efficiency and reducing administrative burden can easily contradict with increased security, safety and control. The threat of terrorism resulted in new control regulations. Also from a financial perspective there is a clear business case for increased control. For example, excise fraud for alcohol in the EU amounts to €1.5 billion yearly, approximately 8% of the total excise duties receipts on alcoholic beverages, and VAT fraud is estimated to be 10% of VAT receipts (EU Commission 2006).

The Beer Living Lab (BLL) 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 SW vision. A collaboration among one of the world's largest beer producers (BeerCo), the Dutch Tax and Customs Administration (further referred to as DTCA), two very large technology providers and universities aims to demonstrate that trade facilitation, reduced administrative burden for supply chain partners and improved control and security are not necessarily contradicting 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 modeling approach, which specifically focuses on designing inter-organizational controls. Kartseva et al. (2005) suggested e^3-control using a value perspective to analyze control problems. A value perspective focuses on the value that can be lost if no controls exist in an inter-organizational setting. Next, Liu et al. (2006; 2007) showed that a value perspective is not rich enough to reason about actual control mechanisms. They extended e^3-control to include a process level analysis, and suggested that the last step in e^3-control, after a process level analysis, should be going back to the value level to analyze how the network has changed (see Figure 1). However, this last step has not been worked out in earlier papers.

The contribution of this paper is threefold. First, parts of e^3-control have been described in earlier publications. In this paper we discuss the whole methodology. Second, earlier publications focused on steps 1, 2 and 3 of e^3-control. In this paper we discuss step 4 as well. Third, we present here a rich and complex case study in the beer industry. Our paper shows how modeling facilitates achieving innovation in a complex inter-organizational setting.

The remainder of this paper is organized as follows. Section 2 is dedicated to providing the theoretical grounding for this paper. In Section 3 we introduce the Beer Living Lab. Section 4 presents the business result of the BLL: a new trade procedure. In Section 5 we discuss how our modeling approach facilitated achieving this result. Finally, in Section 6 we provide our conclusions.

2 Theoretical Framework: e^3-control

e^3-control is being developed as a conceptual modeling methodology for designing control procedures (Kartseva et al. 2005; Liu et al. 2006; Liu et al. 2007). It captures knowledge on internal and inter-organizational control from academic research and best practices [e.g., Romney and Steinbart (2003), Arens and Loebbecke (1999), Bons et al (1999), Chen and Lee (1992), COSO (1992)]. e^3-control proposes visual-based models as a means for communication between stakeholders, to achieve a shared understanding of the problem domain and of possible solutions. Modeling is done at two abstraction levels. First, Kartseva et al. (2005) suggest to use value models – business models that focus 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. Value models are drawn using the e^3-value notation (Gordijn & Akkermans 2001). Second, Liu et al. (2007) suggest to complement the value modeling with (business) process modeling, because controls are defined in the literature as processes, and value models do not provide enough details to reason about operational (i.e., process level) solutions for control problems (e.g., fraud, opportunistic behavior or innocent mistakes). They propose a combined model as summarized in Figure 1, which includes four-step iterations. Step 1 was worked out in Kartseva et al. (2005). Steps 2 and 3 were worked out in Liu et al. (2007). In this paper we elaborate on step 4.

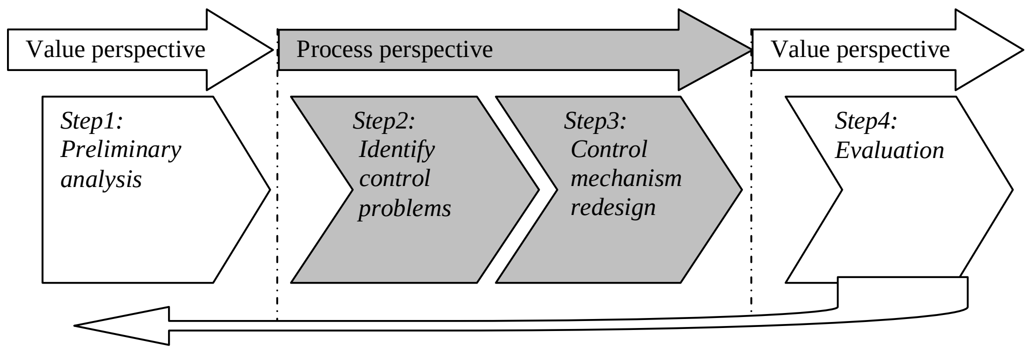

Figure 1: e^3-control: value & process perspectives combined into a redesign method

