

## INFORMATION TECHNOLOGY FOR ADOPTION AND INTELLIGENT DESIGN FOR E-GOVERNMENT (ITAIDE)

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*A major concern of the European Union is to solve the dilemma to increase on the one hand security and on the other reduce the administrative load concerning international trade. In this paper we argue that IT has the potential to bring innovation to eCustoms and we outline four major categories of challenges for the design and adoption of eCustoms solutions, namely standards, interoperability, procedure redesign and network collaboration. Furthermore, we present a European project (ITAIDE), we discuss what contribution ITAIDE will bring to addressing these challenges, and we introduce the concept of living labs as a research setting used in the project.*

### 1. Introduction

In the globalised trading environment where not only corporations but national economies compete, the European Union hopes to facilitate trade within and across the Union while ensuring citizens are not placed at risk through lax control and security holes. The EU and member state governments are faced with contradictory requirements for greater control and security, and lower administrative costs imposed by the systems of international trade. The apparently paradoxical demands for increased security and control of international trade, with reduced administrative overhead borne by organizations, can only be solved by European governments and businesses working in cooperation.

Two stated long-term goals of e-customs development in Europe are crucial to these objectives (e.g. see policy reports of the European Commission including: the Draft eCustoms Vision State and Multi-Annual Strategic Plan, TAXUD/477/2004 and The Role of eGovernment for Europe's Future, COM(2003) 567)<sup>1</sup>. The first is the provisioning of online Single Window, where businesses can do all their interactions with public administration offices with one online access point. The second is enabling Authorized Economic Operators (AEO), businesses that are authorized by a public administration office to perform certain customs related procedures throughout the Community. For these AEO companies, simplified customs procedures will apply, which will lead to significant reductions in the administrative load and hence a reduction of costs.

ICT is widely perceived as a key component of a solution to the dilemma of the EU government. It is envisioned that creating a sufficiently granular and reliable representation

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of the physical, financial and information flows, will increase the transparency of underlying processes and hence potentially increase both, control and efficiency of systems (for a critical view on the representational view of information systems see [7]). Currently, technological solutions for e-government to facilitate cross-border trade are being developed. Examples are the Excise Movement Control System (EMCS<sup>2</sup>) and the Tamper-Resistant Embedded Controller (TREC<sup>3</sup>). EMCS is an EU-wide system for monitoring of the transport of excise goods. The TREC device is a mobile device which can be used trace a container location and to detect unauthorized opening of a container and can be used to reduce fraud.

Although technological solutions like EMCS and TREC have the potential to allow for timely information and to increase control and security, this outcome is neither automatic or inevitable, as the development, introduction and maintenance of such a complex IS creates its own control needs, uncertainties and inefficiencies. One of the main issues, as outlined in the TAXUD report, is how to achieve interoperability between the new EMCS systems that will be implemented in different member states.

Even if problems with integration of technology are overcome, technology can bring little value, if it is simply introduced to replace the paper-based communication ignoring the possibilities of reorganizing current working practices [2,5]. Moreover, while the development of IS within organisations and to a lesser degree in inter-organisational settings, is relatively well understood, the challenge of eCustoms solutions is that they must work in an international setting, align interests of commercial companies and public institutions, e.g. customs and taxation authorities, companies and supply chain service providers. This means that the development and adoption of IT-enabled eCustoms reveals deep complexities at different levels (technical, semantic, procedural, social, political), which need to be understood and tackled in order to be able to address this dilemma faced by EU governments for increased security while reducing administrative burden.

The goal of this paper is to outline the major challenges for the design and adoption of eCustoms solutions and to propose the research context (the ITAIDE<sup>4</sup> Integrated Project) within which these challenges can be studied and addressed.

The remainder of this paper is organized as follows. In Section two, the eCustoms innovation challenges are discussed. This is done in the context of an example from the beer industry. We then reflect on the diversity of the stakeholders involved and consider specific challenges for the design and adoption of eCustoms solutions. In Section three, we discuss the specific approaches taken in ITAIDE and in Section four we introduce the notion of a living lab as the research setting to be used in ITAIDE. The paper ends with conclusions.

## **2. eCustoms innovation challenges**

To give a flavour of the challenges of eCustoms innovation and transformation, we start with an illustration of the procedures for export of beer from one EU country to another.

