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Accelerating Global Supply Chains with IT-Innovation

ITAIDE Tools and Methods

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for Adoption and Intelligent Design
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Preface[1]

This book is the result of the joint efforts of numerous people who collaborated in various forms in the research project *IT for Analysis and Intelligent Design of e-Government* (ITAIDE) in the period January 2006 to December 2010. The objective of the project was to study IT innovations that can help to make global trade more efficient, safer and more secure. We gratefully acknowledge the funding of the ITAIDE project from the 6th Framework Information Society Technology (IST) Programme of the European Commission. The Vrije University Amsterdam acted as coordinating partner and Yao-Hua Tan[2] acted as project coordinator.

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[1] The listing of people per organization is done in alphabetic order.

[2] Since September 1, 2009 Yao-Hua Tan also holds an affiliation at the Delft University of Technology.

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The views and opinions expressed in this book are those of the authors, and do not necessarily reflect the views of the European Commission or other organizations directly or indirectly involved in the ITAIDE project.

We strongly recommend readers to consult the web-site established for the project, where it is possible to find two short videos about the project, all scientific papers published in relation to the project, a number of working documents, and other project relevant material: www.ITAIDE.org.

The editors,

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Chapter 1: Introduction

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1 Global economy, global risks

We live in a distributed, networked economy, which is characterised by dynamic business relationships and is global in nature. Every single day, we as consumers hold products in our hands, often without being aware of the long route that they had travelled to reach us or the large number of business actors involved in their production and distribution. For example, a mobile phone can be designed in California, produced in Asia and destined for a customer in Europe; and shrimp from Europe is processed in Africa and returned to Europe for consumption. These are only two examples; however, the majority of the goods that we buy in stores are products of this global networked economy. The new economy is also associated with volumes of trade which we have not seen before. In the Port of Rotterdam alone, trade has risen from 160,000 containers per year in 1970 to currently almost 10 million[1].

Despite this highly distributed and dynamic nature of the economic activities and the large volumes of trade, you as a customer still expect that you will not discover empty shelves in the supermarket when you do your weekly shopping. One fundamental building block that makes these complex networks work is the supply chain predictability, which allows companies to plan their logistic processes, so that inventory levels can be drastically reduced and goods can flow seamlessly in this global networked world.

Inter-organisational systems, which led to new IT developments such as EDI, XML, web services, service-oriented architectures, allow networked partners to exchange information and coordinate their actions in a timely manner, making concepts such as just-in-time delivery possible. Indeed, information technology is seen as an enabler to achieve a more distributed way of working: by reducing coordination costs, it allows for an overall shift towards more market-oriented coordination mechanisms rather than towards hierarchies (Malone et al., 1978).

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[1] See http://www.portofrotterdam.com/en/doing_business/Cargo_terminals/containers.jsp

What is important to take into account, however, is that in the context of international trade information flows need to be correctly connected to and reflect the physical items and flows in the real world (e.g. the goods that are in a container need to be correctly reflected in the information about the goods in that container). If this is not the case, the value of information would significantly diminish.

Globalisation and increased international trade are the two most important drivers of economic growth. Accordingly, all western countries are in favour of and are indeed actively promoting international trade. At the same time these developments expose us to new risks related to fraud, security and safety on a scale that we have not experienced before. Due to these risks, in the last decade, international trade has come under increased pressure. In particular due to the terrorist attacks (that started with 9/11, 2001), governments are compelled to take action to counter the vulnerability of these global supply chains. There are no clear cut answers, however, on how to proceed. On the one hand, governments have an interest in protecting their national economies and stimulating economic growth, which calls for reduction of administrative burden and fewer inspections at the borders. On the other hand, there is a clear need for stricter controls. It is clear that since 9/11 security in international trade has been tightened to counteract the possible threats (e.g. a nuclear device in a container). In a similar vein, the extent of fraud in international trade – fraud with VAT and excise in the European Union, for example, amounts to tens of billion Euros per year – is by all accounts increasing along with globalisation and international trade, and governments cannot remain passive observers.

Exercising control in this context of the global trade environment, however, is extremely difficult. First, the sheer volume of trade makes it virtually impossible for governments to physically control all the cargo (as mentioned earlier, almost 10 million containers per year are handled in the Port of Rotterdam alone). Second, in this global economy, the sources of risk spread well beyond the jurisdiction of a single government, requiring governments to take supra-national coordinated action.

As a response to these developments, new information systems and control procedures are imposed by governments. Unfortunately, these technical measures are limited in fulfilling the desired level of control, incur high costs for both government and businesses, and lead to an increased burden on traders and international trade. The costs of totally eliminating risks in international trade will be exorbitantly expensive. For example, it is estimated that the planned increase from scanning 3% of US-bound containers at ports of origin to scanning 100%, as required by the US government, would need a US$150 billion investment by ports that ship to the US[2]. Eventually, consumers would have to pay for these extra transaction costs. The higher risk leads to more control, but becoming 100% safe is theoretically as well as practically impossible. To quote Einstein, “a problem cannot be solved using the same perspective as the one that created the problem”.

[2] See http://ec.europa.eu/enterprise/newsroom/cf/document.cfm?action=display&doc_id=5143&userservice_id=1&request.id=102456

Governments in the EU and across the world are currently exploring an alternative Customs approach based on a different perspective. This approach moves away from the traditional antagonistic relationship based on distrust, in which governments are perceived as a source of administrative burden eager to interrupt supply chains with frequent inspections at the border and in which companies are seen as potential suspects, towards a new so-called *Public-Private Partnership* (PPP). The PPP approach relies on trust relationships businesses and governments and builds on overlap between the societal interests of governments and business interests of companies. This new perspective relies on delegation of control from government agencies to businesses and differentiation in inspection intensity between trusted and non-trusted companies. This approach allows for facilitation of legitimate trade by considerably reducing the number of physical inspections, which in turn enables governments to focus their scarce resources on control of the non-trusted traders. In addition, the electronic exchange of trade data provides the opportunity for business intelligence, which makes risk analysis and risk management possible.

The ITAIDE project should be seen in this context. ITAIDE proposes a way out of the dilemma of trade facilitation versus regulatory compliance. It demonstrates that these goals are not necessarily mutually exclusive and that IT innovations can help to achieve trade facilitation while at the same time ensuring that societal concerns are safeguarded.

ITAIDE developed the *ITAIDE Information Infrastructure* (I3) framework, which consists of key components that are helpful to achieve accelerated trade. More specifically, ITAIDE offers a set of IT-related innovations such as (software) tools and methodologies, which enable companies to achieve end-to-end control of the flow of their physical goods, as well as end-to-end information transparency. By doing so, companies are better able to show to the government that they are in control of their business operations, which makes them well positioned to obtain a trusted trader status and the related benefits of trade facilitation. A well-known example of this is the so-called Authorised Economic Operator certificate, which will be explained below. Governments can build on the available information infrastructure to achieve better quality of controls and reduced inspections.

The IT-related innovations developed in the ITAIDE project have been tested and validated in five Living Labs in four different sectors of industry and were conducted in five different countries. They focused on export of dairy products from Denmark, beer from the Netherlands, pharmaceuticals from Ireland and Germany, and paper from Finland. The Living Labs provided real-life innovation development environment where businesses, governments and technology providers could explore win-win scenarios. These Living Labs should not be seen as scientific proof, but they are proofs-of-concept of the kind of developments that may be achieved.

The research in ITAIDE and the related Living Labs were carried out in the period 2006-2010. In order to understand their starting point and the context in which they were developed, it is necessary to provide an overview of key historic events and developments.

Below we provide a historical overview where we discuss cross-border trade developments and the role of government in the time span of what we call the *fiscal wave*, followed by the *security wave*. As part of the fiscal wave we discuss the move towards globalisation in the post-World War II era, the fall of trade barriers and the relaxation of government control at the borders and the related information and audit requirements. As part of the security wave, we explore the events of 9/11 and the reaction of governments. More specifically, we discuss how the new strict safety and security requirements fundamentally reshape the relationship between governments, as well as between governments and trade. By doing so, we are better able to position the ITAIDE project, which proposes a way of trade facilitation to solve the government dilemma.

2 Historical view on trade facilitation and the role of government

2.1 Note on globalisation and the development of the European Union

2.1.1 Reduced trade barriers, increased trade volumes due to globalisation and the development of regional integration

Trade has become global and so has the government control over cross-border trade transactions. From an economic perspective, historians associate modern globalisation to the-post World War II era, starting from the Bretton Woods conference, and proceeding through a number of negotiation rounds under the General Agreement on Tariffs and Trade (GATT). Later on, as part of the World Trade Organisation (WTO), governments agreed to lower trade barriers. Accordingly, governments have taken steps to move away from their protectionist policies. For example, as far as industrial products were concerned, in the Uruguay Round the aim was to reduce tariff barriers by at least one third in five years and to increase the number of bound customs duties (where governments agree not to raise the level of duty). As a result of these commitments, customs duties levied by developed countries on industrial products imported from all regions of the world have fallen by 40% on average, from 6.3% to 3.8%.[3]

The lowering of trade barriers allowed goods to flow more easily from one country to another, and figures indicate that the trade volumes have risen. The international trade in goods increased from $23 per capita in 1948 to $1,201 per capita in 2003; in the period 1950-2003 the increase of international trade in goods was on average 6.1% per year, the increase in production on average 3.7% per year[4]. Under

[3] http://europa.eu/legislation_summaries/food_safety/international_dimension_enlargement/r11011_en.htm

[4] Source: WTO, International trade statistics, 2004

the GATT agreement[5] it is also recognised that world trade may be expanded by closer integration between the economies. The customs union and the free-trade area were introduced as instruments that encourage such regional integration. A customs union like the EU means a substitution of a single customs territory for two or more customs territories. In this case, the internal trade barriers between member countries disappear and all the members of that customs territory apply the same tariffs to third countries. A free trade area comprises a group of two or more customs territories in which the duties and other restrictive regulations of commerce are eliminated. As such, the free trade areas enable free trade between the members of that territory, while at the same time allowing all the members to negotiate their own third-country tariff policies.

2.1.2 The road to fiscal trade facilitation in the EU

Focusing on Europe in the post World War II era, a series of events including the Schuman Declaration, as well as the treaties of Rome, Maastricht and Amsterdam, led to the establishment of the European Union as we know it today. A major motivation was to reduce the risk of confrontations between European nations by moving towards a more integrated Europe. A starting point for this process was economic integration, where trade barriers between countries were removed. The aim was to provide trade facilitation and to create a stronger internal market in order to enable European businesses to be more competitive in the global arena.

In terms of GATT, the European Union was established as a Customs Union. This meant that first of all, the internal borders (and the customs offices that operated at the borders between member states) disappeared and a common European market was created, meaning that the goods could travel freely within the EU without the need to pay import duties. Second, the customs offices shifted to outer borders of the EU to control cross-border trade activities with non-member countries.

The Community Customs Code is the legal framework that provides the basis for Customs affairs in the EU and it applies to all Member States. The duties that are collected by the Customs offices are mainly used to finance the EU budget, and the Member States handling the import formalities receive a fee for providing services to the EU. It is important to mention, however, that the power of EU legislation over the Member States is not so strong when it comes to indirect taxation, such as Value Added Tax and Excise. In these cases, Member States have much more autonomy: the EU can issue legal document in the form of regulations, but Member States have considerable discretionary power to adapt these for their own jurisdiction. The reason is that these indirect taxes are used to finance the national budgets of the Member States rather than the EU budget, and the power of the EU legal framework in that area is much weaker than that of Customs. This makes the EU a complex environment: while the Member States have achieved tight integration with respect to Customs issues, the level of integration is much weaker when it comes to indirect taxation, or for that matter to health and safety control procedures. As we will see

[5] article XXIV of GATT, http://www.wto.org/english/tratop_e/region_e/regatt_e.htm

later in this book, this creates considerable challenges when it comes to introducing IT-based solutions for cross-border trade.

With respect to globalisation, the establishment of the European Union brought further economic and political dynamics and changed the relationship between government and trade, as the EU countries now acted as one union to pursue their economic interests in the international arena. For example, in the Lisbon agenda in the year 2000, which was set as an action and development plan for the European Union, the ambition was to make the EU "*become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion*"[6]. This shows the ambition of the EU to be a major player in the global trade environment.

Historically, countries followed protectionist policies by imposing among other measures, high tariffs on imported goods. Customs officers had to do extensive controls in order to make sure that the import duties were properly collected. However, the EU countries also took part in the negotiation rounds for reducing trade barriers the tariffs for goods imported to the EU dropped significantly as well.

As the tariffs gradually went down, so did the importance of import duties and related controls. This enabled Customs to undertake responsibilities and perform tasks of a non-fiscal nature on behalf of other government agencies. These developments have led to less fiscal control and a shift from control based on tariffs to control based on subjects. Subjects such as counterfeiting, environment, and public health have become the focus of control.

As a result of the globalisation and the increased volume of trade, the traditional approaches used by Customs to control cross-border trade activities became inadequate: the sheer volume of trade made it impossible to rely on physical inspections carried by Customs officers at the border and they had to investigate other methods of exercising control.

These new Customs strategies have first and foremost been explored by Northern European countries such as Sweden and the Netherlands in the "Stairway" and "Compact" models[7], which allowed for a fundamental shift in the relationship between government and businesses. The basic idea behind these models is that traders can be distinguished in compliant (trusted) and non-compliant traders. The benefit of doing so for the government is that they could become more efficient in performing their tasks: they could focus their efforts and better target the non-compliant companies while at the same time they could reduce administrative burdens for the compliant ones.

Trusted trader status with respect to fiscal affairs was granted by using the principles of system-based control[8], as opposed to transaction-based control. In the former, government examines company's internal systems and procedures and identifies potential risks. As a follow-up, an agreement between trade and Customs

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[6] http://www.europarl.europa.eu/summits/lis1_en.htm

[7] See e.g. http://www.unece.org/trade/security_conf03/docs/white_paper_scs2_mindre.pdf

[8] See also http://ec.europa.eu/taxation_customs/resources/documents/customs/procedural_aspects/general/community_code/pres_mccc_en.pdf, slide 12.

is made on how to mitigate this risk. Once the appropriate risk measures are in place, the company is granted a trusted trader status and receives fiscal trade simplifications. It is no longer controlled per transaction[9] and government performs periodic audits to check whether the control procedures are still in place. This is an approach in which the specific situation of the company is taken into account. It is a fundamentally new way of controlling the company, where the physical interference in the logistics processes of each transaction is replaced by licensing and periodic audits. It is important to mention that following this approach, companies could receive fiscal facilitation. The control concerning the non-fiscal matters such as environment and health remain based on traditional physical inspections and rely on simple risk analysis techniques performed at the moment the goods arrive at the border.

2.2 Focus on safety and security

The events of 9/11 made it very important to focus on anti-terrorism. This led to major shift in thinking about international trade. It became obvious that as trade has become global, the security threats have also become global and measures needed to be taken to make the flow of goods more secure.

2.2.1 Shift in the safety and security relationships between businesses and governments

Due to the safety and security concerns, several aspects came to the forefront to redefine the relationships between businesses and governments. These included new data and auditing requirements, the focus on supply chains (as opposed to single traders), and the need for government-to-government collaboration[10]. Information technology and the use of standards became key enabler in this new international trade environment.

2.2.1.1 New data and auditing requirements

Historically, companies needed to provide information concerning the origin of goods and the value of goods. This information was used to calculate import duties. For several decades the goal was to remove trade barriers by lowering the tariffs and providing fiscal facilitation, so this was also associated with minimising the information requirements; the system-based audit approach allowed for reliable companies to provide aggregated information periodically, instead of per transaction. Auditing on past information was possible, as even if irregularities were identified after the fact, it was still possible for Customs to collect the duties.

[9] Although the control in this case is not done per transaction but periodically, it is still important that the information per transaction that is stored in the company's enterprise system is correct.

[10] The legal frameworks capturing these developments, as well as references to relevant documents addressing these issues, will be discussed in Section 2.2.2 of this chapter.

After 9/11 safety and security issues related to health, environment, anti-terrorism were added as high-level concerns and this had an impact on the whole Customs system and the relationships between governments and trade; it set new demands with respect to the data that companies need to deliver and the related audits. One major change was the growing importance of information for risk assessment and for taking action upon risk signals. Information needed to be available in advance (much earlier before the goods reached the border), so that the Customs officers could act on it in order to eliminate security threats.

Two important instruments, the instruments of "pre-arrival" and "pre-departure" information, were introduced in order to collect in advance information about the goods[11]. These two instruments make it possible for governments to do risk analysis and risk assessment and carry out targeted checks on high-risk cargo. The instruments for risk analysis and risk assessment are a new feature of modern Customs. Previously, a primitive risk analysis was made at the moment goods arrived at the border. Nowadays, the use of green lanes (or fewer physical inspections on the cargo of low risk traders) is possible only if information is made available in advance.

The pre-arrival and pre-departure information provide a major shift for both trade and Customs administration. From a trader perspective, it used to be possible for trusted companies to make an aggregated declaration for goods once per month rather than for each single transaction; if they had well structured administration, the monthly reporting provided a sufficient basis for them to calculate the duties. Following this approach allowed for removing the interference of Customs from the real-time logistics processes of companies, enabling better predictability in the supply chain. Now these companies need to deliver information per transaction, which with respect to trade facilitation means going several steps backwards. This new approach makes Customs again an integral part of the logistics processes, which creates a dependence and potential for disruptions and delays in the supply chain.

2.2.1.2 From trusted traders to trusted supply chains

Risk analysis and risk assessment are closely related to the concept of trusted traders. While the idea of trusted traders already existed regarding fiscal matters, this concept did not exist regarding security matters and needed to be developed. The idea is that trusted traders (with a focus on security) or traders that can demonstrate that they comply with a set of security requirements, will get "green-lane" treatment and will be subject to fewer inspections at the border. This will enable Customs to focus their efforts on the non-trusted traders and perform more targeted checks on high-risk cargo. The question then became how to identify trusted traders, when it comes to security.

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[11] In the EU, these are addressed in Annex 30A of the Commission Regulation No 1875/2006, http://ec.europa.eu/ecip/documents/transitional_measures/annex30a_en.pdf. These requirements reflect and are related to the requirements linked to the Container Security Initiative in the US (http://www.cbp.gov/xp/cgov/newsroom/fact_sheets/trade_security/csi.xml). See also http://ec.europa.eu/taxation_customs/customs/procedural_aspects/general/prearrival_predeparture/index_en.htm.

Trusted traders are identified through security certification programmes which establish a partnership between government and business. In the security context, however, looking at a single trader is no longer sufficient and a supply chain perspective is needed.

While in the old situation individual companies were responsible for the payment of import duties and were the focus of government control, it is clear that for safety and security concerns this focus on a single company is no longer sufficient. Goods travel through global supply chains and, at different moments in time, different parts of the supply chains have access to the goods and the information about the goods. One weak link is sufficient to disrupt the security of the whole chain. A shift of control from a single trader to a whole supply chain became necessary. Now the trader is seen as part of a global supply chain and a green-lane situation can be achieved only if the whole supply chain is secure. Supply chain management has become much more important.

Supply chain management has already been of commercial interest to traders. In the commercial context the benefits of information sharing and the consequences of not sharing have been widely addressed in both the scientific and the practitioner's literature (e.g. Waller et al., 1999; Dyer & Nobeoka, 2000; Lee & Whang, 2000; Lee et al., 2000; Grean & Shaw, 2003; Fliedner, 2003; Lee et al., 2004; Bowersox et al. 2005; Elkins et al. 2005; Finley & Srikanth 2005; Malhotra et al. 2005; Rai et al., 2006). As a result of technological advances, supply chain partners can work in tight coordination to optimise the chain-wide performance and the realised return may be shared among the partners (Lee & Whang, 2000). *Vendor Management Inventory* (VMI), and *Collaborative Planning, Forecasting and Replenishment* (CPFR) have emerged as widely used types of partnership. In the former, the vendor monitors the buyer inventory level and makes periodic re-supply decisions (Waller et al., 1999), while the latter allows for coordinating the activities of production and purchase planning, demand forecasting and inventory replenishment through collaboration among all supply chain trading partners (Fliedner, 2003, p. 16). It has been shown that lack of information sharing can lead to the so-called *Bullwhip effect*, a distortion in the supply chain where orders to the supplier tend to have larger variance than sales to the buyer; a distortion that propagates upstream in an amplified form (Lee et al, 2004). Sharing business information can help to mitigate the bullwhip effect.