2.1 Modeling from a Value Perspective

The value perspective ensures a high level of abstraction, and hides operational details. Therefore it has been found suitable for discussing innovative ideas with business developers and managers (Gordijn & Akkermans 2001). Kartseva et al. (2005) suggest to use the e^3-value notation (Gordijn & Akkermans 2001) to draw business models. e^3-value business models have a feature that enables calculating cash flow for the various actors involved. Figure 2 shows an educational example of an e^3-value model. A buyer purchases goods from a seller and offers a payment in return. According to the law, the seller is obliged to pay value-added tax (VAT). This can be conceptualized with the following e^3-value constructs (in bold). **Actors**, such as the buyer, seller, and the tax office are economically independent entities. Actors transfer **value objects** (payment, goods, VAT) by means of **value transfers**. For value objects, some actor should be willing to pay, which is shown by a **value interface**. A value interface models the principle of economic reciprocity: only if you pay, can you obtain the goods (and vice versa). A value interface consists of **value ports**, which represent that value objects are offered to and requested from the actor's environment. The scenario starts with a start stimulus, in most cases presented as **consumer need** of an actor, which, following a path of **dependencies** will result in the transfer of value objects. Transfers may be dependent on other transfers, or lead to a **boundary element** (end stimulus)**,** which finalizes the scenario. Kartseva et al. (2005) extended the e^3-value notation to model also control problems (referred to as *sub-ideal situations*) using e^3-control. We demonstrate this extension later in the paper.

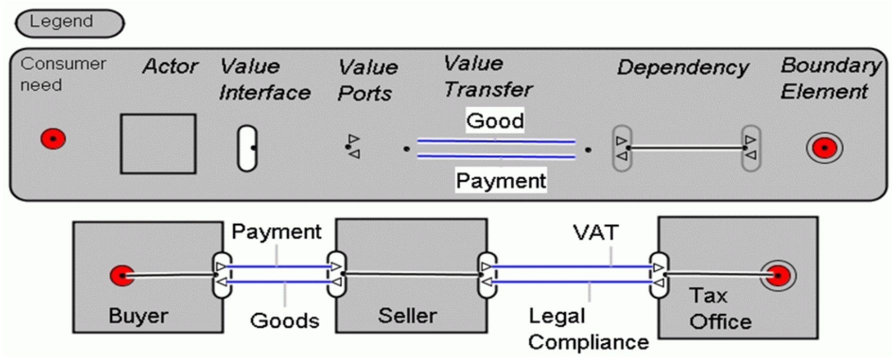

Figure 2 Example of an e³-value business model of a purchase with tax payment

The above terminology is useful mainly for commercial settings though. The definition of value for public sector organizations is different from that of private sector organizations; value is not necessarily money. To this end, evaluating public sector projects cannot focus on financial feasibility only. Therefore we are currently engaged in a study about the notion of value in the public sector, and in establishing value assessment schemes for public sector organizations (e.g., Cole and Parston, 2006; Moore, 1995; Cresswell et al. 2006; CIO Council, 2002). We will embed such schemes in e³-control, to complement the existing profitability analysis functionality.

2.2 Modeling from a Process Perspective

We argued in Liu et al (2007) that to apply governance and control, we have to analyze the detailed process level of business models. The main driver for using a process-level analysis is that the large knowledge base on designing controls, which is the grounding of e³-control, [e.g., Coso (1992); Chen & Lee (1992); Bons et al. (1999); Arens & Loebbecke (1999); Romney & Steinbart (2003)], focuses on analyzing operational tasks, or business processes, and describes control as a process. Process models [which we express in UML Activity Diagrams and Use Cases (Fowler & Scott 1997), but other notations are possible too], enable us to identify control flaws by applying control principles, and to design new business processes based on these principles. For a detailed description of e³-control's process level analysis and its contribution to scientific knowledge base, refer to Liu et al. (2007).