### **2.1. Running example: the export of beer**

When goods like beer and cigarettes (also called excise goods) are sold, the producer needs to pay a special tax called excise. However, the general principle is that excise only has to be paid in the country where the beer is actually consumed. Hence, if a beer producer in the

Netherlands exports beer to a retailer in the UK, who sells the beer to English consumers, the excise has to be paid by the English retailer to the UK Tax office. In this case the beer producer in the Netherlands can export this beer excise-free to the UK and does not have to pay excise to the Dutch Tax office. Clearly, this is only acceptable for the Dutch Tax office, if the beer producer in the Netherlands can prove that it shipped the goods outside the Netherlands. This information exchange and the related procedures currently revolve around the exchange of paper-based documents. The core document for this excise-free export procedure is the Administrative Accompanying Document (AAD). This document is signed by the warehouse in UK and then sent to UK Tax. UK Tax then signs the AAD confirming that the goods have arrived in the UK. Finally, the AAD is returned to the Dutch beer producer as proof that the goods have arrived in UK and will be presented to Dutch Tax upon request.

The European Commission has initiated the development of a new information system solution to replace the paper AAD with an IT solution, the so-called Excise Movement Control System (EMCS). EMCS can be considered as a typical eCustoms example. EMCS is intended to satisfy two goals: first, to be a high-level specification of a national database for excise data in each European country; second, to be an international message standard for exchanging data between all the EMCS compliant systems in member states. In a preliminary case study conducted at a large Dutch beer producer in the Netherlands, it was discovered that in the current functional specification of EMCS, a reference-number for the AAD is still needed on a paper trade document. Hence, the current EMCS is not a complete paperless solution, however we can demonstrate that the EMCS solution can become completely paperless if it is combined with TREC technology. For this to happen, the ERP systems of the companies, the EMCS and TREC need to be interoperable. The beer producer in the Netherlands will allow Dutch Tax to access its ERP system directly if it can completely control the access that Dutch Tax has to the data in their ERP system. Secure access technology is now available but are other businesses prepared to simply grant tax authorities continuous access to sensitive corporate data?

Further opportunities to introduce efficiencies, better controls and security through redesign or restructuring of systems and procedures for excise-free export of beer are available. A system called VIES (VAT Information Exchange System) is already in place in Europe for the exchange of VAT (value added tax) data between the European Tax agencies for exporting companies. One possibility is to check whether the data relevant to the operation of EMCS is already available in the VIES systems. We must ask the question, 'why introduce a whole new system for excise when it might be possible to adapt the existing VIES system?' Another opportunity is presented when we contemplate the use of electronic invoicing (e-invoice) between companies, their suppliers and customers. The e-invoice contains all the data required for the EMCS; is it possible to adapt EMCS to utilize e-invoices instead of having special systems for the exchange of tax data?

In a preliminary study conducted for ITAIDE, the large beer producer in the Netherlands indicated a desire to avoid the tremendous costs required to adjust their ERP systems to generate data in the special formats required by the VIES and/or EMCS systems. They preferred the first option, TREC integration with their ERP and granting Dutch Tax direct access to the system. However they also argued that in order to adopt this redesign certain legislative changes are first needed at national, EU and international level; a complex and uncertain task involving a large network of actors and political interests. This shows that even if the redesign is initially concerned with introducing innovations desired by the businesses and governments directly involved, a broader political process and negotiation of a

network of actors may need to take place to successfully reconfigure these systems and processes.

## **2.2. The diversity of stakeholders**

Our example provides a flavour of the difficulties related to the design and adoption of eCustoms innovations. Before discussing the eCustoms innovation challenges in more detail, we need to pay specific attention to the diversity and the scale of the actors involved or implicit in the process of innovation. This sets out the broader context within which eCustoms solutions are designed and adopted. We can distinguish between the following major types of actors involved in the development and adoption of e-customs solutions: (1) citizens, who as consumers are expected to benefit indirectly through reduced tax and who at the same time have expectations for certainty of the supply of goods; (2) commercial companies and supply chains, e.g. the beer producer, carrier and intermediaries described in the example; (3) public administration, e.g. different national customs offices; (4) harmonization and standardization bodies, e.g. DG Taxation & Customs of the European Commission that is coordinating the standard development for EMCS; the World Customs Organization (WCO) and UN/CEFACT that are active in developing international standards for taxation and customs messages; (5) ICT companies, e.g. the provider of the TREC technology. Each of these types of actors has its own interests and characteristics, which makes the network of stakeholders diverse and implies different and even contradicting perceptions and expectations. For example, while commercial companies are mostly interested in adopting information technology and engaging in process redesign pursuing efficiency gains and economic interests, public administration is more interested in issues of control and security, rather than efficiency gains. The diversity of the stakeholders involved is a major challenge to achieving an eCustoms outcome acceptable to all parties.