While it is evident that supply chains have used supply chain management for decades, the new element that was brought in place as a result of the security measures is that traders have to combine supply chain management with Customs systems. In the trusted trader situation government expects that businesses will also incorporate security measures in their supply chains and that they will make their supply chains more secure – or as secure as possible, since achieving 100% security is virtually impossible. There are also commercial reasons for enhancing the security and control in supply chains, as if something goes wrong companies can detect the problem and take actions in an earlier moment, rather than acting after the fact (e.g. by recalls from end customers).

2.2.1.3 The need for Government-to-Government collaboration, mutual recognition and Single Window

Traditionally, business-to-government interactions took place within a single country. Governments did not trust other governments or agencies (like ISO) and preferred to carry out all the controls themselves. The events of 9/11, however, made it necessary for governments to rely on other government and certification bodies within and outside their own country.

One type of collaborative relationship that is gaining attention is that between Customs and other government agencies that have an interest in cross-border trade activities. Currently, there are a number of other government agencies, in addition to Customs, which are entitled to carry out inspections of goods at the border, such as veterinarian inspections and checks related to agricultural subsidies. However, there appears to be little collaboration and information exchange among these agencies. This has important consequences with respect to both trade facilitation and security. Concerning the former, companies are burdened with communicating similar information to different authorities. Furthermore, inefficiencies in the supply chain are created due to the lack of coordinated border management, meaning that the same cargo can be inspected at different times by different agencies, which brings additional costs and delays. With respect to security, vital information for performing appropriate risk management may not be shared. This can lead to delays lasting days rather than hours and the risk of security threats may go undetected.

Collaboration between Customs and other agencies is a central objective to the development of Single Window. Single Window is broadly defined as "a facility that allows parties involved in trade and transport to lodge standardised 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" (UN/CEFACT, 2005, p.3). The Single Window concept allows for governments to carry out coordinated border management. This leads to efficiency gains and better targeting for high-risk cargo. For businesses Single Window allows the information to be made available once only to the relevant government agencies.

Going beyond the national context, collaboration between different national governments is also important. The reason is that in the global economy, goods pass through territories of different countries and no single government holds the control over the entire process. Governments have to rely on each other and work together in order to make international trade less vulnerable. In that light, different aspects of government-to-government collaboration come to the foreground. First of all, there is the need to rely on each other in order to exchange the pre-arrival and pre-departure information necessary for carrying out risk assessment and risk management. This information is available long before the goods have reached the territory of the country of destination, where the respective government has legal power. Only through collaborative arrangements can the receiving country acquire the pre-arrival information, which is needed to identify high-risk cargoes and take preventive actions. The collaborative relationships between governments may extend even beyond the exchange of advanced information, where the authorities from the coun-

try of destination may request the authorities in the country of origin to make inspections of high-risk cargo. To realise the above, governments need to set up the appropriate information infrastructures for government-to-government communication to make the necessary information exchanges possible. A very advanced form of such infrastructure can be seen in the context of Single Window. While Single Window initiatives usually start at a national level, they can expand to the supranational and international levels, when governments make agreements to exchange information with each other via a network of inter-related national Single Windows.

Another aspect of government-to-government collaboration relates to mutual recognition. *"Mutual recognition is a broad concept whereby an action or decision taken or an authorization that has been properly granted by one Customs administration is recognized and accepted by another Customs administration." (WCO, 2005, p.54).* Mutual recognition can be seen as a framework agreement between different countries or economic zones.

One aspect that is a subject of mutual recognition is related to the trusted trader certification programmes. While countries or union of countries (such as the EU) have the legal power to define their own legal requirements that companies need to fulfil in order to obtain a trusted trader status, traders may experience increased administrative burden if they have to apply for separate certificates in each country in which they operate. Mutual recognition of certificates can bring significant trade facilitation benefits for the certified companies. If there is a mutual recognition of certificates between, for instance, EU, US and China, companies would need to be certified only in one of these countries and the other country will accept the certificate and grant companies the associated benefits of trade facilitation.

Another form of mutual recognition agreements can be when countries agree to rely on each other's control systems in the sense that if a check is conducted in one country, it is not repeated in the other country. Following that logic, concepts such as "Import-is-Export" may be introduced, which would mean that all the checks are done on the exporting side by the authorities in the country of origin and these checks are recognised at the country of destination. In such a case, there will be no further inspections of the cargo once the goods enter the country of destination.

2.2.1.4 The role of international standards and interoperability tools

Focusing on supply chains rather than individual organisations requires extensive use of information technology to exchange data. A proper Information infrastructure is needed to enable not only the business-to-business (B2B) interactions among the supply chain partners, but also the business-to-government (B2G) and government-to-government (G2G) communication. With respect to the B2B aspect, companies have already invested for decades in IT solutions to exchange information with their supply chain partners to manage and optimise their supply chain operations. Despite that, there is still a need to streamline and make the supply chain operations more secure; IT provides ample new opportunities to achieve that.

With respect to the B2G and G2G aspects, the situation is quite different the B2B domain. In the past, there was a limited need to exchange information between governments; therefore automating G2G communication was not well developed.

Concerning the B2G communication, on a national level, countries have followed at a different pace the implementation of eGovernment services and have often relied on national standards to develop national Customs systems for their interactions with businesses. In the current Customs and trade environment, a major challenge then becomes how to deal with the diversity of governments systems and make them interoperable. Interoperability can be seen as "the ability of two or more systems or components to exchange information and to use the information that has been exchanged" (IEEE, 1990). While this definition has a focus predominantly on technical systems, it can be expanded to capture socio-technical systems as well (Stegwee & Rukanova, 2003).

Achieving interoperability is specifically problematic in the EU, where historically the 27 Member States have developed different national Customs systems, which now need to be able to exchange information as the EU acts as one Customs union towards third parties. Added to that, there is the need for global interoperability to exchange information with other governments outside the EU. Global interoperability is required due to the highly distributed nature of the global economy, as well as the new risks associated with it: supply chain partners and governments operating across the globe need to be able to exchange information and act upon this information in a timely and coherent manner. Due to the high diversity of standards and systems, achieving interoperability on a global level is a very challenging task.

International standards can play a key role in facilitating the information exchanges on a global scale, as they will provide a common ground for communication. Two international organisations are instrumental when it comes to developing international standards: the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) and the World Customs Organisation (WCO). The mission of UN/CEFACT is to support activities dedicated to improving the ability of business, trade and administrative organisations, from developed, developing and transitional economies, and to exchanging products and relevant services effectively. UN/CEFACT focuses on facilitating national and international transactions by simplifying and harmonising processes, procedures and information flows, and so contributes to the growth of global commerce[12]. The work of UN/CEFACT predominantly focuses on the B2B domain. WCO focuses on development of standards and frameworks that are applicable to the G2G and G2B domains. Two developments at WCO – the WCO *Cross-Border Data Model* (CBDM), which defines a maximum set of data for the accomplishment of export and import procedures, and the *Unique Consignment Reference* (UCR) to exchange information between enforcement agencies[13] – are very instrumental in the context of cross-border trade. Especially interesting is the WCO data model Version 3, which captures the information requirements that companies need to fulfil with respect to various government authorities (not only Customs) when crossing borders. The UCR allows achieving traceability of the goods when they flow through the global supply chains.

[12] http://www.unece.org/cefact/about.htm

[13] http://www.wcoomd.org/home_wco_topics_pfoverviewboxes_tools_and_instruments_pfucrcontent.htm

Despite the fact that there are dedicated international organisations developing standards that can facilitate international trade, having all actors in international trade adopt these standards will be challenging. First of all, there is the issue of time of availability of standards. The WCO V3 model was only recently published, whereas companies and governments have already invested in IT solutions for years. Making new investments in the short run to comply with the new standards is unrealistic and for some it may take a decade before they decide to make this shift. Second, countries are at different levels of development of their IT systems and their need to renew these will arise at different times. In that respect, ensuring a wide adoption of these international standards in the near future is not very realistic. Other solutions can help to manage this diversity, while in parallel governments and businesses can work towards more data and process long-term harmonisation.

Interoperability tools play a key role in facilitating information exchanges and in making eCustoms solutions work. Their importance can be seen in two directions. First, they can play a mitigating role in the current environment, characterised by diversity of standards and solutions, by providing possibilities for XML-based semantic mapping and translation between different standards. Second, even if in the future there is a wide adoption of international standards like the WCO data model, there will always be a need for some degree of local adaptation of these standards. In that context, interoperability tools play a key role in facilitating the mapping of the standards to the specific situation where they are applied.

2.2.2 New legal frameworks

The new aspects concerning safety and security as discussed in Section 2.2.1 are incorporated in different international, regional and national legal frameworks. Below we give a brief overview of developments at international level (focusing on the World Customs Organisation), followed by an overview of legal developments in the EU.

2.2.2.1 International level: the World Customs Organisation

A key player on the international arena is the World Customs Organisation. Started in 1947 as a Study Group to examine the possibility of establishing one or more Customs Unions between European countries in accordance with GATT principles, it grew to a powerful international organisation, currently consisting of 175 members from all over the world. The name "World Customs Organisation" was adopted in 1994 to better reflect the global nature of the organisation. Several developments are of particular interest. First of all, throughout its history, WCO has put a strong emphasis on the simplifying and harmonising Customs procedures, through the Kyoto convention from 1974 and the subsequent revised Kyoto convention from 1999[14]. Second, the SAFE framework of Standards[15] to secure and facilitate global trade was adopted in 2005 to reflect the new aspects of security.

[14] http://www.wcoomd.org/home_wco_topics_pfoverviewboxes_tools_and_instruments_pfrevisedkyotoconv.htm

[15] http://www.wcoomd.org/files/1.%20Public%20files/PDFandDocuments/SAFE%20Framework_EN_2007_for_publication.pdf

The SAFE Framework recognises the importance of international trade as a driver for economic prosperity. It also acknowledges, however, that terrorist threats can severely damage the entire global economy. A main objective of the Framework, therefore, is to establish standards that provide supply chain security and facilitation at a global level to promote security and predictability. It contains four core elements and builds on two pillars. The four core elements are: 1) harmonised advance electronic cargo information requirements concerning import, export and transit; 2) a consistent risk management approach to address security threats; 3) the possibility of Customs administrations of destination to request from the sending nations Customs administration to perform inspections of high-risk cargo; and 4) benefits defined for businesses that meet minimal supply chain security standards. With respect to the two pillars, the first one encourages Customs-to-Customs network arrangements in order to detect high-risk shipments. The Framework also encourages the establishment of co-operative arrangements between Customs and other government agencies in international trade in order to facilitate the seamless transfer of international trade data (Single Window concept) and ensure coordinated border management and control. The use of the WCO Data Model, which defines a maximum set of data for the accomplishment of export and import procedures, is seen as a fundamental prerequisite to ensure interoperability among different Customs IT systems. The second pillar of the SAFE Framework fosters Customs-to-Business partnership having Authorised Economic Operator (AEO), or what we earlier referred to as trusted trader, as a central concept. Authorised Economic Operator is defined by WCO as *" … a party involved in the international movement of goods in whatever function that has been approved by or on behalf of a national Customs administration as complying with WCO or equivalent supply chain security standards. Authorised Economic Operators include inter alia manufacturers, importers, exporters, brokers, carriers, consolidators, intermediaries, ports, airports, terminal operators, integrated operators, warehouses, distributors". (WCO, 2005, p.36).* The Framework establishes that AEO companies can benefit in terms of reduced inspections, which translates into savings in time and costs, as well as simplified reporting requirements. In order to increase the benefits for the AEO companies, the SAFE Framework also calls upon Customs administrations to work with each other to develop mechanisms for mutual recognition.

With respect to its legal power, the SAFE Framework can be seen as a soft-law approach. Countries can agree to adopt it; however it is not a binding legal instrument. In order to gain such a binding legal power for national administrations, the principles of the framework need to be translated into specific national or regional legislations.

There are two interesting observations that can be made regarding the power of regulation in the new global trade environment. On the one hand, the power of regulations diminishes when moving from a national to an international level. As in the case of SAFE, it is a form of soft law which relies on the willingness of countries to adopt it. On the other hand, we also see a movement in the other direction, where national legislations expand their power way beyond the national borders (also referred to as extra-territorial legislation). One example of that is the requirement

imposed by US Customs and Border Protection (CBP) for pre-arrival and pre-departure information to be provided, where the obligations of other governments to provide information are defined in a national legislation. This also highlights the complexity of the problem, where global interlinked economies are exposed to global threats and require complex legal frameworks to address the concerns.

In the section below we focus on the EU, showing how it incorporated aspects of the SAFE framework in its own legislation.

2.2.2.2 Focus on the EU

Security concerns are high on the political agenda of the EU and have been incorporated in a number of running policy and legal developments related to eCustoms. Influenced by international developments, in Europe efforts have also been made to facilitate legitimate trade by using IT and by improving and simplifying legislation. Two political initiatives were launched in 2002 to address these concerns: *eEurope*[16] and *Better Regulation*[17]. These developments have provided favourable grounds for innovation in the area of eCustoms and a Communication from the commission on a simple and paperless environment for Customs and trade[18] was published in 2003. In this document, Information technology (IT) tools combined with modern risk management techniques were seen as powerful enablers to address both trade facilitation and security concerns.

Several issues were brought to the forefront. First of all, it was recognised that the paper-based procedure was old-fashioned and did not take into account the potential possibilities for simplification, which could be realised when using IT. Second, it recognised that different member states have developed their own IT systems, which has led to a diversity of legacy systems and Customs procedures, proving burdensome to trade. In this light, it was recognised that Member States alone are not able to bring about the necessary legal and IT environment required for eCustoms in the EU. The European Commission was seen as an actor which can act as a catalyst to bring these developments into operation. In the Council Resolution of December 5, 2003 the Commission was invited, in close cooperation with the Member States to draw up a "*Multi-Annual Strategic Plan* (MASP) aiming at creating a European electronic environment which is consistent with the operational and legislative projects and developments scheduled or under way in the area of Customs and indirect taxations". The Directorate General of Customs and Taxation of the European Commission (DG/TAXUD) is the body responsible for coordinating the implementation of MASP. An important due date for MASP is 2013, when a number of eCustoms systems need to be up and running.

On the legal side changes were also made. In the short run, through Regulation 648/2005[19] the Community Customs Code was modified to incorporate elements related to increasing security at the external borders. Related to that, the correspond-

[16] See also http://ec.europa.eu/information_society/eeurope/2005/index_en.htm
[17] See also http://ec.europa.eu/governance/better_regulation/index_en.htm
[18] See also http://europa.eu/legislation_summaries/customs/l11019a_en.htm
[19] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32005R0648:EN:HTML

ing implementation provisions also took effect in the form of Commission Regulation 1875/2006[20]. These modifications of the Customs Code provide a legal basis for concepts like risk management and the related need for pre-arrival and pre-departure information, as well as AEO. The bigger change that followed was adoption of the Modernised Customs Code, which further promotes the shift towards a paperless environment for Customs and trade. Goals of the Modernised Customs Code include streamlining of Customs rules and procedures in order to achieve simpler and paperless environment for Customs and trade, enhancing efficiency of Customs legislation to ensure safety and security, compliance and reduced risk of fraud, facilitating legitimate trade and enhancing the competitiveness of businesses in the EU (DG/TAXUD, 2008, p. 9).

The AEO certification programme for trusted traders as established in the EU legislation, like the AEO as envisaged in the WCO SAFE Framework, builds on the idea of establishing partnership between Customs and trade. In the EU companies can apply for an AEO certificate and, if they fulfil the necessary requirements, they receive a certificate which entitles them to enjoy benefits of trade facilitation. Having fewer physical inspections at the border is an example of such benefits. One problem with the AEO certification in the EU is that it is issued by a Member State, but should be accepted by all other Member States. This creates tensions internally in the EU (related to the ways the different Member States implement the AEO application procedure) as well as externally, when it comes to discussing mutual recognition of certification programmes with other economic zones.

The AEO concept as set in the EU legislation has similarities with and differences from its counterpart security certification programme C-TPAT[21] (*Customs-Trade Partnership Against Terrorism*) in the US. The C-TPAT certification is a levelled system to indicate a progression of trustworthiness of the companies carrying the certificate; the focus is on import processes and security aspects only. The European AEO does not have levels, focuses on both import and export processes, and allows for companies to apply for fiscal facilitation, security facilitation or both.

An important development in the EU was also the policy to perform more and more controls (e.g. veterinarian and agricultural) at the outer border of the European Community. This also has consequences in terms of trade facilitation. For logistics purposes the easiest would be if the goods are checked at the company's premises before loading. The efforts for checking a container when loaded increase, but they scale up even further when a container needs to be rerouted and checked at the border. Therefore, for logistics purposes it is more efficient if these controls are performed as close as possible to the company's location.

Coming back to the legislative change that took place in the EU Customs environment, the multi-annual strategic plan can be seen as a plan for developing and implementing eCustoms systems in the EU. It reflects the needs set in the Modernised Customs Code and Security Amendment of the present Customs Code. MASP is the overall plan for developing automated systems in Europe and for helping to

[20] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:360:0064:01:EN:HTML
[21] http://www.cbp.gov/xp/cgov/trade/cargo_security/ctpat/

put the European legislation into practice. An explanation about the systems envisaged in the MASP can be found in Annex 1.

MASP has no legal power but it aims to provide a basis for planning and implementation of the *Electronic Customs Decision* (Decision No 70/2008/EC on a paperless environment for Customs and trade[22]). It outlines how to develop applications and make interoperable Customs systems which make it possible in practice to follow the flow of in/outgoing goods of the EU. It does not address how to structure the supply chains but looks only at how to structure and exchange declarations on import/export between governments.

The MASP was used as a major inspiration for the ITAIDE project. The objective of ITAIDE was to develop a set of IT-related innovations and demonstrate, by using these innovations, one possible way to shift the boundaries in the direction of trade simplification even further compared to what is currently envisaged in the MASP.

3 The ITAIDE project

3.1 ITAIDE in a wider context

Earlier in this chapter we argued that, in order to understand the starting point and the context in which the ITAIDE project was carried out, we needed to have an overview of key historical events. On a high level, we examined cross-border trade developments and the role of government in the time span of what we called the fiscal wave, followed by the security wave. Figure 1 is an attempt to capture key characteristics related to these two waves and to position the contribution of the ITAIDE project in this context.

The waves represented in Figure 1 vary along two dimensions. The vertical dimension captures the moves in the direction increased burden for trade (upwards move) or trade facilitation (downwards move). The horizontal axis captures the historical developments over time. The figure captures two waves, namely the fiscal wave followed by the security wave[23]. Under the fiscal wave we distinguish the protectionism period, which is characterised by high trade barriers, followed by globalization which turned the move of the wave in the opposite direction. In the security period, part of the security wave reversed the wave back into more burdens for companies.

[22] See also http://europa.eu/legislation_summaries/customs/l11019b_en.htm;

[23] The security wave is actually a continuation of the fiscal wave (the developments of the fiscal wave continue); however, it also has security as an added element. Although this wave captures both fiscal and security aspects, we call it the security wave for the sake of simplicity.