3 The Beer Living Lab: Introduction to the Case Study

The Beer Living Lab (BLL) brought together government and industry to rethink control procedures for international trade. BeerCo has a wide international presence through a global network of distributors and breweries. It owns and manages one of the world's leading portfolios of beer brands and is one of the world's leading brewers in terms of sales, volume and profitability. The main brand of BeerCo is considered almost as sacred within the firm. Accordingly, BeerCo has implemented extensive internal control mechanisms throughout its value chain. As a manager within the firm explained, if a container with beer is stolen, BeerCo does not care so much about the direct financial loss, but rather BeerCo is afraid that the thieves would tamper with the beer, and then introduce it to the market while it does not meet the BeerCo quality criteria, resulting in damage to BeerCo's brand and image. In accordance with EU and WCO (World Customs Organization) visions, DTCA wishes to rely on BeerCo's own control of its supply chain, so that BeerCo can be seen as a low risk shipper, be certified as AEO and enjoy simplified procedures. This results in a tangible benefit for DTCA too.

Namely, if less effort has to be invested in inspecting the low-risk BeerCo shipments, DTCA can focus its resources on high-risk shipments.

3.1 Current Procedure for the Export of Beer

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 main actors are involved in this study: (1) BeerCo NL; (2) BeerCo UK, the UK business unit of BeerCo Ltd, functions as an intermediary between BeerCo NL and retailers in the UK; (3) Customs NL (DTCA); (4) Customs UK (HMR&C); (5) Excise Warehouse (EW) in the UK, a warehouse which has been certified for the deposit without payment of duty of excise goods; (6) Retailer, a UK-based company that buys Dutch beer from BeerCo UK; and (7) the Carrier.

Using current EU procedures, for every shipment BeerCo NL has to fill in numerous paper documents and to submit electronic messages to numerous governmental information systems for export, VAT, excise, national statistics and more. Even if we limit ourselves only to documents and messages related to export and excise procedures of BeerCo, this accumulates to 560,000 interactions with the government yearly (65,000 paper documents, each in four copies, plus 300,000 electronic interactions), while these figures cover only two procedures. The core document for shipments of excise goods in the EU is the paper-based *Administrative Accompanying Document* (AAD). 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 sends the stamped AAD back to the EW, who will forward it back to BeerCO NL. DTCA 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 stamped AADs. As transferring paper-based AADs can take months, the verification is done several months later. In practice, DTCA relies on BeerCo to verify AADs. BeerCo NL only submits stamped AADs upon request of DTCA which checks AADs only randomly because control is labor intensive.

3.2 Problems as Perceived by BLL Participants

DTCA is interested in a high degree of control. As explained before, having and exerting control in the supply chain is invaluable also for BeerCo. However, the issue at hand is broader than just a control problem. From BeerCo's perspective, collecting the paper-based stamped AADs costs only 0.2 FTE. Much higher costs are caused by legislation concerning trade in excise goods. EU Legislation is fragmented and different regulations exist for different procedures (e.g., excise, VAT, statistics) surrounding a single shipment of beer. The EU is currently implementing a new system to cope with excise fraud: EMCS (Excise Movement & Control System). This will require that BeerCo implements yet another expensive system, while it already implemented systems for export procedures, for VAT procedures and others. BeerCo wishes that EMCS will not be introduced.

Also DTCA, a targeted beneficiary of EMCS, is not all too happy with the EU plans. EMCS will indeed provide a faster information exchange among customs authorities in EU Member States and improved excise control, but it will simply replace a single paper procedure rather than innovate the whole trade procedure. In fact, there already exists a system similar to EMCS, namely VIES for VAT procedures, but VIES fails to achieve its goal, because it does not provide enough information. That information is available in the national statistics (CBS) system, but Dutch law does not allow DTCA to access that system. In fact, different governmental agencies all request from BeerCo the same or similar commercial data for various procedures, resulting in redundancy and fragmentation, while a holistic approach is required. The fragmentation in procedures is caused by fragmented legislation. To the dissatisfaction of businesses, separate information systems have been introduced for every piece of legislation, disregarding existing systems and related regulations. Furthermore, even if DTCA can establish that a company is in control of its supply chain, it cannot provide simplifications (e.g., exemption from export declarations), because the current legislation does not allow that.

4 Redesign of Administrative Procedures

In this section we describe the solution that was designed by BLL participants such that it is satisfactory for all. First, we discussed innovative IT solutions that enabled innovation in the trade procedure. Second, we present the BLL trade procedure. In section 5 we discuss how modeling facilitated the whole process.

