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Summary

Many governments worldwide have adopted the Single Window initiative as a national Programme of work since they recognize that Single Window is a crucial instrument that can be used to eliminate inefficiency and ineffectiveness in business and government procedures and document requirements along the international supply chain, reduce trade transaction costs, as well as improve border control, compliance, and security. Single Window systems are considered to be a means to establish improved information sharing between government agencies and businesses involved in cross-border trade. A Single Window can be used as a "one-stop shop" for traders and other commercial organizations to exchange information with the government agencies that, based on regulation and control procedures, require data on a variety of aspects of the trade transactions and the flow of goods through the international supply chain. The implementation of a SW faces complicated challenges that relate not only to the technical aspects of SW systems, but also to the organizational and inter-organizational, managerial, financial, political, legal, and national and international settings. As "policy managers" who are involved in initiating and overseeing the management of SW implementations, need to develop a strategy transforming their vision into implementation, a strategic and holistic framework that informs how the implementation challenges can be systematically addressed is much needed.

For this purpose, we introduce the *Single Window Implementation Framework* (SWIF). It builds upon the use of "enterprise architecture" to decompose and structure the challenges that accompany a SW implementation. The SWIF is an adaptation of the TOGAF Architecture Development Method to the specific requirements and features of Single Window projects. Part I of the SWIF provides the conceptualization of the framework. The guiding principles underpinning the SWIF are phasing and alignment. SW implementations need to align IS and business strategies within the national but also international setting and developments for the long-run success. SW implementations typically follow a step-wise, phased approach and the SWIF provides a coordination mechanism between the overall SW Programme and sub-projects. Sub-projects involve a smaller set of stakeholders, based on prioritization and impact, and may focus on a sub-set of activities of the SWIF method. Through cycling and iterations, as well as the (re-) use of artifacts related to the SW architecture, these sub-projects are coordinated with the overall SW implementation. Part II of the SWIF presents a set of guidelines and techniques related to five areas that are essential for SW implementation, and that differ substantially from other information system implementation, thus requiring further adaptation of the TOGAF work. These areas are stakeholder management and interagency collaboration, business process analysis and simplification, data harmonization, interoperability, and the realization of the legal framework. The SWIF can also be seen as a useful structure for case comparison, as we have found for the SW implementation cases of Thailand and The Netherlands, which helps to synthesize lessons learned from prior and on-going SW implementations. For the future, this also facilitates the SWIF to the contexts of Single Window implementations in specific countries.

Additional work on the SWIF can be used to further evaluate, adapt and tailor the SWIF. For example, we have already started to relate the SWIF to other results of the ITAIDE research, and to tailor the discussion further to the European context[1]. Moreover, the UN is also preparing "A Manager's Guide to Single Window Implementation" based on the ideas presented in this deliverable. Future work on the SWIF could also focus on the development of a series of blueprints to prepare the National Master

[1] Van Stijn, E., Phuaphanthong, T., Kerotho, S., Pikart, M., Hofman, W., and Tan, Y. (2010). Implementation Framework for e-Solutions for Trade Facilitation. In: Tan, Y., Bjørn-Andersen, N., Klein, S. and Rukanova, B. (Eds.) (2010). *Accelerating Global Supply Chains with IT-innovation: ITAIDE tools and methods.* 1st edition. Springer, 285-317.

Plans, which we see as Part III of the SWIF, in order to facilitate the application of the SWIF during SW implementations.

Preface

Part of the research efforts in the ITAIDE project have focused on the topic of Single Window (SW). ITAIDE Deliverable 5.0:4 *State of Art* has presented five case studies of Single Window systems implemented by the public authorities, in particular, the Customs of Australia, Denmark, Hong-Kong, Japan and Singapore. Those countries are considered to be among the most technologically advanced adopters of e-Government solutions. The SW systems presentation and the analysis both in terms of technical and organizational implementation offer useful insights by highlighting the technical and organizational challenges faced by Customs in each case while discussing the solutions provided as well as the main benefits for the stakeholders involved. This document essentially has provided a state of art review of existing Single Window systems, a comparison between the different systems and the solutions provided, and recommendations for the technical and the organizational implementation of Single Window.

This ITAIDE Deliverable 5.0:4b *Single Window Implementation Framework* is a continuation of the SW research, and presents the Single Window Implementation Framework (SWIF). The SWIF presents a systematic, aligned and phased, way of dealing with Single Window implementation challenges. The SWIF builds on the ideas of enterprise architecture and architecture development method from The Open Group Architecture Framework (TOGAF). Next to a conceptualization of the SWIF, this deliverable includes guidelines and techniques tailored to the specific context of Single Window implementations. We also present two SW implementation case studies, namely of Thailand and The Netherlands.