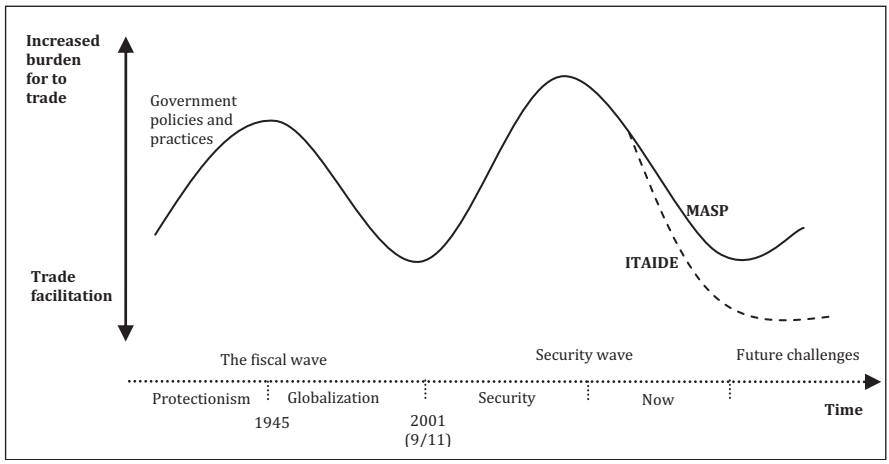

Figure 1: Positioning ITAIDE in the historical context: a wave approach

Table 1 below provides an overview of these periods by discussing key characteristics, the role of Customs in that period, relationships of Customs and other agencies, the relationship to trade and the role of information and information supply.

Table 1: Characterisation of international trade in the periods of protectionism, globalisation and security

	Protectionism	**Globalisation**	**Security**
Characteristics	– Goods produced locally – Lower volumes of international trade – High import duties	– Goods produced globally – Large volumes of international trade – Low import duties	– Global security threat
Role of Customs	– Strict control related to duty collection – High level of physical checks for all traders – Simple risk analysis at the border	– Limited risk analysis at the border – System-based audit and facilitation for Fiscal Trusted Traders (FTT) – Less physical inspections for FTT	– Sophisticated risks analysis and risk management using IT – System-based audit and facilitation for Security Trusted Trader (STT) – Strict controls and increased administrative burden due to security
Relationship of Customs with other agencies	Customs does not trust/ rely on other governments/ agencies	Customs relies on other national agencies (for the system-based approach)	Customs heavily relies on other (Customs) agencies
Relationship to trade	– Hierarchical – Non-differentiated treatment – Interference in the logistics processes	– Differentiation of FTT – No interference in the logistic processes of FTT	– Differentiation of STT – Dependence in the logistic processes of STT for information provisioning
The role of information and information provisioning	– Paper-based – Per transaction	– Paper-based – Periodic monthly declarations for FTT – Use of IT for system-based audit and for launching Customs declarations	– Electronic procedure; IT key for providing pre-arrival and pre-departure information in advance for risk analysis – per transaction reporting for all traders

What we witness now are the attempts to reverse the direction of the security wave towards trade simplification. In the EU, the Multi-Annual Strategic Plan (MASP) outlines the approach that the EU will follow to enable simpler trade. The positioning of the ITAIDE project needs to be seen in that context. Being an innovation project, ITAIDE aims to demonstrate a way forward to push the frontiers towards trade simplification even further, compared to what can be achieved with the measures as set up in the MASP[24]. It does so by providing a set of IT-related innovations and by showing in the real-life setting of Living Labs how these innovations can be put in place to enable simpler trade. Being an innovation project, the goal is to develop visionary ideas, not constrained by the current legislation. Nevertheless, the legal and political considerations play an important role throughout the whole project. Specific aspects that were explored in the Living Labs were how further simplifications can be achieved if procedures of various government authorities (such as customs, agriculture, indirect taxes) are combined[25].

3.2 The ITAIDE approach

The ITAIDE approach consists of three key components: (1) it relies on the piggy-backing principle, which in this context means reuse of business data for government control purposes; (2) it proposes a fundamental shift from a "data push" model, where companies actively submit information to the government, to a "data pull" model, where government pulls necessary information from the business systems of the supply chain partners; (3) it proposes the ITAIDE *Information Infrastructure* (I3) framework, developed by ITAIDE, which outlines key components that need to be brought about in order to achieve accelerated trade. Living Labs are used as an innovation environment to develop and test the ITAIDE ideas in a real-life setting.

3.2.1 Piggy-backing (or reuse of business data for government control purposes) as a fundamental principle

In the MASP, which is a key reference for ITAIDE, the focus is predominantly on developing information infrastructures that support the B2G or the G2G collaboration.

The ITAIDE project took a fundamentally different approach. It adopted what we call the *piggy-backing principle*, meaning the re-use of existing data and data

[24] A year after ITAIDE project started, the Commission launched the Action Programme on reducing administrative burdens in the European Union in order to measure administrative costs arising from legislation in the EU and reduce administrative burdens by 25% by 2012. http://ec.europa.eu/enterprise/policies/better-regulation/administrative-burdens/action-programme/index_en.htm

[25] A year after ITAIDE project started, the Commission launched the Action Programme on reducing administrative burdens in the European Union in order to measure administrative costs arising from legislation in the EU and reduce administrative burdens by 25% by 2012. This action program also served as inspiration for our work in the project. http://ec.europa.eu/enterprise/policies/better-regulation/administrative-burdens/action-programme/index_en.htm

flows for a goal other than that for which this data was initially intended. In the ITAIDE project, piggy-backing refers first and foremost to reusing business data for government control purposes. Currently, a company sends business data (some on paper, some electronically) to other supply chain participants (e.g. buyer's address, packing lists, invoices). This business data can be re-used for government control purposes. For example, in the Beer Living Lab, which is discussed in Chapter 3 of this book, we demonstrate how the business data from Heineken's enterprise systems can be reused for Value Added Tax (VAT), Excise and statistics purposes. In extreme cases this information can be pulled directly from the B2B information infrastructure, as demonstrated in the Beer Living Lab.

The starting point of the ITAIDE project is the B2B information, one reason being that the most reliable data can be obtained at the source. The focus on the B2B interactions is an added emphasis that the ITAIDE project brings when compared to the MASP approach.

In the context of B2B interactions, the business data exchanged within and between commercial partners in the supply chain is primarily meant for (1) own management control and (2) optimisation and cost reduction across the whole supply chain (e.g. to reduce inefficiencies such as bull-whip effects or to enhance quality control). In the context of B2G interactions, data is exchanged in the form of various declarations, including export declarations or declarations for indirect taxations such as excise and VAT. This approach has limitations: on the one hand, there is a repetition of data that needs to be supplied to the different authorities, and on the other hand, for reporting purposes, the business data is processed or aggregated, which has implications for the data quality. The challenge that was addressed in ITAIDE was to see how business data such as invoicing and procurement data could be reused for control purposes (fiscal, safety and security) by government and how this could help to reduce the administrative burden for companies.

3.2.2 Radical transformation from "Data Push" to "Data Pull"

The ITAIDE approach proposes a radical transformation from a traditional "data push" model, where the businesses actively submit (push) information to various government authorities (such as Customs, veterinarian, and statistics), to a "data pull" model, where interested governments can pull information from the business systems of companies when needed. Whereas the current legal environment is still based on the "data push" model, ITAIDE demonstrated that the "data pull" model offers benefits to both business and government. Businesses can benefit from not having to invest in the development and maintenance of interfaces to multiple government systems. Governments can benefit by obtaining access to the original business data at the source. As this data has not been processed or aggregated for adhering to Customs procedures, the quality of the data is better, which allows for more timely and accurate risk assessment and risk management.

3.2.3 The ITAIDE Information Infrastructure (I3) framework

The I3 framework is a core element of the ITAIDE approach. It is a layered framework, where each level enables the next one and the ultimate goal is to achieve accelerated trade; i.e. trade facilitation in the broadest sense. The logic of the I3 framework is that IT-related innovations enable companies to build the critical capabilities necessary for ensuring end-to-end control of their physical flows and end-to-end information transparency. Governments can rely on these embedded controls and in return can grant traders and trade networks a trusted trader status and the associated benefits for accelerated trade.

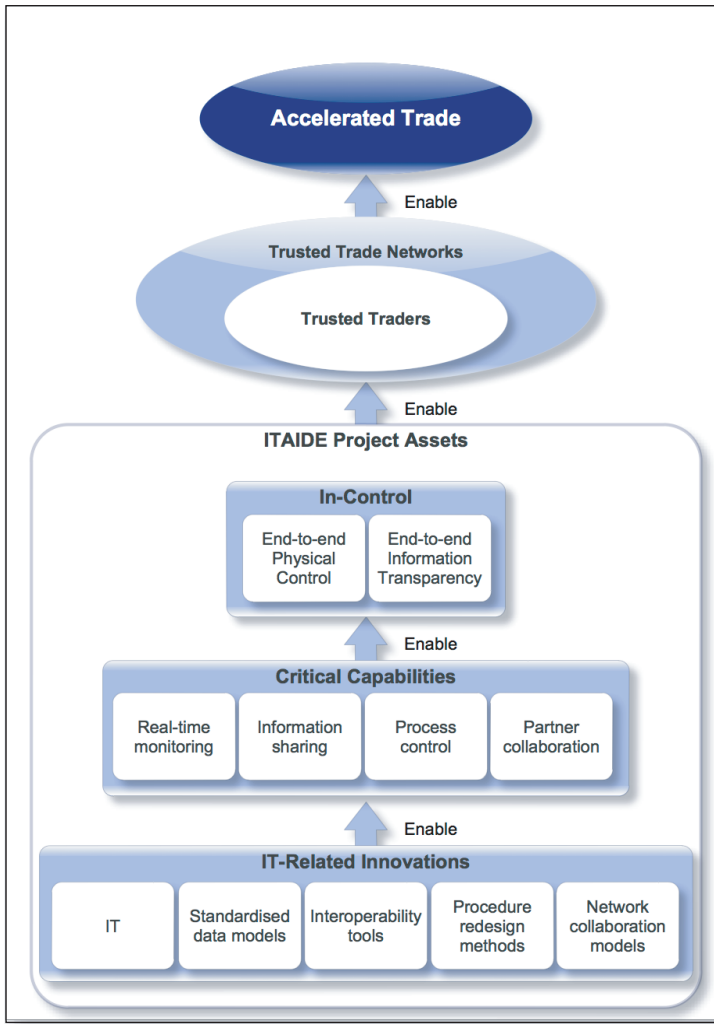

Figure 2: The ITAIDE Information Infrastructure (I3) framework

Below we explain in more detail how the I3 framework enables full control over a complete network. A basic assumption is that accelerated trade is enabled by trusted trade networks. Trusted trade networks are in turn dependent on the proper control of both physical and information flows in a supply chain network.

The network perspective is essential in order to address the security threats in the modern economy. In the specific context of eCustoms, networks of trusted traders are the basis for secure trade lanes, which act as arteries to allow for faster passage. Being in control of a trusted trade network is in two respects fundamentally more complex than being in control of a single organisation. First, companies must collaborate in order to prove the existence of end-to-end control over the whole network. This physical control is often referred to as a Secure Channel, where traders can prove full traceability from the origin to the destination of goods in a supply chain, as well as all the components involved in the manufacture of these goods. Second, in a trusted trade network traders must collaborate in order to achieve 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 organisation that needs to see it (such as Customs, tax, veterinarian authorities, and statistics).

In order for a trusted network of traders to establish and assert end-to-end control of both physical and information assets, trading organisations must possess a number of critical capabilities, such as real-time monitoring of goods, control of processes, information-sharing and collaborations amongst the supply chain partners and government. These critical capabilities are directly dependent on IT solutions. Five IT-related innovations are identified as necessary to enable the critical capabilities: (1) IT innovations, such as tamper-resistant seals on containers to enhance the tracking and tracing functions, or web-enabled applications and service-oriented architectures for information-sharing; (2) standardised data models that enable the exchange of information in international supply chains between business partners as well as the governments all over the world; (3) data interoperability tools to support the exchange of information that is not fully standardised; (4) procedure re-design methods to simplify control procedures; and (5) innovative network collaboration models to improve inter-organisational partnerships[26]. These five components are essential for traders to address the fiscal, safety and security concerns of government.

The IT-related innovations allow traders to build the critical capabilities in order to ensure that they are in control of their business operations. Governments in their turn can rely on these embedded controls and grant traders and trade networks with a trusted trader status and the associated benefits of accelerated trade. In that respect, the I3 framework captures key components that need to be brought about in order to achieve accelerated trade. ITAIDE provides a set of IT-related innovations, and shows in the real-life settings of Living Labs how these can be brought about to ensure end-to-end control. Showing that businesses are in control is a prerequisite

[26] In these collaborations, government should be seen as a real (pro-)active partner as well

for governments to provide trade facilitation. Having I3 functionality in place, instruments for system-based control become possible.

3.2.4 Beyond the fiscal and security wave

The ITAIDE project was inspired by problems that came about during the fiscal and security wave. Through Living Labs, it was shown that by following the ITAIDE approach it is possible to push the boundaries towards more trade facilitation, compared to what is envisaged in the MASP. In order to enjoy the benefits of trade facilitation, however, companies need to invest in making their supply chains more transparent, safe and secure, and installing an appropriate information infrastructure is a key prerequisite for this. Within the context of the fiscal and security wave, such companies would be better prepared to be among the first to benefit from future eCustoms developments, such as system-based control, single window, coordinated border management and the use of the pull rather the push model.

However, the benefits can be seen beyond the fiscal and security wave as well. Companies that have such an infrastructure in place and that have established a reputation of trust relationship with government will be better positioned to react when future challenges occur. In the long run, such companies will have a competitive advantage due to the high level of transparency they have created, and they will be more resilient to future shocks. Transparent companies will be better prepared to prove to the government that their goods comply, for example, to environmental requirements or that they are not a product of child labour. Consequently, for trusted and transparent companies the extent to which the future wave curve goes up in the direction of administrative burden would be more limited than for companies that have not invested in setting up the necessary information infrastructure.

4 Structure of the book

The structure of the book is captured in Figure 3. In Part 2 the empirical setting of the ITAIDE project is introduced. It introduces the concept of Living Labs, which are used as collaborative platforms for development and real-life testing of innovative IT-enabled solutions for cross-border trade. Furthermore, this chapter contains detailed descriptions of the different Living Labs which were carried out throughout the ITAIDE project.

The Living Labs (LL) cover four different domains: beer, paper, food and drug.

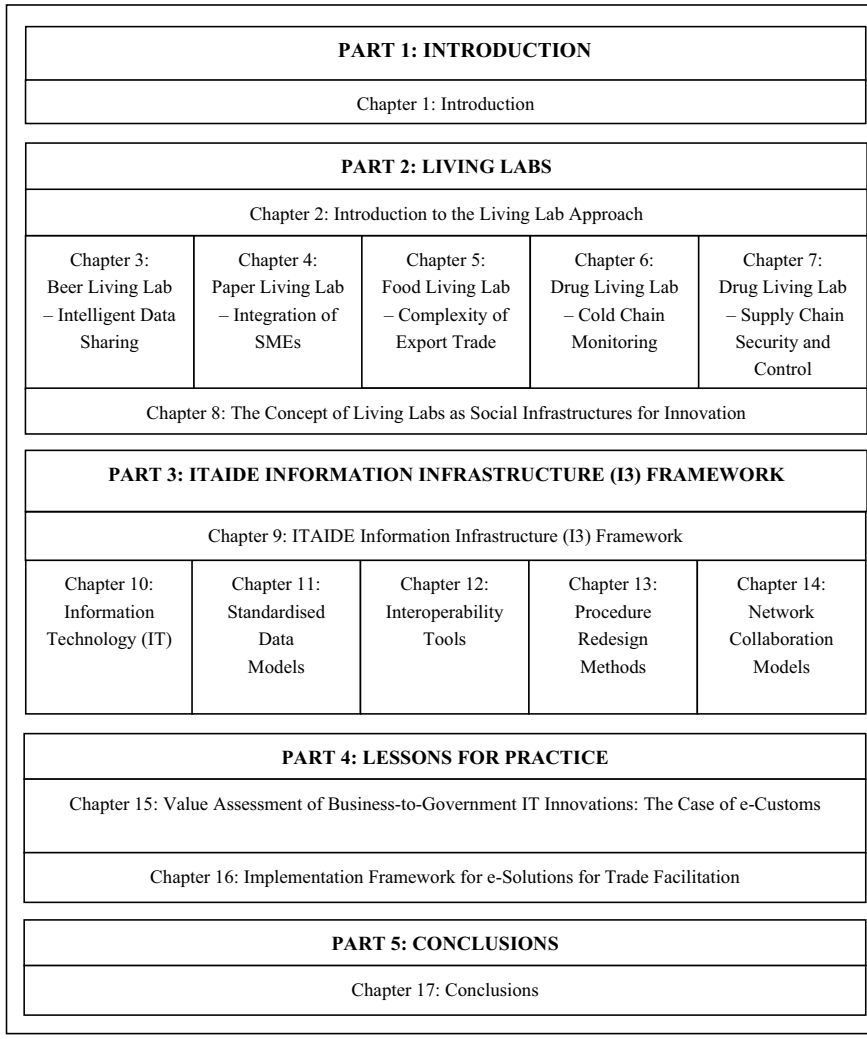

Figure 3: Structure of the book

The focus of the Beer LL was on export of excise goods from the Netherlands to the UK and US using sea containers, where the goal was to explore the possibilities of combining requirements from different authorities related to VAT, excise and statistics. The Paper LL focused on export of paper products from Finland. The Food LL addressed the export of dairy products from Denmark. The Drug LL was split into two separate Living Labs that address two different problems related to cross-border trade of pharmaceuticals. The first, also referred to as the Cold Chain, examines the export by air freight from Ireland to the US of temperature-sensitive materials used for the production of drugs. The second focuses on anti-counterfeiting and was run in Germany. It is the only Living Lab that did not succeed in carrying

out real-life testing. However, the political complexity of the problem makes it very interesting for understanding the underlying issues and we therefore included this case in the book as well. All the Living Labs sub-chapters include a description of the problem analysis and objectives. In addition, they discuss how key components from the I3 framework are brought about to achieve trade simplification. The case descriptions have two purposes. First of all, they aim to give practitioners and researchers an introduction to the practical knowledge including the problem domain, as well as a high-level overview of the solutions which were developed and tested. Second, they are used as background information for the more theoretical analysis made in Part 3 of the book.

While Part 2 aims to introduce the empirical setting, the objective of Part 3 is to present a more theoretical perspective on the problem domain. It contains a detailed description of the ITAIDE Information Infrastructure (I3) framework, which outlines key elements that need to be put in place to achieve trade facilitation. In addition, five thematic sub-chapters zoom in on specific aspects of the I3 framework such as Information Technology (IT), standardised data models, interoperability tools, process redesign methods and network collaboration models. In the thematic chapters, the different theoretical concepts are applied to one or more of the Living Labs.

Part 5 contains lessons for practice and includes two chapters: Chapter 15 and Chapter 16 respectively. Chapter 15 presents a value assessment framework and demonstrates how it can be applied. Chapter 16 is intended for practitioners, as it contains practical guidelines for the implementation of eSolutions for trade facilitation. Finally, Part 5 summarises the main results and provides an outlook to the future. To facilitate the reading process, we have included in a number of annexes a glossary of terms as well as links to relevant websites.

We strongly recommend readers to consult the web-site established for the project, where it is possible to find two short videos about the project, all scientific papers published in relation to the project, a number of working documents, and other project relevant material: www.ITAIDE.org.

Chapter 16: An Implementation Framework for e-Solutions for Trade Facilitation

Eveline van Stijn[*], Thayanan Phuaphanthong[**], Somnuk Keretho[**], Markus Pikart[***], Wout Hofman[****], Yao-Hua Tan[*****,*]

Abstract: To offer practical guidelines for the implementation of e-Solutions for Trade Facilitation (e-ST), such as e-Customs and Single Window, we provide the *Implementation Framework for e-Solutions for Trade facilitation* (e-STIF). The e-STIF is meant for policy managers, who are responsible for overseeing the implementation of e-ST innovations. Once the initial policy decision is made by the government, policy managers take responsibility for developing a master plan for its implementation, coordinating technical activities, monitoring its progress, and ensuring the delivery of the expected outcomes. The e-STIF covers the full spectrum of implementation activities, using the TOGAF enterprise architecture development methodology to structure the implementation phases. It starts with the preparatory phase to scope the e-ST innovation, supporting the coordination among the various government agencies to harmonize their data and procedures and alignment with international initiatives. Eventually, the e-STIF goes into providing support for specific aspects, like network collaboration and interoperability, using the redesign principles of the *ITAIDE Information Infrastructure* (I3) framework.