4.1 Innovative IT

Information technology provides ample opportunities to introduce efficiency gains, security and visibility. One option is to replace paper-based procedures by electronic ones. This is what the EU is currently doing by introducing EMCS instead of the paper-based AAD. However, much greater benefits can be achieved if a radical rethinking takes place and the assumptions underlying procedures are questioned. The BLL has opted for this approach. Two technologies are used as corner stones in the BLL export procedure: the TREC smart seal for container security and EPCIS databases.

The *Tamper-Resistant Embedded Controller* (TREC)[1] 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 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, an automatic message can be triggered by a TREC device to supply chain partners including DTCA, when the container actually leaves the Netherlands, deviates from its predefined route, is being opened by an unauthorized party, or when other predefined events occur. By monitoring a container's location, TREC devices could replace the AAD's functionality to provide export evidence.

Container Information Services are leveraging the EPCglobal network and EPCIS (Electronic Product Code Information Services) non-proprietary standards currently under definition by EPCglobal[2]. Those standards define interfaces, discovery services, security mechanisms and other infrastructure for capturing and querying supply chain data (and other EPC related data). The EPCglobal network, also called the 'Internet of things', is a suitable backbone for tracking goods moving along a supply chain. It

[1] Further information on TREC is available at http://www.zurich.ibm.com/news/05/trec.html and http://www.research.ibm.com/jam/secure_trade_lane.pdf, last accessed on April 27, 2007.
[2] For further details see http://www.epcglobalinc.org

leverages the infrastructure from the Internet to create an open standards, Service Oriented Architecture-based data sharing mechanism between trading partners.

4.2 Innovative Trade Procedures

Current trade procedures are based on silo solutions, requiring that BeerCo submits various declarations containing similar commercial data. This introduces large costs for BeerCo, and creates redundancy among governmental information systems. BeerCo and DTCA agreed on a paradigm shift. In a future scenario BeerCo will be certified as an AEO, and will be trusted as a low-risk trader. As opposed to the large number of declarations currently, DTCA will no longer require *any* declarations (for excise, export and other procedures), because in reality it does nothing with the vast amounts of data that BeerCo submits. Instead, BeerCo will make its commercial data available for DTCA through a BeerCO EPCIS database, such that DTCA can retrieve it whenever it wishes. BeerCo will be audited periodically; it has to prove to be in control of its supply chain, and DTCA has to be convinced that all commercial data is indeed available if DTCA decides to inspect it. This leads us to a new situation where BeerCo is not required to pro-actively submit declarations to DTCA. The new situation is sketched in Figure 3.

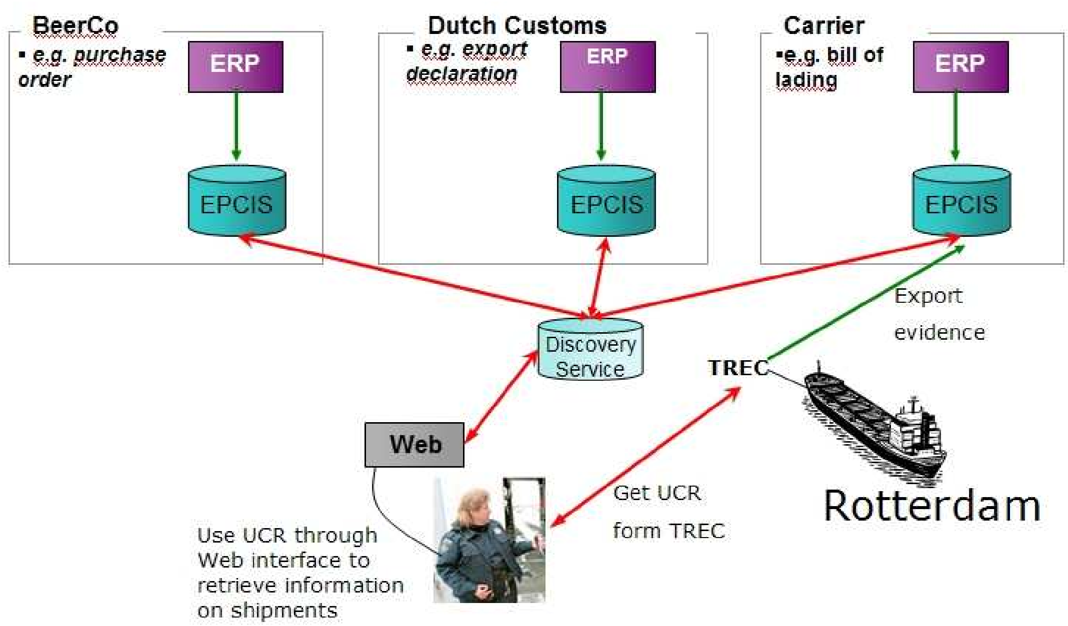

Figure 3 TREC devices and EPCIS databases used to share information and guarantee security and control