## **2.3. Specific eCustoms innovation challenges**

Having considered the diversity of the stakeholders involved or affected by the design and adoption of eCustoms solutions, we now look at specific eCustoms innovation challenges. To structure the discussion, we have defined four general categories of challenges; (1) interoperability, (2) standards, (3) procedure redesign, and (4) network collaboration, each of which will be briefly discussed below. Although for analytical purposes we will discuss them separately, these four perspectives are closely intertwined.

### *2.3.1. Interoperability*

We face a complex network of organizations (both public and private) which cross national borders and legislations. These organizations have existing technological solutions and it is unrealistic to expect them to adopt one integrated system (even if such as system existed). In Europe the issue is not only how to integrate the new technology with the legacy systems but to ensure interoperability between the newly developed systems of each member state [1]. These different countries develop their own solutions in which they implement the specifics of their national legislation. However these different systems need not only to connect and exchange data, but they also need to act upon the exchanged information in a meaningful way. Conducting such a meaningful communication and achieving interoperability between the newly developed e-government systems is a key issue for member state administrations due to inherent differences between the systems in terms of syntactic structures, embedded

semantics, and embedded logic of interchange agreements, business rules and legislations and even to the level of acceptable and viable work practices.

### *2.3.2. Standards*

In such a diverse and distributed environment, it is impossible to achieve interoperability without establishing a degree of shared understanding for the design, deployment and use of these systems. The challenges related to standards implicate both standards development, as well as standards implementation and usage. The complexity in defining and using standards in local and national settings is huge, however this problem extrapolates magnificently when we consider global trade and standards based systems interoperating at a world-wide level. Although the EMCS standard is an EU wide standard and may be used when the trading parties are EU member states, if the beer producer wants to export outside the EU, for example to the US or China, EMCS as a standard may not be sufficient. Additional standards may then need to be developed for international trade, leading to another complex process of standards development. This may necessitate the adjustment of legislation of different countries, and the involvement of international standardization bodies like the World Customs Organization and the UN/CEFACT as well as initiatives to avoid the proliferation of competing standards or to facilitate their harmonization and alignment.

### *2.3.3. Procedure redesign*

Even if the challenges related to interoperability and standards are overcome and integration of technology is achieved, as argued in the BPR literature, it is not sufficient to introduce a technology and to keep the old processes. BPR requires a broader view on activities and IT and that IT should be viewed not only as a means for automation but also as a mechanism to fundamentally reshape the way of doing business. If we go back to the running example, one such possibility is to use the system for declaration of value added tax (VIES system) to exchange also excise information, instead of introducing a completely new system. In the redesign process conceptual modelling plays a key role to understand the current situation and develop scenarios for redesign. In the traditional redesign literature, the actors in the redesign are usually commercial parties which strive for efficiency gains, and the available modelling methodologies are tailored for supporting these demands. As we have outlined earlier, in e-customs redesign projects both public and private parties are involved, and while the business parties strive for efficiency gains the public organizations strive for control and security. This adds the demand for a new methodology of how such e-customs processes can be conceptualized and redesigned, taking into account the commercial interests of the parties and at the same time ensuring that the control and security requirements of the public organizations are taken into consideration in the proposed redesign.

### *2.3.4. Network collaboration*

The need for a new methodology for redesign of e-customs procedures can thus be examined from an modelling perspective. This perspective is important to provide a clear view of the current situation and possible redesign scenarios. However, in a redesign project, the socio-political perspective plays an equally if not even more important role than the modelling perspective. In the context of traditional BPR projects, as Malhotra [8] points out, more than 70% of the BPR projects fail and some of the key reasons for failure are lack of sustained management commitment and leadership, unrealistic scope and expectations, and resistance to change. These issues relate to the social processes that take place in the redesign project and show their tremendous importance. In e-Customs redesign projects however the challenges

related to the social perspective are much greater than those in BPR projects which involve only business parties. Furthermore, a redesign may affect the structure of the relationship between the different actors. These changes may be favourable for some and completely unacceptable for others. This emphasizes how important it is to understand the social processes that can lead to alignment of interest and expectations in order to achieve an acceptable redesign. Furthermore, due to the specifics of the e-customs context, there are legislative and political elements, which make this collaboration extremely challenging.

Having discussed specific challenges that need to be considered in the design and adoption of eCustoms solutions, we now discuss the specific approaches taken in the ITAIDE to address these four categories of eCustoms innovation challenges.

### 3. ITAIDE contribution to addressing the eCustoms challenges

Four key research building blocks are identified and related to the challenges discussed in the previous section: 1) standards, 2) interoperability, 3) procedure redesign and 4) network collaboration.