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Glossary

Activity: A set of tasks to be undertaken to achieve meaningful results.

Application: A deployed and operational IT system that supports business functions and services. [TOGAF]

Application Architecture: A description of the major logical grouping of capabilities that manage the data objects necessary to process the data and support the business. [TOGAF]

Architecture: The structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time.

Architecture Vision: 1. A high-level, aspirational view of the Target Architecture. 2. A phase in the SWIF methodology which delivers understanding and definition of the Architecture Vision. 3. A specific deliverable describing the Architecture Vision. [TOGAF]

Artifact: An architectural work product that describes an architecture from a specific viewpoint. [TOGAF]

Business Architecture: The business strategy, governance, organization, and key business processes, as well as the interaction between these concepts. [TOGAF]

Concerns: The key interests that are crucially important to the stakeholders in a system, and determine the acceptability of the system. Concerns may pertain to any aspect of the system's functioning, development, or operation, including considerations such as performance, reliability, security, distribution, and evolvability. [TOGAF]

Data: A re-interpretable representation of information in a formalized manner suitable for communication, interpretation or processing by humans or automatic means. [ISO 2382-1]

Data Architecture: The structure of an organization's logical and physical data assets and data management resources. [TOGAF]

Capability Architecture: A highly detailed description of the architectural approach to realize a particular solution or solution aspect. [TOGAF]

Component: A constituent part, element, or piece of a complex whole. [PMBOK]

Enterprise: The highest level (typically) of description of an organization and typically covers all missions and functions. An enterprise will often span multiple organizations. An "enterprise" can mean any collection of organizations that has a common set of goals. For example, an enterprise could be a regional economic forum of member countries, a national collaboration of several agencies and possibly collaborating with certain business sectors, a government agency, a federation of business entities, a whole corporation, a division of a corporation, or a single department. [TOGAF]

Enterprise architecture: A conceptual blueprint that defines the structure and operation of an organization. [SearchCIO.com]

Information Systems Architecture: The combination of the Data Architecture and the Application Architecture.

Iteration: A complete development loop resulting in a release of an executable component, a subset of the system under development, which grows incrementally from iteration to iteration to become the final system. [RUP]

Interoperability: 1) The ability to share information and services. 2) The ability of two or more systems or components to exchange and use information. 3) The ability of systems to provide and receive services from other systems and to use the services so interchanged to enable them to operate effectively together. [TOGAF]

Legal Framework: A set of measures that may need to be taken to address legal issues related to national and cross-border exchange of trade data required for Single Window operations. [UN/CEFACT]

Master Plan: A document that defines how the overall programme and a series of projects under its domain are executed, monitored, and controlled.

Organization: A collection of persons organized for some purpose or to perform some type of work within an enterprise. [PMBOK]

Programme: A group of related projects managed in a centralized and coordinated way. [PMBOK]

Programme Management Office: An organizational body responsible for managing a programme or a group of related projects under its domain in a centralized and coordinated way to obtain benefits from the control and sharing of resources, methodologies, tools, and techniques that are not available from managing each project individually. [PMBOK]

Project: A temporary undertaking to create a unique product, service, or result. [PMBOK]

Regional Single Window: A Single Window that is established between two or more countries.

Requirements: A quantitative or qualitative statement of a business need that must be met by artifacts.

Requirements Management: A process of managing requirements throughout the overall development phases of Single Window Implementation, including the ability to deal with changes in requirements.

Segment Architecture: A detailed, formal description of areas within an enterprise, used at the program or portfolio level to organize and align change activity. [TOGAF]

Single Window: A facility that allows parties involved in the international supply chain to lodge data in a standardized format at a single entry point to fulfill all import, export, and transit-related regulatory requirements. If the data are electronic, they should be submitted only once. [UN/CEFACT]

Single Window Implementation Framework (SWIF): A framework that guides policy managers in the process of initiating, setting up, and managing the implementation of a Single Window.

Single Window Steering Committee: A group established to oversee the Single Window implementation and consider an urgent issue or to set the directives for the execution of the SW Programme and projects under its domain in a relatively short span of time. [OECD]

Stakeholder: Person or organization who are actively involved in the SW programme, who may exert influence over the SW Programme, or whose interests may be positively or negatively affected by its execution or completion. [PMBOK]

Strategic Architecture: A summary formal description of the enterprise, providing an organizing framework for operational and change activity, and an executive-level, long-term view for direction setting. [TOGAF]

Sub-project: A smaller portion of the project created when the project is subdivided so that the scope is more manageable. [PMBOK]

Sub-system: A set of components which serves as a part of a system. [Wikipedia]

System: An integrated set of regularly interacting or interdependent components created to accomplish a defined objective, with defined and maintained relationships among its components, and the whole producing or operating better than the simple sum of its components. [PMBOK]