In the new procedure, when BeerCo NL prepares a shipment of beer, it publishes the goods' commercial data (originating from its ERP system) in its own EPCIS database that is accessible through the Internet for authorized supply chain partners, including DTCA. 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 DTCA. This message contains a Unique Consignment Reference number (UCR), which the carrier and customs can use to retrieve commercial data from BeerCo's EPCIS and use it for all their procedures, including excise, VAT, statistics and more. Hence, data is kept at BeerCo's EPCIS and is accessible for all relevant supply chain partners and government systems, also for periodic audits. As soon as a container physically leaves Dutch territory (or: arrives at the country of destination), the TREC device triggers sending a message to DTCA, providing 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 the commercial information identifying this shipment in BeerCo's EPCIS. 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. The Service-Oriented Architecture (SOA) presented in Figure 3 offers two more very interesting opportunities. First, whenever a supply chain participant (including BeerCo, an ocean carrier, DTCA and the buyer) seeks for 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 party, and the party seeking the data is authorized to access it, the data will be retrieved and presented through a Web interface. We refer to this mechanism as "googling". Second, the discovery service is informed about the presence of the 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 of beer has arrived in the UK or US, a notification can be sent to DTCA as export evidence, removing the need for the current cumbersome paper-based export evidence procedure.

5 e^3-Control Applied in the Beer Living Lab

We engaged in different modeling efforts in deploying e^3-control (see Figure 1) in the Beer Living Lab case study.

5.1 Step 1 in e^3-control: Value Modeling

First, business (value) models using the e^3-value notation facilitated a discussion between BLL participants, to study inter-organizational relationships, to understand roles and interdependencies between actors. Figure 4 depicts a business model for the supply chain at hand. It assumes a value perspective rather than reflect the business processes behind the supply chain. Actors (visualized as rectangles) exchange (visualized as blue lines) objects of economic value (text labels) such that every actor gives something, and receives something in return, based on the economic principle of reciprocity, or duality (McCarthy 1982). We start our procedure redesign on a value perspective, rather than process perspective, because the value perspective enables us to focus on the purpose of controls: to safeguard from the loss of value. This enables us to zoom in on the most critical processes in step 2.

Figure 4 includes one element of e^3-control that is not part of e^3-value. Namely, dotted blue lines (as seen in the value exchanges between the retailer and Customs UK) denote a so-called *sub-ideal* situation. The UK based retailer has a choice: either it pays excise to Customs UK, and is granted legal compliance (see the value exchanges "Excise payment/Legal compliance" between the retailer and Customs UK), or it does not pay excise (see the dotted exchanges between these actors), i.e., it commits fraud or behaves opportunistically. We used models as the one in Figure 4 to explore with BLL participants this and other control problems in the trade procedures.