Key words: Implementation framework, trade facilitation, e-Customs, single window, enterprise architecture, TOGAF

1 Introduction

Similar to governments around the world, the European Union (EU) and its Member States are under political pressure to simplify trade procedures, ensuring security and other public values are guarded, and decrease the administrative overheads put on companies. In response to this pressure and to achieve trade facilitation, the EU has set out a strategy that involves several pillars, including the establishment of Authorized Economic Operators, revision of the Modernized Customs Code, and the envisioned implementation of e-Customs systems, and a European

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Single Window (SW). A Single Window can be defined as "a facility that allows parties involved in the international supply chain to lodge data in a standardized format at a single entry point to fulfil all import, export, and transit-related regulatory requirements. If the data are electronic, they should be submitted only once" (UN/CEFACT, 2005, p.3). In other words, the long-term ambition is that an EU Single Window would provide a "one-stop shop" for businesses dealing with authorities in one Member State involved in the movement of goods. The vision is that it does not only mean information sharing between businesses and national authorities of one of the Member States becomes as efficient as possible, but also that information is shared amongst national authorities of different Member States and with relevant EU-level government agencies (such as EUROSTAT for statistics). As such, Single Window is part of the national domain of a country and has an international dimension. One of the objectives of Single Window is to facilitate "smooth logistics" in value networks, that is, the fulfilment of the regulatory requirements should be effective and intervene as little as possible in the actual logistic processes of companies. Implementing Single Window can improve logistics, making it faster and less costly, and also better targeted towards "high-risk" trade transactions.

In the ITAIDE project, we have demonstrated with the *ITAIDE Information Infrastructure* (I3) framework, how the trade facilitation vision can be achieved by addressing how businesses can become part of "trusted trader networks" through end-to-end control and information transparency (see Chapter 9). Trusted trader networks can benefit from trade facilitation, and achieve reduced administrative burdens and trade simplifications. Through improved information sharing, the logistic processes could become "seamless" as coordinated border inspection and other controls of goods can take place. In the Living Labs, it has been investigated how advanced e-solutions and new technologies could work to facilitate this. As Single Window is one of the pillars for trade facilitation, a third question that we paid attention to in the ITAIDE project deals with implementation e-Solutions for Trade facilitation (e-ST) such as e-Customs and Single Window. In the remainder we will simply refer to e-solutions or e-ST, when we mean e-solutions for trade facilitation.

The implementation of e-ST is not an easy task. There are many challenges that may arise because of the complexity and typically long duration of its implementation. Because of the strategic interests and substantial investments involved, it is important to carefully manage the implementation process and mitigate potential risks. The purpose of this chapter is to provide a roadmap for e-solutions implementation in support of the trade facilitation vision. The e-STIF *implementation framework for e-solutions for trade facilitation* was inspired by the Single Window Implementation Framework (SWIF)[*]. The e-STIF is developed with the objective to assist national "policy managers" in initiating and managing the process of transforming the e-solutions for trade facilitation vision and political directives into

[*] The Single Window Implementation Framework has been developed in cooperation with Markus Pikart (UN/ECE), and Dr. Somnuk Kerotho and Thayanan Phuaphanthong (Kasetsart University, Thailand) and is presented in ITAIDE deliverable 5.0.4b.

reality. Policy managers are responsible for preparing holistic policy options for high-level decision-makers. Once the initial policy direction toward e-solutions implementation is approved, policy managers take responsibility for developing a master plan for its implementation, coordinating technical activities, monitoring its progress, overseeing its operation, and ensuring the delivery of the expected outcomes. The e-STIF aims to provide national policy managers with guidelines in:

- Formulating visions and policies that address the need for national e-solution implementation;
- Identifying performance measures;
- Systematically decomposing and structuring challenges that may occur during the implementation of e-solutions; and
- Planning and governing the overall implementation of e-solutions by providing the foundation for developing the national e-solutions for trade facilitation Master Plan.

Second, the e-STIF also serves as a template for documenting regional and national experiences in implementing e-solutions. Documenting e-solutions for trade facilitation cases in a consistent manner facilitates case comparison and analysis, and thus aims to contribute to a better understanding of the e-ST implementation process.

The e-STIF is a holistic, generic framework, which focuses on implementations of e-solutions for trade facilitation. To serve our purpose here to provide guidance in the form of a roadmap for the EU and its national Member States, we have used the SWIF as a basis and further tailored our discussion to the specific context in which the European e-ST implementation efforts take place, targeting policy managers from both the European Commission (EC) and national Member States. We have investigated e-Customs implementation in general, as well as Single Window initiatives, taking into account that there are many different e-Customs systems (as foreseen in the MASP). Lastly, we have further synthesized and included the relevant lessons learned from our experiences and research in the ITAIDE project.

The rest of this chapter is outlined as follows. In Section 2, we discuss e-solution systems for trade facilitation and their objectives in more detail, the challenges that may occur during implementation, and the underpinning principles that we adapted from the e-STIF to come to a roadmap. This roadmap for implementation of e-solution for trade facilitation is presented in Section 3. The chapter ends with a reflection on the implications and the conclusions in Section 4.

2 Implementations of e-Solutions for trade facilitation

2.1 e-Solution systems for trade facilitation

Governments are under political pressure to simplify trade procedures and decrease the administrative overheads put on companies. A study commissioned by the EC states that the costs of complying with these requirements amount to account for

3.5 – 7 per cent of the value of the goods (OECD, 2002). It can be as high as 10 – 15 per cent if there are typing and other errors (UNCTAD, 1994). Additional indirect and opportunity costs from procedural delays due to information errors are incurred as a result. At the same time, governments have increased control mechanisms within international trade as part of the "security wave" after 9/11 (see Introduction). This has led to complex control procedures that also put a burden on international trade, as they may hamper the smooth flow of goods. It is argued that each day saved in shipping time would be worth about 0.5 per cent of the value of the goods (Hummels, 2001).

E-solutions for trade facilitation such as Single Window systems are IT solutions that support the information sharing between stakeholders in order to fulfil legal requirements involved in international trade. Figure 1 provides a simplified scope of a Single Window system.

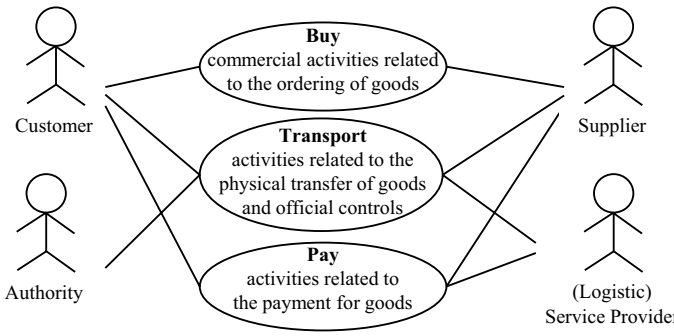

Figure 1: Scope of Single Window and the international supply chain (Adapted from UN/CEFACT, 2001)

Stakeholders of the international supply chain fulfil different roles, like:

- *Supplier* (exporter/seller) who sells goods or services as stipulated in a sales contract;
- *Customer* (importer/buyer) to whom goods and services are sold as stipulated in a sales contract;
- *(Logistic) Service Provider* who provides commercial, financial, transport, (trans-)shipment and/or warehousing services within an international supply chain, such as freight forwarder, customs broker, express integrator, carrier of all modes, port, terminal operator, inland container depot, bank, insurance company, IT value-added service provider, bank and financial institutions; and
- *Authority* (including authorized private inspection agency) of exporting country, importing country, and country in transit, which monitors goods crossing borders in a way that reflects national and international public interests.

Although it is stated that the focus of Single Window is on import, export, and transit of goods (UN/CEFACT, 2005), it is mostly applied for border management pro-

cedures. These, also known as incoming and outgoing goods movements, are succeeded or preceded by import, export or transit. A Single Window can be implemented in any port, airport or other border location at which goods enter or leave a country. More particular, the European Union considers a Single Window for all goods entering and leaving the EU.

The implementation of e-solution for trade facilitation, such as e-Customs and SW, can have various business objectives, for example the reduction of administrative burden by data harmonization and electronic data sharing. Another example is to prevent re-entering the same data for all procedures and data re-use by all government authorities involved. These business objectives can be grouped as follows:

- *Efficiency improvement* (administrative burden reduction). The same data used on different documents is harmonized and can be exchanged electronically.
- *Effectiveness improvement* (coordinated inspections). Processes of all government control agencies involved are coordinated and similar activities are only performed once; in particular coordination of physical inspections by different government authorities involved in goods movement.
- *Strategic changes* (risk-based governance). These imply that processes changes, based on technical innovations as visualized by the I3 framework, are implemented. Piggy backing and service orientation allow, for instance, direct access to data by government authorities that only have to focus on their core activity: risk-based governance implemented by mechanisms like AEO.

Each of these business objectives can be achieved by different solutions.

The way that the e-Customs and Single Window facilitates the information sharing can be designed in different ways. In the end, these e-solutions for trade facilitation entails that the traders face only one single online authority to deal with the formalities regarding the flow of the goods. There are different options to bring this about.

- *Technical interoperability*. This type of interoperability is defined at two levels, namely communication and technology for data sharing:
  - *Communication interoperability* implies that a limited set of communication protocols is supported. On a higher level, one government service access point can be defined: one communication channel between business and authorities for handling all formalities. Digipoort is such a communication channel in the Netherlands.
  - *Data sharing technology* comprises both syntax for data structuring and the paradigm for data sharing. EDIFACT (Electronic Data Interchange for administration, commerce and transport) is still the most commonly used syntax in (international) trade and transport, although XML (eXtensible Markup Language) Schema is also more and more used. Paradigms for data sharing are for instance messaging for exchanging declarations, web services to implement a data pull mechanism or a combination of web services and events, where events indicate changes in logistic flows and trigger processes.

- *Semantic interoperability – data harmonization*. It comprises alignment of data required by different authorities. It implies that identical concepts also have the same definition and format. The UN Trade Data Elements Directory (UNTDED) contains a large number of data elements commonly used in trade and logistics. UN/CEFACT Core Components add structure to these elements resulting in building blocks for data exchange.
- *Data re-use – single declaration, multiple authorities*. The previous step is a prerequisite to enable that a trader or logistics service provider is able to handle his formalities with one declaration. Such a declaration needs to meet data requirements of all individual authorities. As each authority may have different requirements regarding the time for submitting a declaration, the data of the declaration can already be lodged and an event mechanism can be used to perform an official declaration.
- *Business interoperability – data sharing by business process.* A more sophisticated option is that all data regarding a particular goods flow is lodged by one actor in the logistics chain and others submit their additions or changes to this data. It actually implies re-use of data by authorities for a particular goods flow. Each goods flow is represented as a consignment, consignments can be combined with, for instance, a Manifest, or several consignments in one container can lead to one transit declaration. Such an approach not only requires data sharing between authorities, but also between actors in supply chains. It can be implemented by, for example, a Port Community System for data sharing amongst business partners and a similar system at the side of authorities.

2.2 Implementation challenges for e-Solutions for trade facilitation

When it comes to e-Customs and Single Window implementation, governments in general often face complicated challenges. These challenges, as represented in Figure 2, concern not only the technicalities of the implementation, but also organizational, managerial, financial, legal, and political issues.

SW implementations are about harmonizing data requirements and synchronizing business processes used by different stakeholders in different phases of the international trade activities. While integrating data requires the harmonization of their attributes such as definition, format, and position in the message with relevant international standards, synchronizing business processes may require changes and additions to procedures as well as laws and regulations. Because the integration is made possible by automation, new information systems that are capable of interoperating with other information systems have to be developed; for example e-Customs related systems such as the Export Control Systems (ECS), Import Control System (ICS), Excise Movement Control Systems (EMCS), VAT reporting system (VIES) etcetera. Existing information systems that have been introduced by different stakeholders have to be made interoperable with others. These challenges typically involve many different stakeholders, who need to collaborate to find a common solution.

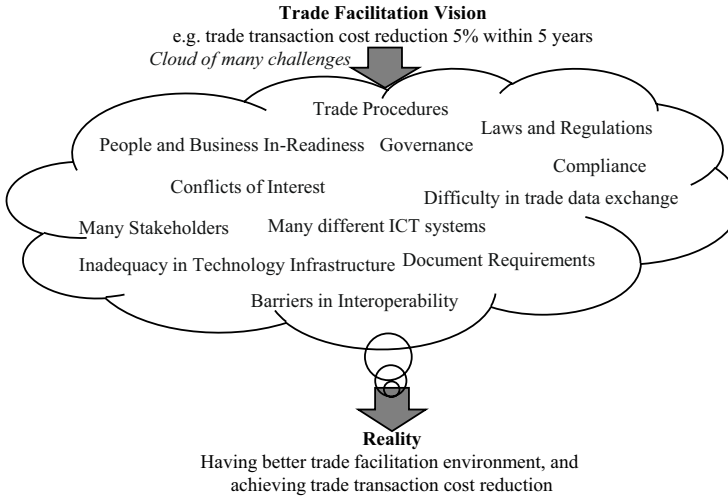

Figure 2: Challenges in Single Window implementation

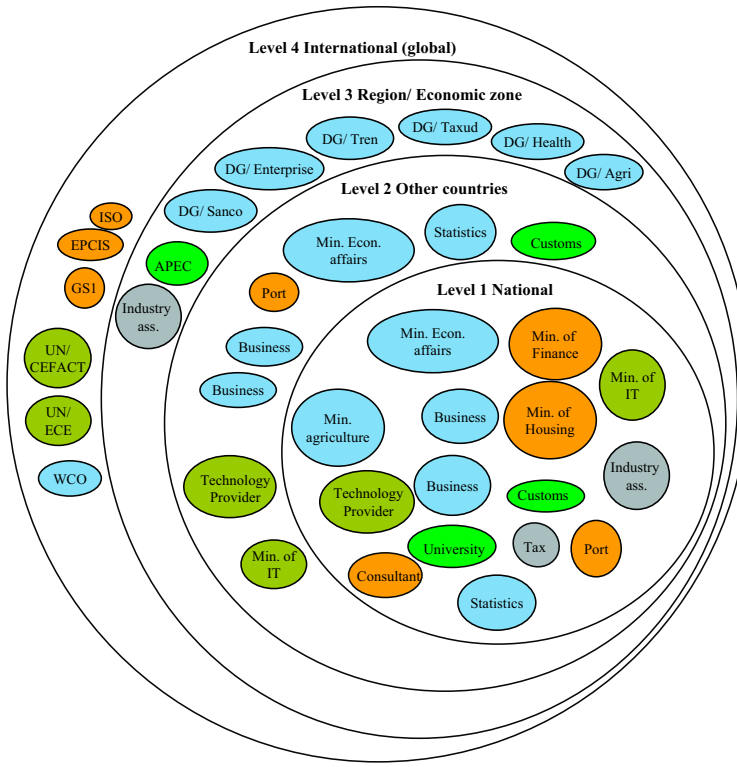

Figure 3: Stakeholder network overview (Adapted from Rukanova et al., 2009)

Figure 3 represents the stakeholder groups at the four levels

More specifically for the EU context, we can make the following observations. First of all, the stakeholder group that is in some way or another involved in the e-solution implementation is much larger, and there are also different political and legal dynamics in play, compared to national implementations. For e-solution implementations, we can distinguish four levels of stakeholders: 1) national stakeholders, 2) stakeholders in the same or another region/ economic zone, 3) stakeholders at the regional/ economic zone, 4) international stakeholders (cf. Rukanova et al., 2009; Van Stijn et al., 2009).

The stakeholders can be divided in stakeholders that directly participate in the e-ST Programme (i.e. take part in the (management of) the development and implementation), and stakeholders that influence or are affected by these initiatives. Examples of stakeholder organizations at level 1 and 2 are: Tax & Customs, Veterinary agency, Ministry of Agriculture, Ministry of Health, Ministry of IT, trading businesses (MNCs/ SMEs), carriers, shippers, logistic service providers, ports, industry associations, IT providers, consultants, academics, Stakeholders at level 3 represent organizations at the region or economic zone are for example Directorate Generals of the EU, APEC, or regional industry associations such as the European Shippers Council, the European freight forwarders association CLECAT. Examples of stakeholders at level 4 are the United Nations (e.g. UNECE and its Centre for Trade Facilitation and electronic Business), the World Customs Organization (WCO), the international Organization for Standards (ISO), and other international standardization organizations such as EPCIS, GS1, IATA, FIATA, and IMO.

These stakeholders have different interests, backgrounds, find themselves in different sectors, contexts, and so on. Thus, the negotiation and collaboration process is essential, but potentially also a challenging one. However, there has to be agreement and commitment at the EU as well as national Member State levels, and also support from other key players, to move forward.

Secondly, the current landscape of the IT infrastructure is complex; there is certainly no "clean slate" status like, for example, in some of the developing countries. Typically, authorities within each of the 27 Member States of the EU have implemented their own systems, which led to silo automation. To the extent that member states have already realized (partially) integrated e-Customs and Single Window systems at a national level, these efforts have in the past not been coordinated by the EU, which has led to a heterogeneous set of e-solutions that are not all interoperable. More recently, the EU has set up several Programmes, including the Customs 2013, in order to implement common EU-wide systems, such as the NCTS for transit goods, EMCS for excise goods, VIES for VAT reporting, EORI for AEO registry database etcetera (See Annex 1 for an overview). The requirements for these systems have been set at the EU level, and national governments have been requested to further develop and implement these systems in their own countries, adapting it to national legislation, processes, and the existing legacy national IT infrastructure. Though these systems may contribute to efficiency measures, silo automation makes it more difficult to reach the more ambitious objectives of effectiveness and strategic changes as described earlier. Again, this draws attention to underlying issues regarding collaboration that may need to be overcome, but also to technolog-

ical challenges regarding for example interoperability and data harmonization, as well as issues related to procedural changes.

Dealing with these challenges requires strong political willingness, long-term commitment, typically in the range of 10-15 years, and support from top management, a reliable institutional platform for collaboration, effective management of stakeholders' expectations and perceptions, workable business and architectural models, and necessary business and regulatory reforms (cf. UN/CEFACT, 2005). Even when these necessary conditions are in place, there seems to be no mechanism that helps governments transforming their vision into implementation. For these reasons, a strategic and holistic framework that informs how these challenges can be systematically addressed was developed. In the next sub-section, we address the underlying principles, which we also used for further development of the roadmap.

2.3 Towards a roadmap: underlying principles

2.3.1 Scoping and phasing

The full scope of e-Customs and a national single window project is often far reaching. Typically an e-ST innovation is not implemented in one run but rather in a stepwise approach. The division of the overall project in steps and the decision which stakeholders, business processes and components are included and developed in the different phases are subject to priorities, readiness and available resources in each Member State country and at the EU level. Both business objectives and stakeholder prioritization will determine what the scope of the different phases will look like exactly. In the EU, it is important to take into account the scoping and phasing as it decided by the European Commission, for example through the Multi-Annual Strategic Plan (MASP), as well as the initiatives by the Member States.

Prioritization of stakeholders

To keep the implementation manageable, typically, not all stakeholders will be actively involved at all points in time, but a prioritization has to be made regarding who will be involved when during the implementation. Prioritization of the different government agencies and private sector companies for inclusion in a project phase will need to be made. Also it is a fundamental scoping decision whether the implementation of e-ST has to be aligned with the implementation of other countries. For example, a Single Window in EU member states only make sense if the national SWs are interlinked among the member states, such that they jointly act as one interoperable SW at EU level. Prioritization can be made based on the impact the stakeholder makes to the success of the SW and/or on the readiness of the stakeholder to participate in a SW operation:

- *Impact*: Estimate the impact of each individual stakeholder inside and outside the country taking into account the number of transactions and the importance of the goods/services traded. Limited resources should be allocated to the development of information systems that generate the greatest impact. Examples are (i) inclusion of the customs declaration systems or of the Port Com-

munity systems, which typically process large amount of transactions; (ii) stakeholders that support export/import operations of key products for the national economy, (iii) stakeholders with large number of transactions, trade volumes and high transaction value, (iv) counterparts of the stakeholders i-iii in other countries.