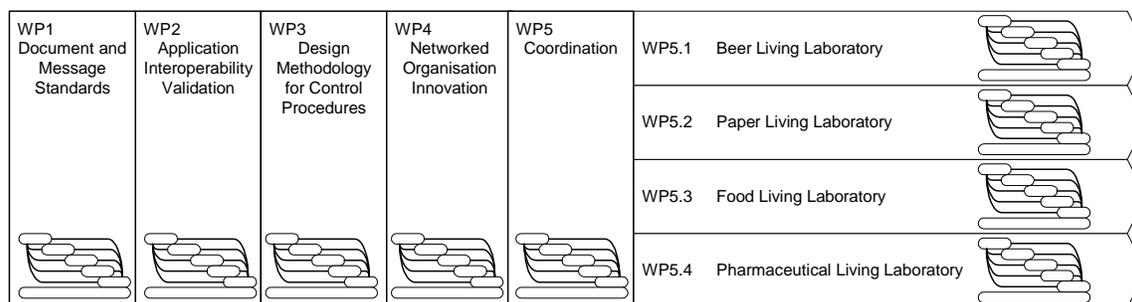


Figure 1. ITAIDE Workpackages and Phases

The project aims to contribute to the four areas in the following ways. Concerning interoperability and standards, the goal is to bring practice oriented contribution while with respect to procedure redesign and network collaboration the aim is to bring scientific research contributions.

In taking a practice oriented approach to the challenges related to standards and interoperability, we will develop demonstrators based on innovative eCustoms technology like TREC or the Finvoice implementation for e-invoices, constructing prototypical work systems and technology to demonstrate how interoperability can be achieved. These demonstrators will focus on both interoperability of the newly introduced systems with legacy systems, as well as interoperability between the newly developed systems within different member states. Results from the demonstrators could be compared with other projects which focus on interoperability issue like INTEROP, ATHENA, eGOV, and GUIDE. This will provide rich grounds for exchange of experiences and learning from each. The goal within ITAIDE is not to develop new standards, but to reuse dominant de-facto standards for the development of the demonstrators. For the identification of the dominant de-facto standards, the input from UN/CEFACT, which is a member of the project, is crucial. The experience gained in using the standards will be fed back to the standard development organizations. Furthermore, as there are multiple eCustoms standards available, it may be necessary to develop mechanisms for translation between standards. A canonical information model will

therefore be developed, which can be used as a common reference point in such a translation process. As issues of standards and interoperability are high on the EU agenda, members of TAXUD are involved in the project supervision of ITAIDE.

We will take a scientific approach to challenges related to procedure redesign and network collaboration. These two challenges relate directly to the principles of Single Window and Authorized Economic Operators, which as discussed earlier are crucial for solving the dilemma of EU governments for increased control and security and reduced administrative burden. As pointed out in part two of this paper, although redesign of eCustoms procedures plays a crucial role to simplify processes, current redesign methodologies are developed and applied in a business setting, where the goal is to achieve efficiency gains. They are not suitable for the redesign of e-Customs procedures, where the redesign methodology needs to ensure that apart from efficiency gains, the issues of control are tackled. In this respect, an eCustoms procedure redesign methodology will be developed, which takes into account both the efficiency and control aspect. To develop this methodology, we will build on earlier research on e<sup>3</sup>-control [6].

As discussed in section two of this paper, earlier research shows that more than 70% of the BPR projects fail to a large extent due to social factors. In the specific context of eCustoms innovation, we have a network of diverse actors and diverse interests. Ultimately for a redesign to be adopted it is important that the interests of the different actors affected by the redesign are taken into account and aligned, so that an eCustoms solution acceptable for all is designed and adopted. To address this, a network collaboration model will be developed. The goal of this model is to ensure that the interests of the different parties are elicited, taken into account and aligned so that an eCustoms solution acceptable for all the affected parties is designed and adopted. For the development of the network collaboration model, the structuration theory [3,4] will be used as a starting point, as it provides a rich ground for understanding the social processes that take place.

Due to the complexities of eCustoms innovation environment we need a complex research setting to be able to develop and test the demonstrators, the procedure redesign methodology and the network collaboration model. Such a complex research setting is what we call living lab and it will be described in the next section.

#### **4. Living Labs**

The use of the Living Lab concept<sup>5</sup> has previously been applied to multidisciplinary research sites for the development of ICT in open societal settings e.g. to test and develop advanced telecommunications products in urban environments. Described as an arena for research, the living lab as a "...kind of socio-technical approach is mainly meant for developing and elaborating sensitizing concepts that draw attention to central characteristics of sociality implicated in ICT usage. The later may then be further explored through continued design. In this way – underscoring the notion of mutual shaping – ICT becomes a vehicle for social research, the results of which in turn drive design" [9]. The living lab builds on the idea of open-ended multi-sited ethnographic methods and action research, thereby offering the potential to weave differing research perspectives and epistemological positions into sophisticated understanding of complex social and technical processes; for example information systems design (ISD), software engineering, business process (re-) engineering and sociological enquiry.