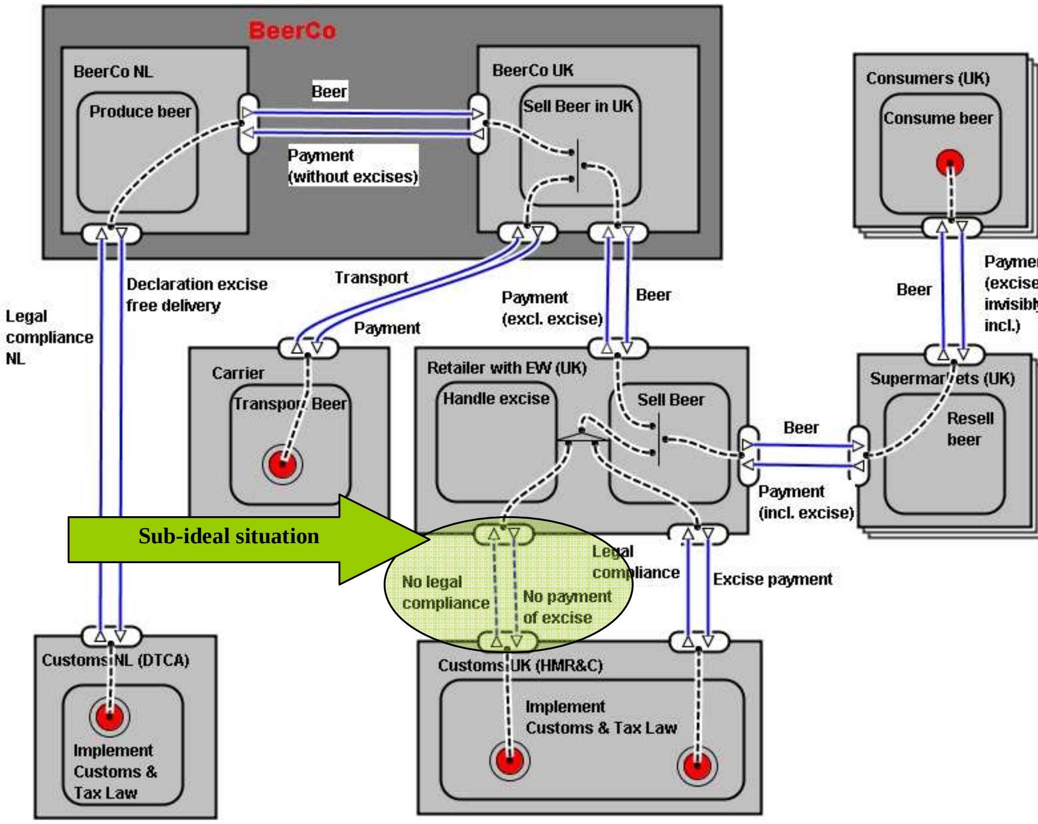

Figure 4 Beer Living Lab sub-ideal business model for intra-community supplies (with a defaulting UK-based retailer), using the e^3-value notation

5.2 Steps 2 and 3 in e^3-control: Process Modeling

Second, we developed business process models that describe trade procedures. Namely, business models can show where value can be lost, and hence controls should be introduced, but they are not rich enough for reasoning about the actual control problem and to design solutions – control mechanisms. In Liu et al. (2007) we elaborate on the application of control principles from accounting and auditing to BLL process models. In short, control principles can be described as rules or dependencies between actors, activities and documents in a process model. We investigated whether the BLL process models adhere to these dependencies. Wherever this was not the case, a control problem has been identified. Control mechanisms ensure that the process does not violate rules. For example, a control principle requires that DTCA witnesses the export of goods to the UK. This is not possible in the current AAD-based procedure. Therefore a control mechanism would introduce such a witnessing activity. In the BLL this witnessing is done by TREC devices that follow the physical location of a container. The process models also identified documents that actors exchange. We then studied the data elements in these documents and identified large redundancies in declarations that BeerCo has to submit when it ships beer outside the Netherlands. We also developed process models of various possible new procedures to explore whether the proposed solutions still introduce control flaws

5.3 Step 4 in e^3-control: Value Modeling

Third, we explored possible new procedures using business models. Two of the scenarios we studied should be mentioned. In the first scenario we involved the EU system-under-development EMCS to facilitate customs control. While this scenario manages to mitigate excise related control flaws, and it certainly improves Customs control compared to the current situation, it has two limitations. First, EMCS handles the excise procedure only, while BeerCo and DTCA specifically prefer a holistic solution for *all* trade-related procedures. Only a holistic solution can ensure high benefits for all parties involved. Second, EMCS replaces the AAD's role as export evidence, but not the AAD's role to identify cargo during a physical cargo inspection en route. A shipment ID (or: EMCS transaction ID) is still required on a paper document, to identify the shipment (the intention is to automate this is the future). The second scenario (presented in Section 4.2) introduced a radical rethinking of the trade procedure, because control is in fact outsourced from DTCA to a commercial TREC service provider and to BeerCo (subject to audits and certification). As business models showed, this scenario requires that a new actor is introduced to the supply chain: a provider of TREC services (this is not necessarily the manufacturer of TREC devices). As a result, some linkages between actors disappear, and other linkages are introduced. We used e^3-control models to explore these changes using models as the one in Figure 5. By comparing this model with the situation in step 1, the value of performing step 4 becomes visible. First, we identify changes in actor and changes in linkages between actors. Second, the model in Figure 5 also allows us to perform a profitability analysis.