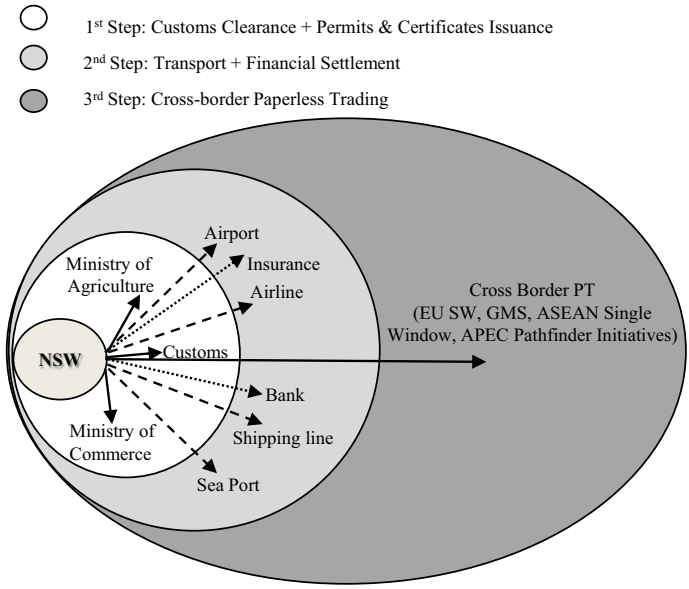

Figure 4: Example of a step-wise SW implementation approach: involvement of stakeholders

- *Organizational readiness of stakeholders*: The organizational readiness of the stakeholder determines the likelihood that the stakeholder will be able to integrate into the e-ST. The assessment of stakeholder's organizational readiness helps to (i) determine the implementation timeline for each Single Window's sub-system and the ease of integrating it with relevant existing information systems in use, (ii) identify implementation challenges and make the corresponding stakeholders look for ways to deal with those.

Figure 4 shows the subsequent phases of implementation approach used in the planning process of a national Single Window. From the EU and Thai experiences so far, a pattern appears to emerge that the political process and government agency involvement starts from Customs, and then extends to the Ministry of Agriculture, the Tax Administration, and lastly Statistics.

2.3.2 The importance of alignment

We take into account two core principles adapted from Henderson and Venkatraman (1993), namely 1) the alignment of business strategy and IT strategy, and 2) the

systematic transformation of the pre-defined strategies into well-governed IT solutions. Figure 5 visualizes these two core alignment principles.

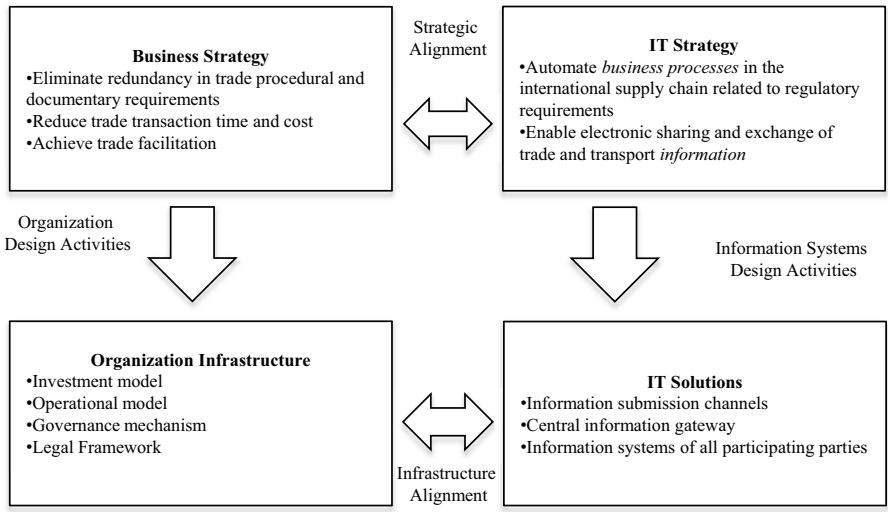

Figure 5: Alignment principles (Adapted from Henderson and Venkatraman, 1993)

For example, in the context of SW implementations, alignment challenges exist regarding the harmonization of procedures and data of various national ministries with international reference models, such as the UN Core Component approach. Until recently, one of the issues was that Customs often had their own reference data model, which was separate from the business-oriented reference data models (e.g. UN Core Component). Now, a convergence is taking place between these two, with the WCO data model version 3. It is important that e-ST policy managers are aware of such international political developments. Another international alignment issue relates to the international SW initiatives. The success of a SW in the long term also depends upon the capacity to link to the SW components and procedures of other countries (e.g. from the major trading partners) and of regional bodies (such as APEC or EU). Whether and how to align with national and regional SW implementations, is a very important alignment question. This alignment might have a major impact on the detailed implementation at later stages; for example, international alignment with de facto standards, by e.g. the World Customs Organization (WCO), UN/CEFACT, the international Organization for Standards (ISO), and other international standardization organizations such as EPCIS, GS1, IATA, FIATA, and IMO, about data and message formats might become crucial for the successful alignment between the SW implementations of the different countries. This requires very complex political consensus-building, both internally at the level of the national agencies (who may need to change to start using international data standards and procedures) and at the international level, where national representa-

tives may assess critical developments, and possibly influence the debate. Some of these negotiations may take place at the legal level as well.

2.3.3 Decomposing the implementation challenges

The e-STIF emphasizes the importance of business and IT strategic alignment as well as systematic transformation of the strategic vision into well-governed IT solutions. Without the incorporation of these principles, the implementation of e-Customs or Single Window is likely to face the risk of non-use and failure to capture benefits (Markus, 2004). To this end, the implementation challenges may be decomposed into ten major components (see Figure 6). Each component deals with a set of related issues. The multi-facets of e-ST implementation include issues related to the management of stakeholders' expectations and viewpoints; the development of a business vision; the transformation into the architecture vision; the simplification and harmonization of relevant business processes; the harmonization of data requirements; the identification of value propositions and corresponding services; and the establishment of the IT and legal infrastructure.

By addressing these components and their inter-relationships, the trade facilitation vision can be systematically transformed into reality through the use of e-solutions for trade facilitation with lower risks and higher rate of success. The *ITAIDE Information Infrastructure* (I3) framework (see Chapter 9) provides more specific support for the implementation of certain parts of Figure 6; in particular for the components IT Solutions, IT Infrastructure, Business Processes, Information and Documents, and Stakeholder Collaboration.

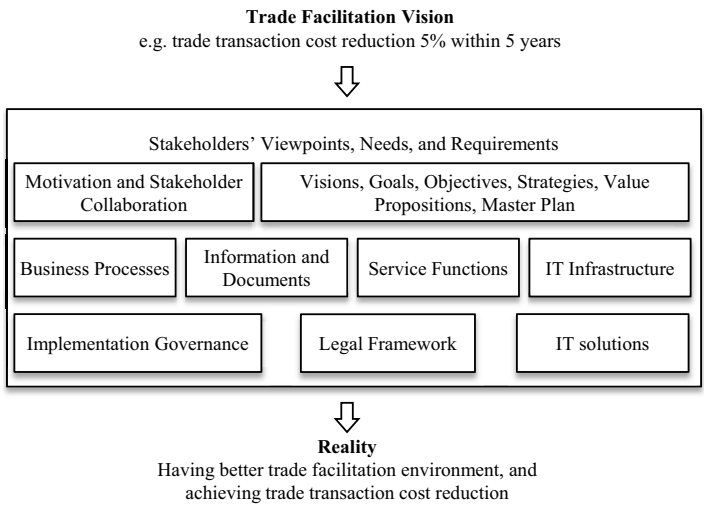

Figure 6: Decomposing the implementation challenges

We briefly explain how the I3 framework can be used for this more specific implementation support (see Figure 7). Regarding the IT Solutions and IT Infrastructures,

the I3 framework identifies specific e-solutions for trade facilitation such as IT innovations as (1) smart tracking and tracing devices that enable real-time monitoring of goods movements, and (2) the use of web services and service-oriented architectures to improve the information sharing across global supply chains. The information sharing is not only between business-to-business data exchanges within the supply chain, but in particular to improve the data exchanges for control purposes between the supply chain as a whole and the various government agencies on the exporting as well as the importing end of the supply chain. These second type of IT innovations do not only enable information sharing between business-to-government data exchange, such as electronic export declarations, but they could also be used to further innovate the current pan-European e-Customs systems for government-to-government data exchange, such as NCTS for transit cargo, ECS and ICS for export and import data, VIES and EMCS for cross-border exchange of indirect tax data on VAT and Excise. In addition to innovate each of these systems individually, web services and service-oriented architecture solutions can also help to integrate these various different types of data exchanges into one SW portal that offers businesses the possibility to provide all their required cross-border data once to all the government agencies of the exporting country as well as the importing one.

Regarding the Business Processes, and Information and Documents, after Documents the I3 framework identifies specific e-solutions for trade facilitation such as (1) Standardized Data Models, (2) Interoperability Tools, and (3) Procedure Redesign Methods. The first two e-solutions, Standardized Data Models and Interoperability Tools, focus in particular on standardization and harmonization of cross-border procedures and data. Harmonization is a weaker type of standardization, where procedures or data are not fully standardized, but still similar enough to allow for defining interoperability software tools, based on relatively simple XML mappings from one data format to the other. Successful application of IT innovations presupposes that the procedures and data have a basic level of standardization, or at least harmonization. No matter how efficient IT can be used to exchange data between organizations, if two government agencies use complete different formats for address data, then the data can still not be exchanged. At a higher level, if two countries use, for example, completely different procedures for handling cross-border VAT issues, that each require different data from the businesses, then no IT innovation is going to help to integrate these procedures. Hence, harmonization and standardization of cross-border procedures and data are a necessary prerequisite for all e-solutions for trade facilitation. The third e-solution, Procedure Redesign Methods, refer to procedure redesign principles, and software support tools for procedure redesign such as, for example, e3-Control. Typical examples of procedure redesign principles are (1) the piggy-backing principle, and (2) the transformation from Data Push to Data Pull. The piggy-backing principle proposes the reuse of business data for government control purposes. The transformation from Data Push to Data Pull proposes a fundamental shift from a data push model, where companies actively must submit information to the government to a data pull model, where the government pulls information, if they need it for control purposes, from the information systems of the company.

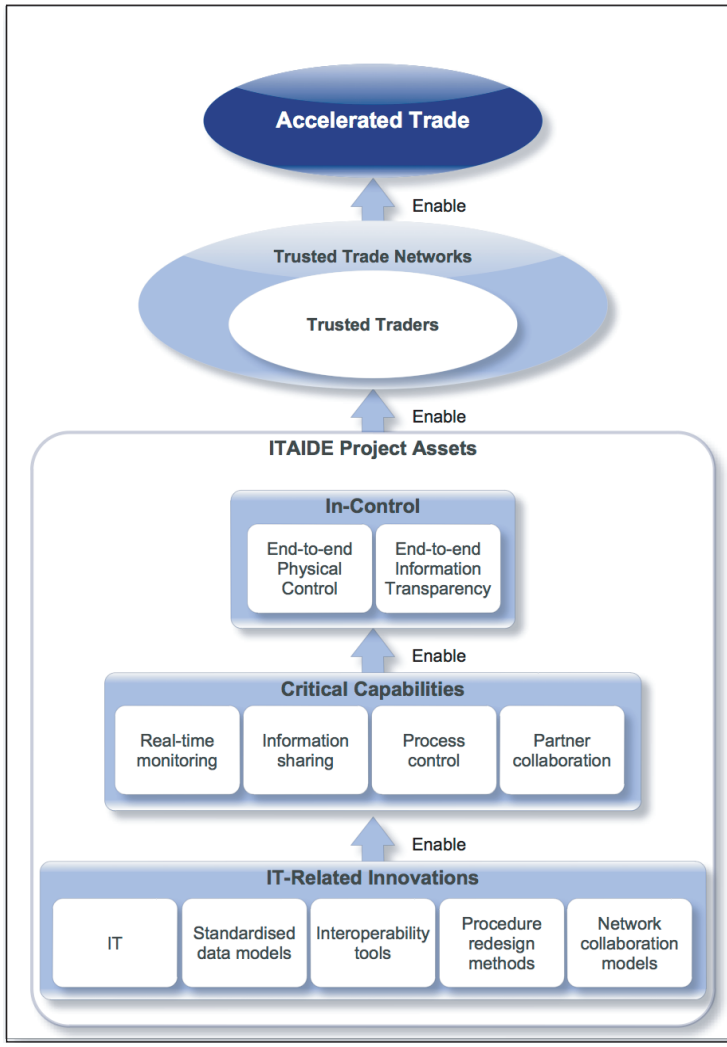

Figure 7: The ITAIDE Information Infrastructure (I3) Framework

Regarding the Motivation and Stakeholder Collaboration the I3 framework identifies specific e-solutions for Network Collaboration models. These models help to identify relevant stakeholders the implementation of Single Window and e-Customs. In particular, these models help to identify the relevant national stakeholders within a country, as well as the relevant international stakeholders, in particular the international bodies that develop standards for cross-border data models, including the European Commission, UNECE and WCO. Furthermore, these network collaboration models also help policy managers to facilitate the alignment of interests in

these networks, such that these networks can become an integral part of their implementation programmes.

More detailed explanations about these components of the I3 framework, IT, Standardized Data Models, Interoperability Tools, and Procedure Redesign Methods and Network Collaboration will be discussed below.

3 A roadmap for the implementation of e-Solutions for trade facilitation

3.1 Implementation methodology

To address the challenges that may arise during the implementation of e-solutions for trade facilitation in a systematic, holistic manner, it is helpful that the implementation is based on an *Enterprise Architecture* (EA) perspective. With an EA perspective, the development and implementation of the e-solutions for trade facilitation follows the principles of scoping, phasing and alignment, as explained in the previous section. As a conceptual blueprint, the enterprise architecture will assist policy managers and concerned stakeholders to clearly assess, analyze, and develop (1) a vision of the enterprise and its environment; (2) a target state of the enterprise organization in terms of its constituent components and how the components fit together; as well as (3) a master plan on how to achieve the target state (Jonkers et al., 2006). There are distinct benefits of using the enterprise architecture as a management tool:

- It promotes collaboration among stakeholders and ensures that a complex set of requirements are adequately addressed.
- It facilitates the systematic identification, refinement, and reconciliation of stakeholders' requirements and how the requirements are addressed throughout the implementation life cycle.
- It allows new requirements to be incorporated.
- It provides high-level visibility and criteria for effective management and evaluation of technical decisions.
- It helps guide and optimize the involved organizations' IT investments.
- It helps to transform the vision as addressed in policy directives into implementable technology solutions as well as measurable outputs and outcomes.

The currently available enterprise architecture approaches – and tools that are based upon them – show variations in the way that they detail the steps and phases that are undertaken in the development and implementation of the enterprise architecture. For our work here, we use TOGAF (2009), an enterprise architecture methodology widely used in practice (see www.togaf.org). We use it here as basis for the roadmap, but the reader should note that other approaches and tools, like Archimate, are also possible to use. In particular, we apply the TOGAF *Architecture Development Methodology* (ADM) here, which has the advantage that it is sufficiently generic to

cover also other approaches. Moreover, we have customized it to reflect the specific context of e-solutions for trade facilitation such as e-Customs and Single Window. This implies that our roadmap at the level we describe here would still be valid also if another EA approach is used.

The TOGAF ADM describes a set of phases, as shown in Figure 8, that each address different architecture domains (for example, architecture vision and data architecture).

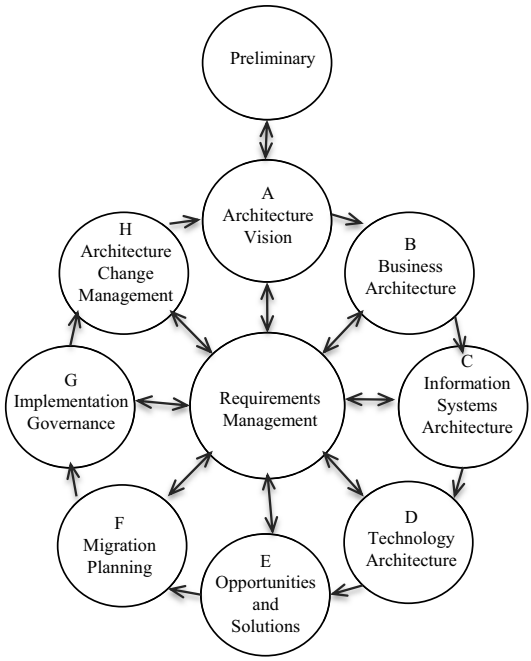

Figure 8: e-STIF phases (Adopted from TOGAF, 2009)

Each phase has a set of specified objectives and deliverables which are implemented through a set of activities. These activities and the deliverables of the phases provide the managerial tools and the artefacts required to plan the project, to develop the systems that comprise the e-solutions for trade facilitation and ensure project control, on-going support and smooth operation. The specific activities of the plan are not necessarily carried out by policy managers. It is however the policy managers' responsibility to a) commission each of these activities to experts with relevant skills; and b) monitor its progress and ensure compliance with relevant policy directives, the e-ST Master Plan, and recommendations.

Table 1 outlines activities that should be carried out in each phase of e-STIF.