Within ITAIDE, four living labs are carried out in four different domains, focusing on different types of eCustoms innovation. The first two living labs are in the beer and the paper industry. The focus in the beer industry is on export of excise goods, while the focus in the paper industry is on e-invoicing. During these two living labs demonstrators will be developed in which innovative eCustoms technologies, like TREC will be used. For example, in the Beer living lab, the TREC device will be installed on real containers; TREC will be integrated with the test systems of the Dutch beer producer, the receiving party in UK, the customs office in the Netherlands and UK. Containers with beer will then be exported following the redesigned customs procedures. The goal is to demonstrate that fully paperless excise customs procedures are possible, using state of the art technology. Demonstrators will also be developed in the other living labs.

Apart from the demonstrators, early versions of the redesign methodology and the network collaboration model will be developed. These, as well as the demonstrators will be further refined and developed in the subsequent living labs in the food and pharmaceutical industries. The focus in the food industry is on traceability and provenance; certificates of origin and veterinarian certificates. The pharmaceutical industry living lab will focus on health certificates, control and flow of manufactured pharmaceuticals and precursor components through the supply network. The choice of different industries and different foci is done for the purpose of generalizability and transferability. The goal is to develop demonstrators, a redesign methodology and a network collaboration model, which will be general enough to be used across domains and at the same time embody mechanisms for customization for a specific domain. Although at first glance the focus of each living lab industry may seem fundamentally different (e.g. 'excise' focus in the beer living lab, e-invoicing focus in the paper living lab), a closer analysis reveals a high degree of potential overlap and convergence. For example, the beer living lab emphasis on excise may benefit from a redesign approach where excise data is obtained via the e-invoicing system of the beer producer. The e-invoicing focus of the paper living lab raises the possibility that findings here will inform actions in the beer living lab. This illustrates that although the beer and paper living labs have different foci, possible overlaps can be found. These kinds of overlapping benefits are not surprising as the variety of customs procedures rely on similar underlying commercial processes.

## **5. Conclusions**

At the beginning of this paper we presented the dilemma of EU governments to increase the control and security requirements and at the same time decrease the administrative burden for the companies. Within this paper we argued that IT has the potential to bring innovation to eCustoms and we outlined major challenges for the design and adoption of eCustoms solutions. We divided the challenges to four categories, namely standards, interoperability, procedure redesign and network collaboration. Furthermore, we discussed the contribution that the ITAIDE project will bring to addressing these challenges. ITAIDE will develop demonstrators and proofs of concept to illustrate that interoperability can be achieved by using dominant de-facto standards. Furthermore, within ITAIDE a canonical information model, a redesign methodology for customs procedure and a network collaboration model for eCustoms will be developed. The development and improvement of the demonstrators, the canonical information model, the redesign methodology and the network collaboration model will be done in an action research setting termed the living lab. Living labs in four different industries (beer, paper, food, and pharmaceutical) will be conducted during the project. The time span of ITAIDE is January 2006- June 2010.

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<sup>1</sup> The Role of eGovernment for Europe's Future, Communication from the Commission to The Council, The European Parliament, The European Economic and Social Committee and The Committee of The Regions

<sup>2</sup> Further information on EMCS available under Taxation and Customs of the European Commission: [http://europa.eu.int/comm/taxation\\_customs/taxation/excise\\_duties/circulation\\_control/index\\_en.htm](http://europa.eu.int/comm/taxation_customs/taxation/excise_duties/circulation_control/index_en.htm)

<sup>3</sup> Further information on TREC available at <http://domino.research.ibm.com/odis/odis.nsf/pages/board.06.html>

<sup>4</sup> ITAIDE is an integrated project of the 6<sup>th</sup> Framework for Information Society Technology of the European Union and stands for "Information Technology for Adoption and Intelligent Design for E-Government". The time span of the project is January 2006- June 2010. For further information see [www.itaide.org](http://www.itaide.org)

<sup>5</sup> For example: Jarmo Suominen (from Finland and MIT) amongst others has used the term living lab to cover a range of situated research methodologies involving new technologies and people (end users). This has been applied to research involving whole cities and regions as well as communities of practice and small groups being monitored in buildings." <http://www.kingston.ac.uk/~ku07009/livinglabs.html>