In Figure 5 we did not assign the role of TREC service provider to an existing actor, but rather introduced a new actor. Variations of Figure 5 include scenarios where a carrier, a technology provider or BeerCo itself offer TREC services. One can argue that this service should be offered by carriers, for two reasons. First, TREC devices will be mounted on containers that are owned by carriers, and not by shippers or technology providers. Second, from a technology adoption point of view the number of large ocean carriers worldwide is limited; market penetration can be much faster if they adopt and offer the technology, rather than have BeerCo do so.

Another important observation from Figures 4 and 5 is that in the electronic BLL procedure DTCA introduces two certifications. First, BeerCo enjoys an AEO certificate, which results in tangible benefits including fast customs clearance. Second, because DTCA relies on EPCIS and TREC technology to achieve its control goals, these technologies need to meet DTCA requirements. DTCA certifies the TREC service provider to offer these services. Certification is typically subject to periodic audits.

e^3-control uses e^3-value to draw business models. e^3-value enables generating profitability sheets for all actors involved in the network, as part of step 4 for e^3-control. Naturally, the TREC hardware and software have a price tag. BeerCo could ship its beer either in regular containers or in TREC-armed containers. While the latter will be more expensive per container, it will enable BeerCo to comply with the AEO requirements (which is not the case with regular containers). AEO certification will result in a faster logistical process and in increased control on BeerCo's supply chain. In the BLL solution BeerCo implements an EPCIS database, but it no longer has to maintain expensive information systems to submit declarations to the government's islands of automation.

We are currently collecting data to investigate the financial feasibility of the BLL scenario using e^3-value. This is not a straightforward task, because a number of obstacles have to be tackled. First, the BLL technology is innovative and still under development. It does not have a known price tag yet. Second, many of the benefits of the BLL are hard to quantify, including fast operations and increased security. Third, an important actor is the government. The definition of value for public sector organizations is different from that of private sector organizations, as we discussed before. As public sector value analysis is yet ongoing research, it is not included in our case study description.