Table 1: e-STIF phases, objectives, and activities

Phase	Objective	Activity
Preliminary Phase	– Identify the rationale for e-ST implementation	– Use existing facts and figures on benefits of e-solutions for trade and transport facilitation – Draw on relevant policy directives and recommendations of international and regional forums – Obtain initial political will and commitment for e-ST implementation
Phase A: Architecture Vision	– Create joint visions, strategy, objectives, and goals of the e-ST – Establish the necessary environment for stakeholders' coordination and collaboration throughout the e-ST implementation lifecycle – Ensure that sponsor stakeholders and other major stakeholders are committed to bringing the implementation to a success – Authorize the e-ST Master Plan	– Identify stakeholders of the international supply chain – Define roles and responsibilities of stakeholders as well as their individual objectives, requirements, and concerns – Create the environment for interagency coordination and collaboration for all later phases of e-ST implementation – Elaborate and refine broad vision, strategy, objectives, and goals of the e-ST – Define value proposition of the e-ST and demonstrate its relations to stakeholders' requirements and constraints – Define the scope of e-ST Implementation and constraints in terms of resources and competence availability – Identify a set of key performance indicators that will serve as a benchmark to measure the success of the e-ST implementation – Assess stakeholders' readiness for e-ST implementation and conduct a review on their existing IT initiatives that are of relevance to the project and categorize them as mainstream systems (part of the e-ST), contain systems (expected to be replaced or modified in the next few years), or replace systems (to be replaced in the planning horizon) – Develop a comprehensive master plan that describes overarching strategies for the overall project execution and a series of sub-projects that will gradually enable the full-scale operation of e-ST – Obtain political willingness and commitment for e-ST implementation – Secure formal approval and initial funding for project implementation – Organize marketing campaign and awareness raising programs
Phase B: Business Architecture	– Analyze As-Is control procedures and related business processes involved in the international trade – Redesign and simplify existing control procedures and related business processes in To-Be scenarios	– Elicit, document, and analyze the existing As-Is export, import, and transit business processes, as well as corresponding information flows – Develop business case scenarios and analyze potential benefits to convey to stakeholders – Redesign and simplify existing control procedures and related business processes – Seek approval for To-Be control procedures and related business processes, and list actions required to be carried out prior to adopting them – Start the necessary activities to establish an enabling legal framework

Table 1: e-STIF phases, objectives, and activities

Phase C: Information Systems Architectures (consisting of Data Architecture and Application Architecture)	Data Architecture: – Simplify, harmonize and standardize data used in the control procedures and related business processes, and develop a data model and messages Application Architecture: – Define the major kinds of application system necessary to process the data and support the e-ST business processes – Formulate a basis for estimating resources needed for implementing, deploying, and operating the e-ST	Data Architecture: – Identify relevant standards for harmonization and standardization of data – Extract data elements from documents/messages required to fulfill documentary and procedural requirements of control procedures and related business processes across the international supply chain – Describe each data elements in terms of their definition, source, type, representation format, and constraint in an actual operation in a way that is in line with relevant international standards – Analyze data elements across various documents/ messages and organize them in a comparable manner – Map data elements with the selected reference data model Application Architecture: – Define major types of application systems, their functions, and capabilities that constitute the e-ST – Understand the list of applications or applications components that are required – Identify logical applications and the physical applications, i.e. which IT-enabled functions should belong to which agencies – Elaborate a set of Application Architecture views by examining how the application will function, capturing integration, migration, and development and operation concerns.
Phase D: Technology Architecture	– Map application components defined in Application Architecture phase into a set of technology components, which represent software and hardware components, available from the markets or configured within the involved organizations into technology platforms	– Identify logical software, hardware, as well as IT and network infrastructure required to support the implementation, deployment, and operation of Single Window – Identify interoperability requirements, and select open and international standards to enable technical interoperability among different involved ICT platforms
Phase E: Opportunities and Solutions	– Estimate resources needed for implementing, deploying, and operating the e-ST	– Identify e-ST sub-systems which have to be implemented in a series of step-wise, phased projects – Establish technical guidelines for developing the various e-ST components to ensure their interoperability – Identify a financial model that supports full scale roll-out and sustainable operation of the e-ST – Develop necessary legal framework for e-ST, e.g. e-Transaction Law, Digital Signature Law, Data Privacy and Security-related Laws
Phase F: Migration Planning	– Ensure that the management and implementation of individual e-ST sub-systems is coordinated with the high-level master plan	– Set up program management office, which manages the allocation of budget and administer the implementation of e-ST sub-systems – Plan the implementation and migration of each e-ST sub-system – Assign business value and performance criteria to each project

Table 1: e-STIF phases, objectives, and activities

Phase G: Implementation Governance	– Establish a framework for monitoring the implementation, deployment, and operation of e-ST and the e-ST sub-systems so that their conformance with the defined specifications, plan, policies, and recommendations can be ensured	– Formulate policies and recommendations (i.e. those related to procurement, contractual agreement, service quality, and charges) to govern the implementation, deployment, and operation of e-ST – Perform governance functions while e-ST sub-systems are being implemented and deployed
Phase H: Architecture Change Management	– Identify areas where changes should be introduced to ensure (a) the maximization of business value from e-ST implementation, and (b) the alignment of implementation approach with relevant emerging international standards	– Assess outputs and outcomes of e-ST to ensure that the defined architectures achieve the targeted business value – Review emerging policy directives and recommendations related to e-ST implementation that are discussed at international and regional forums – Make recommendations for changes – Establish a legal-enabling environment
Requirements Management	– Ensure that a) stakeholders' requirements are addressed across artifacts produced in different phases of the implementation lifecycle and; b) the incorporation of new requirements is facilitated and controlled.	– Identify baseline stakeholders' requirements – Manage stakeholders' and other requirements change requests – Assess the impact of requested changes – Determine whether to implement change or defer it to the later e-STIF cycle – Ensure consistencies of related work products, developed architectures and components with the requirements and objectives of the e-ST

From various best practices on implementations of Single Window, and the ITAIDE Living Labs it appeared that, in particular, the first three phases A, B and C, and the final phase H, are the most complicated ones for policy managers of the implementation of e-solutions for trade facilitation. Therefore we provide, in the following sections, more detailed support for these phases.

3.2 Further support preliminary phase A and B: stakeholder management and network collaboration

The following steps are identified as essential for the Stakeholder Management and Interagency Collaboration that should occur at the Preliminary Phase, and Phases A and B:

Step 1. Obtain political will and a permanent mandate for e-ST implementation
Policy managers should *make use of existing facts and figures related to trade and transport facilitation and potential benefits that the Single Window can bring*. The e-ST vision can range from moving to a paperless environment where the existing forms and procedures remain in place, to harmonization of data and procedures to enable trade facilitation and Coordinated Border Management, by focusing on customs, security and safety (including veterinary and health), as well as statistics and

indirect taxes. Preferably, *the e-ST rationale is linked to a limited set of key performance indicators (KPIs) that should be improved*, based upon which high-level decision makers can assess the potential merits of the e-ST initiative at its start, but also once the e-ST components are deployed. For example, the role of KPIs for Single Window development is discussed in APEC (2009).

It is important to recognize that the ambition of the e-ST implementation can vary considerably among different countries. This can be caused by factors such as the business processes, modes of transport and the type of products that are exported and imported, as well as the volume and type of trade transactions (larger or smaller amounts of import, transit, or export transactions), transaction frequencies, and the existing IT infrastructure (e.g. whether or not different government agencies make use of IT already) (cf. Robey et al., 2008). For example, the Single Window for Thailand was primarily motivated by increasing the efficiency of export of their agricultural products like rice and shrimps, whereas the SW for the Netherlands is strongly motivated by the role as trading hub for Europe, and hence this Single Window development has a strong focus on facilitating transit goods flows via Rotterdam and Schiphol from and to the hinterland throughout Europe.

Regional and international developments also need to be taken into account. For example, what kind of SW the EU Member States could implement is partially decided and regulated by the European Commission (Rukanova et al., 2009). Policy managers should *draw on relevant policy directives and recommendations at international and regional forums* in order to achieve alignment with the broader strategic agenda, such as Trusted Traders, Central Clearance initiatives, Integrated Border Management, Framework of Standards, and cross-border SW implementations, such as the ASEAN SW initiative. Also important is political alignment with international initiatives such as the WCO Data model 3, and UN/CEFACT Core Components.

By aligning the e-ST rationale with the views and concerns of high-level policy makers on trade facilitation, political will and commitment can be achieved for the broad e-ST vision. *Obtaining a high-level policy mandate* is essential to formalize such political willingness and commitment to undertake an e-ST implementation and get formal authorization of the e-ST Programme. Preferably, the mandate should come from the Cabinet level. It is important to consider that the mandate should remain valid for a long term, as the e-ST implementation project typically requires more than ten years.

Step 2. Appoint a taskforce

The Taskforce is responsible for the management of the e-ST implementation programme. In this step, *policy managers have to decide which organization will be the lead agency.* It is crucial that the taskforce includes a strong lead agency. Typically, Customs plays an important role:

"Customs is the largest and most important cross-border regulatory agency in terms of its intrusion into trade transactions, its information gathering and the spread of its business activity. As such, Governments usually see Customs as the natural agency to be the focus of Single Window development. This does not neces-

sarily imply that Single Window will be owned or run by Customs, but even if that is the case, Customs will be the major stakeholder purely owing to its wide business coverage at international borders." (WCO, 2008)

The lead agency can be Customs alone, but it may also leading the e-ST implementation together with Port Authorities, the Chambers of Commerce, or even in the form of a public-private partnership.

Second, *the members of the e-ST taskforce have to be selected and mandated.* The e-ST taskforce should include high-level policy makers, but also people from middle management, as they are a relatively stable group over a long period. Furthermore, members of the e-ST taskforce should be selected on managerial, technical and organizational expertise, and also based on collaborative and communicative skills, because they are responsible for the successful stakeholder management and interagency collaboration throughout the e-ST initiative.

Step 3. Determine a stakeholder management approach

Identify who the main e-ST stakeholders are, i.e. all the organizations and people who are affected by the e-ST implementation project, who have influence or power over it, or have an interest in its successful or unsuccessful conclusion (TOGAF, 2009). Stakeholders include initiators, sponsors, implementers, intended users, receivers of the system's output, intended developers and operators of the system, those impacted and affected by the system, and those who will win or lose from the existence of the system (Phuaphanthong et al., 2009; Pouloudi and Whitley, 1997). Informal stakeholder groups should also be taken into account (TOGAF, 2009).

Table 2: Determinants of Stakeholders' Readiness for Implementing Individual e-ST Subsystems (Adapted from BTEP)

Readiness Factor	Description
Vision	– Objectives of the e-ST information system to be achieved and the benefits that it will bring are clearly identified. – There is a clear link between the vision of e-ST's sub-system and total information system.
Desire and Willingness	– Concerned parties understand the need for targeted information system. – There is a desire to achieve the "vision" and the willingness to accept the impact of doing the work.
Strategic Planning	– There is an established channel for coordinating strategic decision making between the project (the development of e-ST's sub-system) and the program (e-ST implementation initiative as a whole).
Sponsorship and Leadership	– The executive and senior management support the implementation of the targeted information system. – They are able to engage all concerned parties in the project and keep them on board throughout the project.
Governance	– Roles and responsibilities of concerned parties in the project are clearly identified.

Table 2: Determinants of Stakeholders' Readiness for Implementing Individual e-ST Subsystems (Adapted from BTEP)

Funding	– There is an indication that sufficient financial resources have been or will be allocated to the development of targeted information system.
IT Capacity to Execute	– There exists the ability to perform all the IT tasks required by the project, including the skills, tools, processes, and management capability. – There is a recognition of the need for knowledge and skill-building and corresponding arrangements which may include training or hiring of competent consultants.
Organization's Existing Information Systems	– The organization's existing systems effectively enable the business processes. – They are compliant with standards outlined in the technical guidelines for developing Single Window (interoperability framework).
Ability to Implement and Operate	– There exists the ability to deal with organizational change resulting from the introduction of new information system, and thus new way of doing things.

The next step is to decide which Stakeholder Management Approach is appropriate for each of these stakeholders. Therefore, it is important to *develop a good understanding of the most important stakeholders and record this analysis for reference and reiterate the analysis during the project.* Furthermore, it is also important to make experts from the government available to participate in the international initiatives. In particular, active involvement in bodies for data standardization or procedure harmonization bodies typically require long-term involvement of experts. It might be possible for governments to liaise with businesses that are already participating in these international standardization bodies, but even then governments should assign dedicated contact persons from their ministries to these businesses to make sure that the activities of these businesses are aligned with the long-term objectives of the government. It is also important to *assess the readiness of each stakeholder to behave in a supportive manner*; i.e., demonstrate commitment to the e-ST architecture initiative. TOGAF (2009) recommends the use of readiness factors developed under the Canadian Government's *Business Transformation Enablement Program* (BTEP) to determine stakeholders' readiness. These factors are listed in Table 2.

For each organization whose commitment is critical to ensure success, *make a judgment as to their current level of commitment and the desired future level of commitment* and *decide how they should be involved in the e-ST Programme.* Involvement can range from minimal, or keeping informed, to keeping satisfied or being a key player (TOGAF, 2009).

Step 4. Establish en environment for stakeholder coordination and collaboration
The objective of this step is to further shape the engagement of the stakeholders throughout the process, and to set up the environment in which the stakeholder coordination and collaboration is managed throughout the e-ST initiative.

The e-ST Taskforce is responsible to *develop and maintain the Master Plan for the e-STIF*, which is the guiding project management document. The Master Plan provides the basis for collaboration, as it specifies the roles and responsibilities of participating stakeholders throughout the different phases and in essence it can be seen as a – formal – tool that the taskforce can use to coordinate and manage coordination and collaboration of stakeholders.

The taskforce needs to *gain insights how the ambition level of the e-ST will influence the collaboration needed between stakeholders*. Regarding G2G collaboration, if the e-ST is intended for national data exchange, the taskforce has to ensure collaboration between ministries and other government agencies. At the next level, pre-departure and pre-arrival information may be collected for other national governments, and these need to be involved as well to ensure that the right data are gathered. If information is also exchanged with other national governments, for instance in the context of initiatives to reuse export declaration information for import, the collaboration needs to be intensified to make sure that the resulting e-ST delivers at least interoperable data. It is to be expected that the most intense participation of other national governments will be if there is an ambition to establish mutual recognition of certificates from certification programs like the European Authorized Economic Operator (AEO) and C-TPAT in the United States, or procedural controls (e.g. in the context of the ITAIDE project, there is no need for an additional physical scan if the goods have been checked at another border and the monitoring data do not show a sign of door opening) (See Chapter 3). This would require the most extensive cooperation among two or more countries, because of the necessary harmonization and simplification of procedures and processes, and the implementation of advanced ICT (monitoring as well as tracking & tracing functionality) to realize this ambition.

With respect to regional and international organizations, it is important on the one hand to understand their influence on the e-ST initiative and on the other hand, to decide and manage the active involvement of these organizations. Thus, two additional sub-steps need to be conducted:

– *Identify a list of regional and international organizations and initiatives which develop policies, regulations, projects and standards for regional and global trade.*

Compile a list of organizations and initiatives which develop policies, regulations and standards that may influence the e-ST operation. Prioritize the importance of these organizations for development of the Single Window. Develop a strategy for participation in these organizations including objectives, sustained participation and reporting. Typical examples of such organizations are World Customs Organization, UNECE, ISO, IATA, FIATA, GS1, and for the European context, the European Commission.

– *Analyze the interdependencies between the national and regional e-ST initiatives*

For example, a Single Window links national trade with international supply chains. The interdependencies between the national e-ST project and the international developments need to be analyzed and monitored. This includes initiatives such as development of cross border data exchange, data exchange between national Single Windows, use of Single Window for transit, data exchange between countries for trade facilitation and security. This activity encompasses monitoring of priority areas, definition of objectives, sustained participation and reporting to e-ST taskforce.

The e-ST taskforce is recommended to *decide whether to set-up one or more pilot projects.* For example, the ITAIDE project implemented these pilot projects through so-called Living Labs, which appeared to be especially suitable for delivering "proofs-of-concept" and to develop and pilot innovative components single window and e-Customs (See Part 2). Living Labs bring together stakeholders from government, industry, IT providers. The unique feature of Living Labs is that it can provide a neutral ground as the basis for collaborative innovation. In particular, they shape a context to create win-win solutions for trade and government. Although the neutral ground in the ITAIDE living labs was typically created by the academic partners, we expect that it is typically a government-related organization that can best act as a mediator to create a neutral ground in a living lab.

Define roles and responsibilities of stakeholders as well as their individual objectives, and concerns. It is important to pay particular attention to stakeholder interests by defining specific viewpoints, and views of the enterprise architecture model. This enables the architecture to be communicated to, and understood by, all the stakeholders, and enables them to verify that the enterprise architecture initiative will address their concerns (TOGAF, 2009). The taskforce should also address the *formal organization of the e-ST (sub-)project groups* that will be responsible for activities in specific phases (e.g. data harmonization, IT development, establishment of the legal framework) and needs to be decided upon, implemented, and periodically reviewed.

Furthermore, *a collaborative relationship needs to be established*. Conflicts in understanding and interests among a large and dynamic stakeholder network can be expected to arise during the e-ST implementation. If these conflicts are not addressed, they may hamper cooperation and the e-ST implementation. Awareness of potential conflicts, early identification, and conflict management are therefore important (Rukanova et al., 2007; 2010). Other factors that contribute to successful collaboration include (Phuaphanthong et al., 2009):

– Regular meetings; frequent mediated communications; client-centered focus; and leadership that promotes shared vision (Imel, 1995)
– Interagency collaboration capacity, i.e., formal agreements about conflict management; resources; administrative services; accountability associated with each task; individuals' expectations of others; and their availability and competency for delegated tasks (Bardach, 1998)

The Master Plan should address the iterative and incremental approach of e-ST initiatives, i.e., that there is not one project, but groups of activities that will be conducted as projects and each project will implement a component of the e-ST. The Master Plan will provide the planning for the overarching e-ST implementation programme. As mentioned, the stakeholders and players in each phase and relating to each (sub-) project may vary; the Master Plan presents the overarching e-ST Programme, and provides a coordination means to ensure continuity as well as consistency of the efforts over time.

3.3 Further support for phase B and C: business and IT interoperability

3.3.1 Business interoperability – process analysis, simplification and harmonization

A specific challenge for Phases B and C in the implementation of e-solutions for trade facilitation is the interoperability, process analysis, simplification and harmonization of cross-border data and procedures. Since e-solutions for trade facilitation have a global character per se, it requires modelling methods and tools that are accepted all over the world. Some of these methods and tools are described in this section. Business process modelling is widely used to design business processes for their implementation. Various methods can be applied, e.g. *Unified Modelling Language* (UML) and *Business Process Modelling notation* (BPMn 2.0). Basically, these methods support a visual documentation of processes and their attributes, but there is also tooling available that support the conversion of business processes to software configurations based on BPEL (Business Process Execution Language).

UN/CEFACT has developed the *UN/CEFACT Modelling Methodology* (UMM) to provide a guideline for modelling inter-organizational business processes that is based on UML. UMM facilitates the elicitation of business knowledge for the development of electronic business systems in an incremental manner. It employs a top-down approach that describes step-by-step how process analysts should document knowledge on process attributes that they capture from business experts. It also provides a set of example worksheets that process analysts may consider in adopting when eliciting necessary information. UNNexT (2009a) identifies key steps and stakeholders involved in the analysis and simplification of business processes. Those steps are categorized in three phases (see Figure 9).

While the first phase focuses on the managerial aspect of business process analysis and simplification, the second phase and the third phase deal with business process analysis and business process simplification respectively. These phases will be elaborated hereafter. They will not always run sequential, most probably phase II and III can be conducted in a (set of) workshop(s).

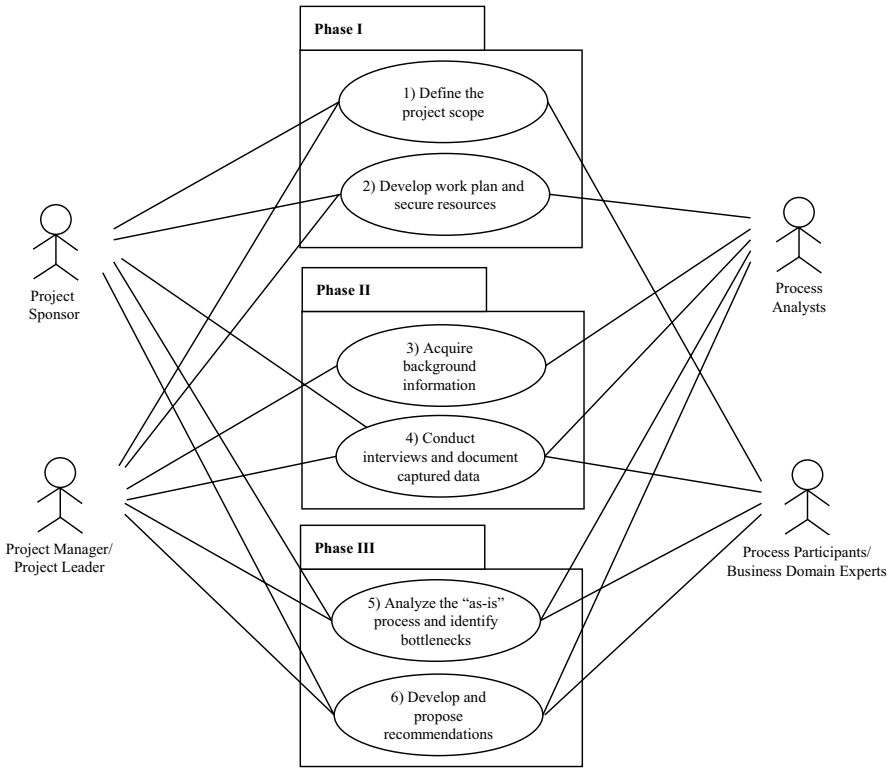

Figure 9: Key steps and stakeholders in business analysis and simplification (Adapted from UNNexT, 2009a)

Phase 1: Scoping and stakeholder commitment

The focus of this phase is to scope an e-ST development. It is necessary to distinguish if the national or international aspects and which type of goods are going to be covered by an e-solution for trade facilitation. The type of goods flow refers to the authorities that need to be involved. Like UNNexT (2009a) suggests, these can be visualized by a UML use case diagram to show the highest level.