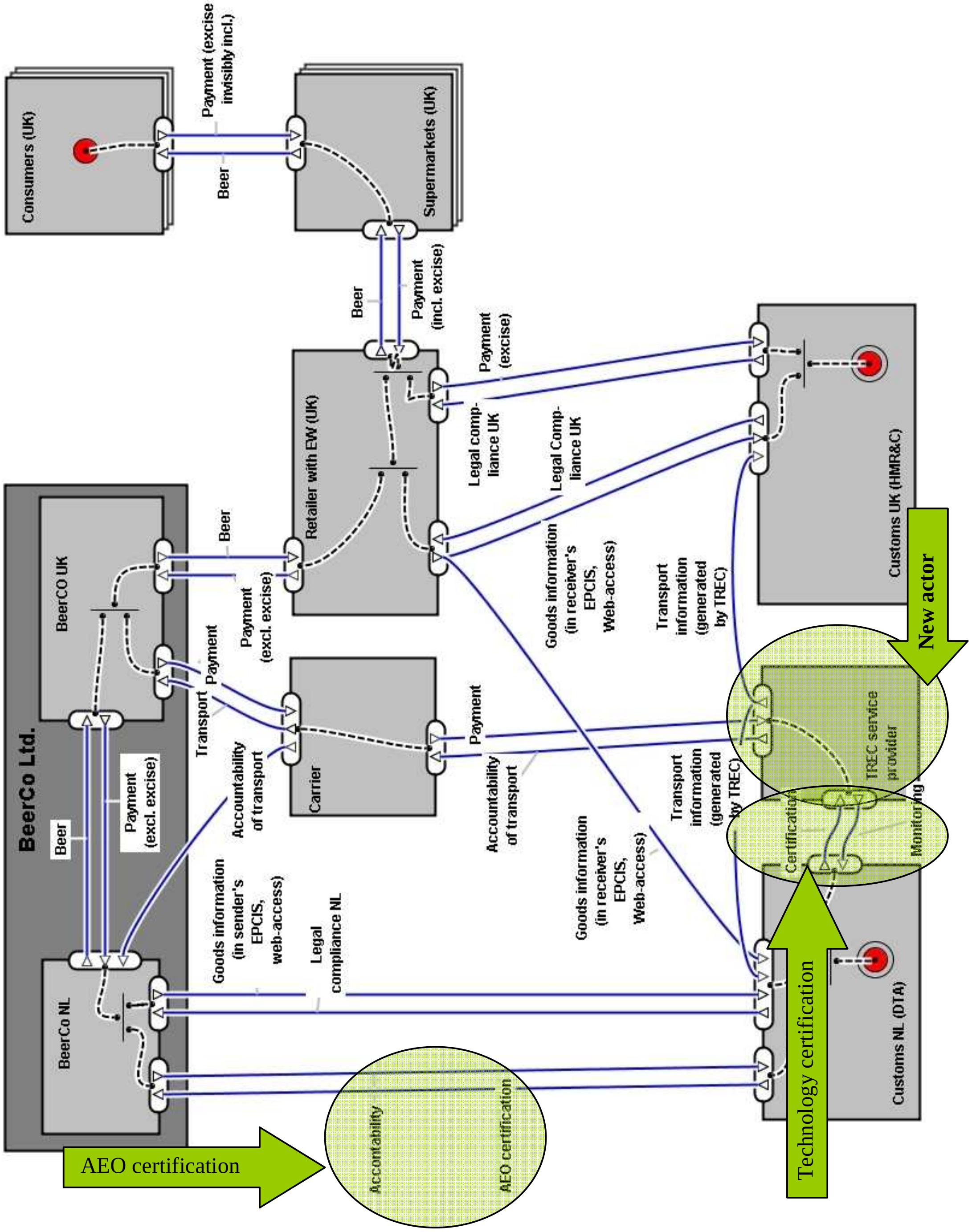

Figure 5 BLL trade procedure: DTCA certifies BeerCo NL as AEO, and a TREC service provider is introduced

6 Conclusions and Future Research

Customs administrations and EU legislators are facing substantial challenges in international supply chains. On the one hand, growing security, health, financial and other threats require increased control on supply chains. On the other hand, growing volumes and ocean port congestion (Crone 2006) make it impossible to exert extensive control inspections at the border, and the administrative burden of businesses should be lowered in order to create and maintain a viable economic zone. New electronic customs control procedures are required in order to cope with above mentioned challenges. Furthermore, important control procedures are still paper-based, while they can be supported much more effectively and efficiently by use of IT. Designing and implementing changes in customs control procedures is a highly complex issue, where technological, financial and political stakes have to be aligned. In order to cope with this complexity we proposed the Living Lab (Tan et al. 2006) as a dynamic research setting.

In this paper we build upon earlier work on e^3-control as a theoretical framework to bring about inter-organizational change in a Living Lab setting. Steps 1-3 of e^3-control have been discussed elsewhere. In the current paper we describe which modeling efforts have been used in the BLL to facilitate all four steps, and we elaborate on step 4. We will continue to develop e^3-control in future case studies.

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 from control tasks, these businesses can be rewarded with simplifications of 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 Internet-based EPCIS databases can complement and even replace the EU-initiated system EMCS, and achieve a paperless trade procedure. Finally, we proposed a trade 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 islands of automation of the government. This realizes the Single Window vision, a key EU goal in the field of Customs and Taxation. Businesses that will use our procedure will greatly improve supply chain and security control thanks to the use of container security technology, thereby qualifying 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 BLL simplified trade procedure.

While the Beer Living Lab is about to end, we identify a number of future research directions. First, as described in Liu et al. (2007), we seek to extend steps 2 and 3 of e^3-control where we analyze business processes. Second, the relation and transition between value and process models has been identified as an important field, with the aim to derive business processes from value models (Weigand et al., 2006). Third, we use the profitability analysis functionality embedded in e^3-value, but acknowledge its limitations. Mainly, when a business models involves public sector organizations, value cannot always be quantified and measured in money. Hence we will focus our future research effort on understanding what "value" means in the public sector, and how to incorporate in e^3-control schemes for value assessment tailored for the public sector.

Acknowledgements

This research is part of the integrated project ITAIDE (Nr.027829), funded by the 6th Framework IST Programme of the European Commission (see www.itaide.org). The ideas and opinions expressed by the authors do not necessarily reflect the views/insights/interests of all ITAIDE partners.

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