To be able to secure resources, commitment at the highest level is required. Such a commitment needs to be based on identifying potential simplifications and thus benefits of an e-ST. These benefits have to be clear to all relevant stakeholders. By relating these benefits to existing programs, an e-ST development program will be better accepted since it fits already in existing policies and strategies.

Phase II: Modelling existing As-Is processes

The objective of this phase is to analyse the existing processes to allow for simplification by the implementation of an e-ST. A common approach is to study all relevant background material, conduct interviews, analyse the overall processes for the scope of an e-ST and validate the results in a workshop with representatives of all

relevant stakeholders. By also including 'time' as a property of the processes, benefits of changes are easier to analyze.

Phase III: Bottleneck analysis and proposal for simplifications
The objective of this phase is to identify simplifications by the introduction of an e-ST according to its defined scope and identified bottlenecks. For example, as one of the aspects of a Single Window is at least electronic submission of data, the impact of replacing paper documents with data on timing needs to be considered. Furthermore, activities that might be eliminated by introducing changes can be identified. Again, the simplification can be performed in workshops with representatives of all stakeholders (or sub-groups focusing on particular areas). The result can be in efficiency improvements (lower costs, improved inspection coordination) and/or strategic changes like the increase of trade.

3.3.2 Semantic interoperability – data harmonization

Within the scope of e-solutions for trade facilitation project and simplification of business processes, data needs to be harmonized. As we have indicated, data harmonization is a prerequisite for all variants of an e-ST implementation.

Semantics is the focus of data harmonization and can lead to syntactic harmonization, like applying the same syntax or messaging structure for data sharing. For example, APEC ECSG (2009) recommends a stepwise approach to data harmonization. These steps are consistent with those identified in the UN/CEFACT Draft Recommendation 34 (UN/CEFACT, 2009). Figure 10 shows the harmonization steps.

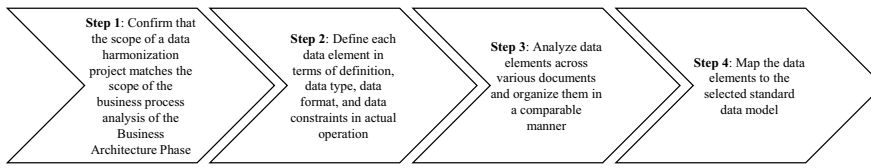

Figure 10: Steps of data harmonization

Data harmonization can follow two approaches, namely:

- Use (inter-)national accepted models for harmonizing current data requirements. Such a model is an intermediate model. The WCO *Cross-Border Data Model* (CBDM) *Version 3*, based on UN/CEFACT Core Components and the UN *Trade Data Elements Directory* (TDED), is an example of such a model covering supply chains in the context of an e-ST.
- Harmonizing data based on available business documents (paper, messages, etc.), which needs the alignment of any conflicts.

In case no international accepted model is used, alignment of data might lead to choices that are not internationally accepted. Therefore, it is recommended to use all

available international models and standards and express national data requirements as much as possible in terms of these international models and standards.

After establishing which business documents are in the scope of the business architecture, international models and standards comprise the following aspects that can serve a particular role in data harmonization:

1. Data harmonization at individual data element level based on the UN Trade Data Elements Directory, which is a list of all data terms including their definitions, formats and possible code requirements. These code requirements might refer to UN Recommendations. Data requirements can be derived for business documents used within the scope defined by the business architecture.
2. Data grouping for data sharing in international trade based on the UN/CEFACT Core Components that identifies sets of related data elements, e.g. the specification of weights, addresses, and currencies. This type of grouping is required to comply with international requirements of data sharing. These international requirements, for instance, state that a weight unit should come with its unit specifier, a monetary amount with a currency code, and so on. In case the scope is national, this type of grouping can be implicit, e.g. by stating that monetary amounts will only be in a specific currency (which gives an additional issue of exchange rates in international trade). In fact, a grouping of data elements leads to a new data type that can be re-used.
3. Data classes and their relations data based on the WCO data model version 3 or any other (national) model for logistics and supply chain management. Such models prescribe, for instance, the data elements specifying a goods item, and the relations of these goods items to form, for instance, a specification of all elements required in a consignment. These classes are specified independent of any mechanism for data sharing.
   Data elements of a specific data type, identified in the previous steps, may have more than one occurrence. Furthermore, data elements can have constraints within the context of a data model, e.g. the list of allowed packaging types can be restricted to a limited set.
4. Data sharing between two types of stakeholders, results in a view of all data shared, for instance, between a declarant and customs for a particular procedure, covered by the business architecture. Such a customs procedure needs to be identified as one of the (high level) business processes. Data sharing can be implemented further by one or more mechanisms within the scope of an e-ST project. Data sharing may also lead to further restriction of data elements, e.g. for sea transport the IMO-UNDG hazardous goods list will be used, whereas for road or rail transport other hazardous goods lists are applicable.

The deliverable of this phase is a data model defining all harmonized data requirements within the scope of the business architecture, and views on this data model for sharing data to support specific business processes. Note that an extension of the scope may lead to changes in the data model, since these extensions can lead to new

insights based on business process analysis. Another reason for change is alignment to changes in international standards used for data harmonization. The impact of these changes needs to be assessed before they are actually implemented.

3.3.3 Technical interoperability

Technical interoperability consists of a selection of communication protocols for actual data sharing, a syntax for structuring data during exchange and a paradigm for data sharing. These will be briefly explained in this section. One has to note that whenever a choice is made in a national domain, i.e. the domain of a country, another choice can still be applicable for sharing data with authorities in other countries. For example, a single window application must be able to support various communication protocols, syntaxes and paradigms for data sharing. The communication interoperability aspect and the data sharing paradigms will be elaborated further. Syntax choices seem to be fairly simple and depend on aspects like its degree of support by business and authorities and the overhead required by, for instance, the application of XML Schema.

Communication protocols
Communication interoperability requires the following choices:

- Selection of a set of communication protocols that might be applied in the communication between businesses and government authorities. Most common, TCP/IP Internet protocols can be used.
- Security requirements of such a network need to be based on a risk analysis. Additional security facilities, for instance to construct tunnels between communication partners, thus having a Virtual Private Network (VPN) over the Internet enhanced with firewalls can be realized. Furthermore, one may choose to implement a complete separate network that is accessible via tunneling.
- Reliability requirements, also based on a risk analysis. Reliability protocols can be implemented to ensure that data is actually received, and can be processed by a recipient. They offer more reliability in data exchange. *Electronic Business* XML (ebXML) has specified such protocols; although simpler mechanisms could be implemented by a receipt acknowledgement. The current EC *Common Communication Network* implements reliability and yet the EC Transit system has receipt acknowledgements.
- An *Application Programming Interface* (API) to allow businesses to select different types of messages. In the past, mail protocols based on the X.400 messaging standards of the CCITT have been implemented by many government organizations on top of communication protocols. Thus, traders have mailboxes that can be accessed via an API that is for instance implemented in a mail client on a local system. The concept of a business mailbox accessible via an API is currently still taken up by many authorities as they allow a trader to retrieve the status of a particular declaration (prioritized communication).

In the Netherlands, DigiPoort specifies such an API between business and government authorities based on the messaging paradigm.

Data sharing paradigms

Messaging is the most commonly applied mechanism for data sharing. It is based on a data-push mechanism in which a sender makes data actively available to a recipient. EDIFACT is the most applied syntax in customs, trade and transport for data sharing by the messaging paradigm.

A data-pull mechanism can be implemented by web services and service-oriented architectures. In this particular case, a data consumer requests the data of its provider. For example, customs is requesting data directly from the shipper, rather than the freight forwarder or customs broker. Such mechanisms can only work if the data requests are periodically or a data consumer is actively submitting a request by for instance a portal. ITAIDE has experimented with a portal, web services and service oriented architectures to implement such a data pull mechanism. Another means to implement data pull is to (1) notify a potential consumer that data is changed and (2) the data consumer initiates a web service to retrieve the data. Notification of data changes can be implemented by an *Event Driven Architecture* (EDA) in which events are actually related to changes in logistic processes, e.g. a vessel is estimated to arrive within the next 24 hours in a particular port and containers are to be discharged and loaded in that port. Upon such an event notification, customs can, for instance, request the Manifest of the vessel that includes information about all containers on the vessel with their place of acceptance and delivery, port of loading and discharge, traders and logistic service providers involved.

In addition to the data-pull mechanism, the piggy-backing principle can also be applied to simplify control procedure, and hence increase trade facilitation. One of most burdensome aspects of data exchange between businesses and government is that typically these data have to be provided in a data format standard, which is quite different from the format standards that are used in the information systems of the business. Hence, to present the data in the correct data format standard to the government, businesses have to do a lot of extra data processing, and in many cases they even have to develop, for this data processing, extra software applications on top of their existing enterprise information systems. This takes quite some extra efforts and investments. The piggy-backing principle indicates how source data from the enterprise information systems can be reused for government control purposes, and hence eliminates the need for companies to do this extra data processing to provide data to the government. If the piggy-backing principle is combined with the data-pull mechanism, trade facilitation is even more increased, because the business cannot only reuse its own business data, but the government also takes care of the actual data exchange process.

3.4 Further support for phase H: Estabilishinga legal-enabling environment

One of the greatest challenges of Phase H; Architecture Change Management, in the case of e-solutions for trade facilitation are the modifications that are required in the legal framework. For example, in the European context, Single Window and e-Customs innovations have to comply with the Modernized Customs Code of the European Commission. Successful adoption of these e-solutions can only happen when the MCC is modified accordingly. The following steps are identified as core of establishment of the Legal Framework (UN/CEFACT, 2005; 2009c).

Step 1. Assessment of the current legal environment
The objective of this assessment is to establish the *Legal Framework* (LF) that will need to be undertaken. First of all, the *current legal environment has to be reviewed in relation to the architecture components. Issues and "gaps" in the legal environment should be identified*, and *an analysis has to be made how they can be addressed based on international best practices and frameworks.* Adaptations may be needed in the architecture components (i.e. feedback to the e-ST enterprise architecture), and/ or at the different levels of the legal environment (i.e. need to take specific legal measures). Depending on the e-ST vision, the current legislation for use of IT, the use of innovative technologies for the e-ST applications, the need for actual change in the legal environment may vary across countries.

The following steps describe the steps to realize the resulting LF, providing some further details on the issues that are often found regarding e-ST. This is not an exhaustive listing. The steps are presented in relation to the level of the legal environment at which they are targeted; it is to be expected that changes at the international level will be more complex and time-consuming then those at the national level, hence they should start earlier.

Step 2. Establishment of supporting international legal environment
The establishment of the supporting international legal environment addresses such questions as the terms of mutual recognition of electronic documents and data messages that may be exchanged, mutual recognition of certificates like AEO and C-TPAT, etc. Considerations regarding security measures, secure data storage, requirements for acceptance, "non-discrimination" between paper and electronic documents may need to be addressed in this context.

As stated by UN/CEFACT (2009c, p. 6-7), "managing many bilateral and/or multilateral agreements, as the number of single window trading partner countries grows, can be a difficult task at least until such time as an international "framework" emerges for such agreements. Countries should involve their foreign ministries early in Single Window development efforts to assist in managing this process." EU member states are in a special situation; the EU being a Customs Union means that especially Customs laws are set at the level of the economic zone. However, not all aspects of cross-border trade are regulated to the same extent and countries may have different degrees of freedom to supplement or adapt the legislations

to their national setting. Also, the introduction of information systems for cross-border trade (e.g. a system for excise management, transit, VAT, etc., which can be seen as e-ST sub-systems) is made obligatory by the EU. Again, there are different degrees of freedom how e-ST sub-systems are developed, as the requirements of some, but not all of them, are set at the EU level, and countries may be responsible for system development themselves. At the national level, countries have to decide their level of active participation in order to influence the outcomes of legal processes related to e-ST (cf. Van Stijn et al., 2009).

Step 3. Establishment of supporting national legal environment
The measures taken for this step again relate to the legalization of electronic documents and data exchange, as well as other backing laws, e.g. Electronic Transaction Law, Digital Signature Law, Computer Laws, Criminal Laws, and Privacy Laws.

The use of e-ST sub-systems by different stakeholders can be made mandatory by law or optional for use. It is to be expected that the highest adoption will take place when the e-ST is obligatory. However, one may also implement certain services that – at least for a certain period of time – remain optional for all or some stakeholders (e.g. because of investment issues on the part of very small businesses).

Step 4. Establishment of terms for organizational agreements
Under this step, the organizational agreements regarding the e-ST operations are established. This includes for example service level agreements, government fee consolidation and electronic payments, terms of use, regulated CA operators, data ownership, and so on.

4 Conclusions

To provide practical guidelines for the implementation of e-Solutions for Trade Facilitation (e-ST), such as e-Customs and Single Window, we have developed the *Implementation Framework for e-Solutions for Trade facilitation* (e-STIF). The implementation framework is meant for policy managers, who are responsible for overseeing the implementation of e-Customs innovations. Once the initial policy decision about e-ST implementation is made by the government, policy managers take responsibility for developing a master plan for its implementation, coordinating technical activities, monitoring its progress, and ensuring the delivery of the expected outcomes. The implementation framework covers the full spectrum of implementation activities, using the TOGAF enterprise architecture development methodology to structure the specific phases of the implementation framework. It starts with the preparatory phase about the scoping of the e-ST innovation, supporting the coordination among the various government agencies to harmonize their data and procedures, and alignment with international initiatives such as, for example, the trade data message standards from UN/CEFACT and the cross-border data

model by the World Customs Organization. Eventually, the e-STIF goes into providing support for specific development aspects of e-solutions for trade facilitation development such as data harmonization, using the core component technical specification (CCTS) methodology, and procedure harmonization and simplification, using the redesign principles of the *ITAIDE Information Infrastructure* (I3) framework, such as the piggy-backing principle to reuse company's business data for government control purposes, and the transformation from data-push by the exporting or importing company to data-pull by the various governmental inspection agencies.

Part 5: Conclusions

Chapter 17: Conclusions

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1 Global economy

There is no question that globalisation and increased international trade are the two most important drivers of economic growth. Accordingly, most countries are actively promoting international trade. As a result, cross-border trade has become global and imported products form part of every aspect of daily life in European societies. The flip side of this expansion is an increasing complexity of trade networks, increased administrative costs and an increased vulnerability and exposure to risks of a scale and magnitude that we have not seen before. It has become evident that the physical and information infrastructures that enable goods and services to travel seamlessly around the globe for the benefit of society can also enable activities to harm this very society – the use of mobile phones and Internet by international terrorists, for instance.

The inherent risks in the networked world have put international trade under increased pressure over the last decade. It is clear that since 9/11 security in international trade has been tightened to counteract the possible security and safety threats of different types of terrorism, such as nuclear devices in containers. But in addition to that, safety issues such as preventing the spread of counterfeited drugs and ensuring the quality and safety of food products sold to end-consumers has become high on the agenda. On a similar vein, the fraud in international trade (e.g. on VAT and Excise), which by all accounts is increasing along with globalisation and increased international trade, also needs to be addressed. For governments, the way to proceed is not obvious: stimulating economic growth calls for reduction of administrative burden and fewer inspections at the borders; addressing fiscal and security risks intuitively calls for tighter controls.

As a response to the fiscal and security risks, new information systems and control procedures are being developed by governments. Unfortunately, traditional technical measures are limited in fulfilling the desired level of control, incur high costs for both government and businesses, and lead to an increased burden on

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traders and international trade. At the same time, the vision of totally eliminating the threats from the international trade environment will be exorbitantly expensive and impossible to achieve in practice.

Governments in the EU and internationally are currently exploring an alternative approach based on *Public-Private Partnership* (PPP) between businesses and governments, which relies on delegation of control by government agencies to businesses and differentiation between trusted and non-trusted companies. This approach allows for facilitation of legitimate trade and enables governments to focus all their efforts on controlling the non-trusted traders. Furthermore, digitisation of all trading documents allows for business intelligence, which makes risk analysis and risk management much more feasible.

The ITAIDE project addresses these issues and proposes a way out of the dilemma of trade facilitation versus regulatory compliance. It shows that these goals are not necessarily mutually exclusive and that IT innovations can help to achieve trade facilitation, while at the same time the societal concerns are safeguarded.

2 The ITAIDE approach

As discussed in the Introduction chapter and reflected throughout the book, the ITAIDE approach builds on four key components,: (1) it relies on the piggy-backing principle, which in this context means reuse of business data for government control purposes; (2) it proposes a fundamental shift from a "data push" model, where companies are actively required to submit information to the government to a "data pull" model, where government can pull information from the information systems of the supply chain partners; (3) it provides an information infrastructure (I3) framework which outlines key components and capabilities that could help a business to qualify as a trusted trader, and hence to enjoy the benefits of accelerated trade. Living Labs, are used as innovation environments to develop and test the ITAIDE approach in a real-life setting.

2.1 Key insights regarding the piggy-backing principle

In the ITAIDE project the piggy-backing principle refers to the reuse of business data for government control purposes. The rationale behind the use of the piggy-backing principle is that modern supply chains already have sophisticated IT in place to coordinate and control business operations for their own managerial and quality control interests. Introducing additional dedicated systems to communicate with the authorities is burdensome for two reasons: first, there are associated costs related to the development and maintenance of the government systems; second, such systems are not directly related to the value added services provided by the supply chain partners. If the existing Business-to-Business information infrastructure is reused for government control purposes, efforts and costs can be reduced by not having to invest in dedicated government systems. The advantage for the gov-

ernment is that they can get better data quality, which is essential in order to conduct accurate risk assessment and risk analysis.

The applicability and potential of the piggy-backing principle for trade simplification has been shown throughout the various living labs. First, our findings suggest that there is a high potential for reusing the business data for government control purposes. However, it is a prerequisite that all supply chains would need to make investments to capture aspects (such as security) which have traditionally been outside of their domains. This would require additional investments to make supply chains more transparent and secure. Only if companies are willing to make such investments will they have the information infrastructure that would enable reuse of business data for government control.

Second, our findings suggest that for the piggy-backing concept to work in practice, it is necessary that not only the businesses but also governments move. Legislation to regulate customs and trade can be a major constraint for innovation and there is a need for government to adjust legislation in order to allow for the maximal reuse of supply chain information..

2.2 Key insights regarding the data pull model

The ITAIDE project proposes a fundamental transformation from a traditional data push model, where companies actively submit information to the various government authorities, to a data pull model, where governments can pull the necessary information directly from the information systems of the companies. The data pull model can be seen as an extreme case of reuse of business data for government purposes. The concept was tested in two of the ITAIDE Living Labs and clear benefits were identified for both business and government. In the data pull model, the administrative burden for companies is reduced, because they no longer have to implement add-on applications on top of their internal systems to generate dedicated data streams for the government. Furthermore, the government gets 24/7 access to the original business data at the source – the business systems of the companies. Since the data from the ERP systems does not have to be transformed to comply with the data format requirements of the customs procedures, the quality of the data is much better and enables better risk analysis and risk assessment.

Adopting the data pull model is challenging in practice. First, there needs to be a willingness of companies to be transparent and open up part of their information systems to the government authorities. The Living Labs showed that companies are positive and willing to agree to such transparency, provided the trusted trade status offers sufficient benefits in terms of accelerated trade. Another complex issue identified was to develop the legislative context to allow such innovations to be put in place in practice; in particular the Modernised Customs Code. For example, businesses would prefer to have integrated cross-border IT solutions that allow them to extend e-customs systems with other functionalities such as cross-border procedures for indirect taxes (VAT, Excise) and food safety controls. However, the current legal framework for e-customs in Europe does not yet allow for these extra functionalities.

2.3 Key insights regarding the I3 model

The I3 model developed by ITAIDE outlines key components that need to be put in place in order to achieve accelerated trade. The basis of this model consists of IT-related innovations such as (software) tools and methodologies, which have been tested and validated in five Living Labs. These IT innovations enable companies to build the critical capabilities necessary for achieving end-to-end control of the flow of their physical goods, as well as end-to-end information transparency. By doing so, companies are better able to show the government that they are in control of their business operations, which makes them well positioned to obtain a trusted trader status and the related trade facilitation benefits. This can be done, as governments can build on the available information infrastructure to achieve better quality of controls and reduced inspections. Below we briefly summarise the five ITAIDE IT-related innovations developed in the project, which are the essence of the I3 model.

2.3.1 IT

The events of 9/11 served as an accelerator for the use of innovative information technologies for enabling new customs procedures and business practices.

In chapter 10, we presented the ITAIDE e-Customs technology infrastructure, composed of two technological innovations: (1) web services and service oriented architecture (SOA) and (2) container security devices. The latter is a combination of sensor technology (to detect events) and data transmission technology (to report events). The container security device has been recognised as having the potential to "significantly impact domestic and foreign cargo handling and trade facilitation" (US CBP, 2006). ITAIDE takes this vision a step further, by integrating container security devices with SOA in order to achieve information sharing across the supply chain and to obtain rich and reliable information concerning cargo movements.

In particular, in the BeerLL there was a fully integrated software demonstrator in which the messages of the container security devices were directly integrated in the SAP back office of Heineken. Furthermore, no export-related data had to be sent by Heineken to the Dutch Customs, because the Dutch Customs had access to the SAP system of Heineken and could retrieve business data about the content and route of the container directly from this database for control purposes. This implementation of the pull model led to a substantial reduction of administrative burden for Heineken as well as for the Dutch Customs. In the DrugLL a similar integration was tested between the mobile sensor device and a back office database. However, due to confidentiality issues this back office data base could not be integrated with the ERP system of the pharmaceutical company, although technically it would have been feasible. In the FoodLL and PaperLL there was no use of track or sensor devices, but the focus was completely on service-oriented architecture solutions.

In the FoodLL it was shown how the SAP software could be used to act as an SOA to facilitate the exchange of Customs data between Arla, its business partners, the Danish Customs and various other European Customs agencies.

In the PaperLL, the focus was on the use of web services and SOA by UPM to provide SMEs access to the advanced ERP system of UPM, which acted as a kind of hub for linking these smaller companies to the e-tax & customs applications of the Finnish Customs. The interesting aspect of the PaperLL is that it shows how web services and SOA can be used to connect small companies, with very limited IT resources, to rather sophisticated IT innovations piloted in ITAIDE project via their larger business partners. Hence, the living labs show clearly show how web services and SOA can make important contributions to information sharing across the full supply chain, including the data pull information sharing between SME and other businesses and government agencies, which is a key prerequisite for end-to-end information transparency. The sensor devices were important in terms of providing real-time monitoring, which is another prerequisite for end-to-end control.

A number of challenges have been identified in deploying these technologies in the ITAIDE Living Labs. First, container security devices are not yet a fully matured technology. Even though the satellite communication of the TREC device in the BeerLL adds considerable security functionality because container transport can be monitored during road transport or even at open sea, it consumes a lot of power and battery life is still a problem. Second, some operational issues have not yet been solved, such as the challenge of returning the smart electronic seals efficiently to the dispatch point (i.e. reverse logistics problem). Third, the business models for tracking devices are not a clear cut case. For example, a worldwide roll-out of tracking devices requires not only huge investments for devices, but also for setting up the worldwide secure communication services for exchanging the messages via these devices. Obviously, shippers will not make these investments, unless there are tangible cost/benefits.

Logistics service providers might consider the investment in the devices, but they are less well equipped to run secure global communication services. Hence, they would have to outsource this to a third-party commercial enterprise, but this dependency might jeopardise their own profit margins.

2.3.2 Standardised data models

In all Living Labs extensive research was done on the data model standards for cross-border trade. In the Beer, Food and Paper Living Labs data modelling experts from the Dutch, Danish and Finnish Customs respectively were actively involved in assessing the existing national Customs data models, jointly with data modelling experts from the IT partners from ITAIDE, such as IBM, SAP and Resultmaker. Some of these experts from SAP played active roles in UN/CEFACT. The Customs experts investigated, in particular, extent to which the national Customs data models of Denmark, Finland and Netherlands were interoperable with those of other EU Member States, and international data models such as the *Cross-Border Data Model* (CBDM) of the World Customs Organisation.[1]

[1] For further information on the WCO cross-border data model, see http://www.wcoomd.org/home_wco_topics_pfoverviewboxes_tools_and_instruments_pftoolsdatamodel.htm.

The research in the ITAIDE project in general and the Living Labs in particular were facilitated by the fact that in 2008 negotiations were started between the World Customs Organisation and the UN/CEFACT about the integration of the trade data model of the UN/CEFACT, the so-called *Core Component Library* (CCL) data model, into the CBDM. Since UN/ECE is a partner of ITAIDE and the WCO has a representative in the ITAIDE Advisory Board, the ITAIDE project could immediately benefit from this convergence between CCL and CBDM, and pilot, in particular in the FoodLL that started in 2008, the preliminary version of this integrated data model. The current status in 2010 is that the initial steps for the integration of the CCL in CBDM have been successful, but it was also observed that it will take a few more years before the CCL is completely integrated in the CBDM.

However, the research in the Living Labs has shown that the current version of CCL is not yet complete. Given that the full set of international trade data consists of well over 10,000 data elements, it is not surprising that a rough estimate of the current situation is that only approximately 40% of all these data elements are represented in the CCL. Clearly, this limitation carries over to the CBDM. Another standardisation issue observed in the Living Labs was that the alignment of national Customs data models critically depends on the harmonisation of among national cross-border data model procedures. This entails two additional complexities. The first complexity is that in many EU Member States, Customs are coordinating substantially more data flows for cross-border trade than the traditional import and export declarations, e.g. extra data for security purposes, for health and safety inspections, as well as indirect taxes such as VAT and Excise.[1] Typically, these additional data are related to national procedures that can differ considerably between countries. For example, procedures for health and safety inspection for dairy products or flowers are much more complicated in Denmark and the Netherlands than in most other countries, because of the huge export volumes of these products. However, this lack of harmonised procedures leads to some considerable differences in the data that the different EU Member States require from businesses, and this hampers the standardisation of the cross-border data model. Even more complicated is the standardisation of VAT and Excise. Since indirect taxes are national policies and contribute considerably to the state finances, every country has its own procedures for them. Again, this leads to substantial differences in the data that the different EU Member States require from businesses, which hampers the standardisation of the cross-border data model. Hence, one of the main findings of our living labs is that cross-border data standardisation in Europe critically depends on the harmonisation of these procedures across the Member States. Recently, the European Commission started new initiatives, in particular in the context of developing a Single Window, to facilitate further steps in the harmonisation of these procedures. The main challenge is to align the procedures for Customs, fyto-sanitary and indirect taxes. Furthermore, there is the issue of timing. Some of the interna-

[1] Indirect taxes become a Customs issue when goods are crossing national borders, because the EU has exemption rules which imply that when a company exports goods to another country, the company is exempted from paying indirect taxes in its own country.

tional standards were only recently developed, companies as well as government institutions have already invested in legacy solutions and it will take time before they are ready to make new investments and shift to international standards.

2.3.3 Interoperability tools

In the previous section we observed that although there are international organisations dedicated to developing standards, the expert's opinions from the Living Labs clearly indicate that it is not realistic to expect a 100% standardisation of cross-border data models in the coming decade. Even though diversity of standards and solutions will remain with us for quite some time, it does not mean that efforts in the area of e-customs cannot proceed. In ITAIDE we have developed and validated a number of tools enabling data model interoperability, ranging from simply transferring paper-based documents to XML format to more advanced tools making it possible to translate between different formats and standards via XML-based semantic models. In the Living Labs we investigated interoperability on two levels.

- *Data and Message level*, where the standardisation is facilitated by the CCTS methodology enabling integration of processes across value chains. We have shown in the Living Labs how it is possible to carry out data and process modelling, carry out online validation and offer web services.
- *Platform level*, where the co-existence of different portals is enabled, heterogeneous systems landscapes are configured for integration, application to application in business-to-business integration is made possible and, in general, applications from multiple vendors are linked via links between platforms.

Various interoperability validations were carried out in the Living Labs. The typical set-up of such a validation was that trade and Customs data from an actual shipment involving various businesses and government agencies were mapped on a common XML-based semantic data model. The validation was considered successful if it was possible to map these different data formats in such a way that all data could be exchanged fully automated among all these partners via the semantic model mapping. In particular, in the FoodLL a detailed interoperability validation was carried out, based on the software tools such as *XML Factory* and *Online Consultant* (see Chapter 12), and in the PaperLL interoperability was validated with *Webmerca* (see Chapter 4). The first two tools are fully compliant with the Core Component Library of UN/CEFACT, whereas the third tool is compliant with the RosettaNet standard. Furthermore, these standards are also well aligned with the standards of GS1 and ISO. Since CCL, RosettaNet, GS1 and ISO can be considered as examples of the dominant de facto trade data standards, the results of the interoperability validations in the Living Labs seem quite representative of the current state of the art of software tools for interoperability mapping. Hence, although we are still far from a complete mapping of all cross-border data, the current interoperability tools can bring us a significant step forward in achieving this objective, given the limitation that complete standardisation of cross-border data will not be achieved in the near future.

All in all, we believe that the interoperability tools provided by the ITAIDE project are of significant importance when implementing new systems in order to achieve compliance between all trading partners. The tools enable them to comply with internationally agreed standards in a specific situation. Furthermore, since there will always be some need for local mapping of the standards to the specific situation, the interoperability tools can enable that process as well.

2.3.4 Procedure redesign methods

When redesigning procedures, it is important to ensure that the control requirements are preserved and societal concerns are safeguarded. To support this redesign process the e^3-Control methodology was further developed and piloted in ITAIDE for control procedure redesign in the Beer, Food, Paper and Pharmaceutical industries. The methodology is a software support tool to help experts from Customs organisations and/or Customs departments in companies to develop and assess different procedures to improve the control of business processes. The e3-Control methodology integrates two perspectives; a value model perspective and a process model perspective. Both perspectives are supported by visualisation tools.

The value model perspective represents the economic exchanges between the partners in a supply chain, including the government agencies. These value models are represented in a Petri net-based visualisation tool. The value-model analysis serves as an eye-opener and helps experts to focus on the high-level redesign issues such as why and for whom a control is needed, and what are the critical economic values that a control mechanism safeguards. For example, in the BeerLL the value model analysis was used to analyse where excise fraud could take place in the export of beer from one country to another. The essential result of this analysis was that there must be a way to testify that the beer left the country of origin.

The process model perspective represents the operational aspects of the new control mechanisms that are identified to improve certain controls. In the BeerLL this process model showed (1) that in the traditional control procedure for beer export 28 different documents had to be sent by Heineken to the Dutch customs and various other government agencies, (2) that many of those documents had the function to testify that the beer had indeed left the country of origin, and (3) that a smart container seal could basically replace most of these documents, since the encrypted location message of the container seal could act as trustworthy signal that the beer had indeed left the country. Basically, the analysis showed that a combination of smart container seals and service-oriented architectures is sufficient to replace the 28 documents in the old procedure. However, most of those documents (although in electronic form nowadays) are mandatory according to existing European Customs legislation, hence amendments are needed to allow further adoption of these e-Customs solutions.

This example of e^3-Control in the BeerLL also shows how IT innovation can lead to a considerable simplification of control procedures. Furthermore, it shows how redesign principles such as the transformation from data-pull to data-push, and the piggy-back principle, are applied in practice. In the old data-push situation

Heineken had to send different data sets for each container shipment, typically in different data formats, to various government agencies aboard. Although, in recent years most of these data are sent electronically rather than by a paper document, there are still quite a few inefficiencies, because the data formats were so different that Heineken had to build a specialised software application on top of their ERP system for each government agency. In the new data-pull situation the Dutch Tax & Customs office could themselves pull the relevant export evidence data for a specific container directly from the smart container seal via the service-oriented architecture via the database of Heineken. Moreover, the Heineken data used for this export documentation were the same business data that Heineken used for their own commercial transactions. These could be invoice data or the quality control data for food traceability that enables Heineken to trace back any contamination in a specific bottle of beer to its beer ingredient suppliers. This reuse of business data for government control purposes is also an excellent example of the piggy-back principle. Finally, it was shown in the Living Labs that the e3-Control methodology is an effective and interactive interface for group discussion, brainstorming and decision making by customs experts and business analysts in redesigning and simplifying Customs procedures.

2.3.5 The value of a collaboration network view

Innovation processes are essentially about discovering and learning how to employ new knowledge. Soft Systems Methodology, Business Process Redesign/Reengineering, Business Network Redesign, Network Business Modelling, and Network Management Framework have been used to interpret situations and they are resources we can use to communicate our organisational choices and actions. Networks can be thought of as explanatory devices or technical objects, and we have found it useful in the project to think of them as both technological and social infrastructures.

Ultimately these theories and frameworks are simply devices to help us make sense of the situations we encounter or attempt to construct. Their value is in how well we can use them ourselves to construct and make sense of the complexities of introducing beneficial change into complicated multi-organisational and market-wide settings. What then can we take from them?

- **Take context seriously and variously;** no single perspective is absolutely correct; listen to and act on feedback, let the situation and context 'talk back' and learn from it.
- **Maps and models of situations are essential;** draw pictures of networks, actor relationships and interactions, process flows, physical and virtual.
- **List the actors involved;** not just stakeholders but wider and perhaps hidden players. Actors will be individual people, groups, organisations, divisions, locations, objects, structures, other technologies and other systems. Meet, get to understand and follow the actors as they enact the things you map; follow an object through the system, walk with people as they process a transfer,

travel with the truck as it crosses a border, trace the documents and messages between paper and technology.

- **Consult.** Engage in real discussions with as many actors as you can; consult and make sense jointly with people 'on the ground.' Learn the language and terms and the practicalities of working networks, looking out all the time for the things you will miss – people making up for the gaps of technology – these things are *obvious* to practitioners and *oblivious* to technology.

In the ITAIDE project, Living Labs were used as innovation platforms to bring businesses, government, technology providers and academia together to develop innovative concepts for cross-border trade and to show how the components of the I3 model can be put in place to achieve accelerated trade. We have used the concept of Living Labs as a framework for studying and acting in living settings such as organisations, work places, public spaces and the wider environment. The Living Lab Research Approach (LLRA) takes a developmental view and studies novel technologies in complex real world settings.

As an enabling concept the living lab has allowed actors with different interests to collaborate, meet and interact with each other within projects of shared concern. These are multi-stakeholder innovation initiatives but importantly, studied in vivo, are in the 'real world' and deal with existing knowledge and regulatory environments. They impact work and user practices and involve other technologies and actual market contexts, e.g. legal arrangements and industry structures. The Living Lab has a main focus activity around which central actors negotiate and interact in a process of social construction and network formation proceeding in parallel with technology development. At different times, these activities both stabilise and strain the network as understanding of the use and meaning of technology evolves. As the numbers of users and organisations involved expand to larger social entities or peripheral actors such as local or regional communities, complex technology-mediated innovation becomes uncertain and open-ended as more stakeholders become involved.

To provide practical guidelines for the implementation of e-Customs innovation, we also provided the e-Customs Implementation Framework. The implementation framework is meant for policy managers, who are responsible for overseeing the implementation of e-Customs innovations. Once the initial policy decision about e-cCustoms implementation is made by the government, policy managers take responsibility for developing a master plan for its implementation, coordinating technical activities, monitoring its progress and ensuring the delivery of the expected outcomes. The implementation framework covers the full spectrum of implementation activities, using the TOGAF enterprise architecture methodology to structure the specific phases of the implementation framework. It starts with the preparatory phase about the scoping of the e-Customs innovation, supporting the coordination among the various government agencies to harmonise their data and procedures, and aligning with international initiatives such as the trade data message standards from UN/CEFACT and the cross-border data model of the World Customs Organisation. Eventually, it goes into providing support for specific

development aspects of e-customs systems development. These include data harmonisation, using the core component technical specification (CCTS) methodology; procedure harmonisation and simplification, using the redesign principles of the I3 model, such as the piggy-back principle whereby a company's business data is reused for government control purposes; and the transformation from data-push by the exporting or importing company to data-pull by the various governmental inspection agencies.

3 Outlook

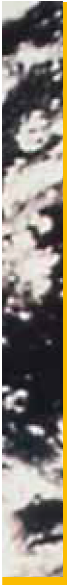
The ITAIDE project was inspired by problems that came about during what we called the "security wave" in the Introduction chapter. Through Living Labs, it was shown that by following the ITAIDE approach it is possible to make a significant further step in trade facilitation, compared to what is currently envisaged in EU policies and plans such as the Multi-Annual Strategic Plan of DG/TAXUD.

In order to enjoy the benefits of trade facilitation, however, companies have to become trusted traders and more in-control of their own business processes, so they need to invest in making their supply chains more transparent, safe and secure. We argued that installing an appropriate information infrastructure is a key prerequisite for this. In the context of the security wave, such companies would be better prepared to be among the first to benefit from future e-Customs developments, such as system-based control, single window, coordinated border management, and the use of the data pull rather than the data push model.

However, the benefits from the ITAIDE approach can also be seen to reach beyond the security wave. Companies that have an appropriate information infrastructure in place to make their supply chains transparent and secure, and that have invested in establishing a trust relationship with government, will be better positioned to act when future opportunities or challenges occur. For example, companies with AEO status will have a better control over their inventory levels and are therefore better able to reduce their operating costs and become more competitive. Furthermore, they will be better prepared to prove to the government and end-consumers that their food products are safe, that goods comply with environmental requirements, that their carbon footprint is minimised or that they are not utilising child labour. In the near future these values will be decisive for the end-consumer in choosing products from one specific company's supply chain or that of its competitors. Being a trustworthy company cannot and should not be a rosy ethical store front. It needs to be the core of corporate governance making business more competitive in the long run. Doing ethical business is doing good business.

ITAIDE has provided a set of tools and real-life proof-of-concept examples of how things can be done differently and how trade simplification can be achieved while at the same time ensuring regulatory compliance. It is now it is up to the political will of governments to utilise the ITAIDE results further. There are various open issues and future Living Labs could help to solve them and to define more innovative concepts for e-customs.

Furthermore, it is up to the business community to develop viable business models for adoption. This process, however, will need to go hand in hand with the further development of the Modernised Customs Code, since the current EU legal framework for e-customs is one of the major barriers to adopting the innovative concepts in practice. An intensive dialogue between the three stakeholder communities – business, governments and IT-providers – will be essential in identifying and implementing the legislative changes needed to reap the full benefits of e-customs for trade simplification. This can be done in the form of public-private partnerships, where IT is key to obtaining the transparency and the control necessary for establishing the necessary mutual trust. This will pave the way for our collaborative efforts towards making Europe one of the most competitive economies in the world.



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Accelerating Global Supply Chains with IT-Innovation

ITAIDE Tools and Methods

One of the major challenges for European governments is to solve the dilemma of increasing the security and reducing fraud in international trade, while at the same time reducing the administrative burden for commercial as well as public administration organisations.

To address these conflicting demands, the ITAIDE project has developed a large set of innovative IT-related tools and methods that enable companies to be better in control of their business operations. These tools and methods have been integrated in the ITAIDE Information Infrastructure (I3) framework.

By using the I3 framework, companies are better positioned to apply for the Trusted Trader status, and enjoy trade facilitation benefits such as simplified customs procedures and fewer inspections of their goods. Hence, the I3 framework can contribute to making global supply chains faster, cheaper, and more secure.

The I3 framework has been tested and validated in five real-life Living Labs, spanning four different sectors of industry, and conducted in five different EU countries. National Tax & Customs organizations from various European countries have actively participated in the Living Labs.

The United Nations CEFACT group, experts from the World Customs Organization and representatives of key industry associations have also provided valuable feedback and ideas for the Living Labs and the project in general.

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