System: An integrated set of interdependent sub-systems or components created to accomplish a set of pre-defined functions. [PMBOK, TOGAF]

Technology Architecture: The logical software and hardware capabilities that are required to support deployment of business, data, and application services. This includes IT infrastructure, middleware, networks, communications, processing, and standards. [TOGAF]

View: The representation of a related set of concerns. A view is what is seen from a viewpoint. An architecture view may be represented by a model to demonstrate to stakeholders their areas of interest in the architecture. A view does not have to be visual or graphical in nature. [TOGAF]

Viewpoint: A definition of the perspective from which a view is taken. It is a specification of the conventions for constructing and using a view (often by means of an appropriate schema or template). A view is what you see; a viewpoint is where you are looking from — the vantage point or perspective that determines what you see. [TOGAF]

List of Abbreviations

ADM	Architecture Development Method
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
B2B	Business-to-Business
B2G	Business-to-Government
B/L	Bill of Lading
BTEP	Business Transformation Enablement Program
CA	Certificate Authority
CCL	Core Component Library
DG	Directorate General (European Commission)
DTTN	Digital Trade and Transportation Network
ebXML	Electronic business eXtensible Markup Language
EC	European Commission
EDA	Event-Driven Architecture
EDI	Electronic Data Interchange
EU	European Union
FFM	Freight Forwarding Manifest
FIATA	International Federation of Freight Forwarders Associations
G2G	Government-to-Government
G2B	Government-to-Business
IATA	International Air Transport Association
IMO	International Maritime Organization
IS	Information Systems
ISO	International Organization for Standardization
ITAIDE	Information Technology for Adoption and Intelligent Design for e-Government
KPI	Key Performance Indicator
NSW	National Single Window
OAGIS	Open Applications Group Integration Specification
OECD	Organisation for Economic Co-operation and Development
PKI	Public Key Infrastructure
PMBOK	Project Management Body of Knowledge
RLF	Realization of the Legal Framework
SMIC	Stakeholder Management and Interagency Collaboration
SOA	Service Oriented Architecture
SW	Single Window
SWIF	Single Window Implementation Framework
TIEKE	Finnish Information Society Development Centre
TOGAF	The Open Group Architecture Framework
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNECE	United Nations Economic Commission for Europe
UN/CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
UNNExT	United Nations Network of Experts for Paperless Trade
VAS	Value Added Services
WCO	World Customs Organization

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1 Introduction

1.1 Background

The international supply chain encompasses activities related to the ordering and physical transfer of goods, and the payment for these goods (UN/CEFACT, 2001). It involves a large number of stakeholders including customers, suppliers of goods from various industries, intermediaries from transport, insurance, and financial sector, and government agencies from at least two trading economies (UN/CEFACT, 2001). The APEC Business Advisory Council (1996) argued that each international trade transaction requires an average of 40 documents to meet rules and regulations set for international trade and transport. These documents are made up of approximately 200 data elements; 15% is repeated at least 30 times; and 60-70% is repeated more than once. These requirements are costly. They are a major cause of delay in cross-border operation. A study commissioned by the European Commission states that the costs of complying with these requirements amount to account for 3.5 – 7 percent of the value of the goods (OECD, 2002). It can be as high as 10 – 15 percent 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. It is argued that each day saved in shipping time would be worth about 0.5 percent of the value of the goods (Hummels, 2001). It is believed that such complications can be efficiently and effectively removed by timely G2G, G2B, B2G, and B2B information sharing and exchange through an environment called Single Window.

United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) (2005, p. 3) defines Single Window 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 fulfill all import, export, and transit-related regulatory requirements. If the data are electronic, they should be submitted only once."[2] The actual Single Window implementation cases, however, suggest that the electronic lodging of all data used to fulfill procedural requirements of the international supply chain does not necessarily have to be performed in one time and at a single point. Given that the international supply chain consists of several business processes; and that those different business processes, which may be carried out by different people from different organizations in different time, have different data requirements, the submission of data is performed as appropriate in different stages of the international supply chain through different data submission channels. The Association of Southeast Asian Nations (ASEAN) Single Window Taskforce (2005) has also inserted that Single Window, as a system, should facilitate a synchronous processing of data as well as enable the decision-making for customs release and clearance at a single point (ASEAN, 2005). Based upon the technological developments and the expanding ambitions of government and businesses, service-oriented architectures, which take the concept of "service" as the basis for the Single Window, are currently the most flexible and advanced IT solutions for exchange of data among different organizations. Real-time monitoring systems, such as RFID tags, container seals, and other tracking & tracing systems, have been demonstrated to enable the collection of data during transport of goods, which is typically needed for cross-border trade (cf. Tan et al., 2010).

[2] The definition of Single Window has been adapted by the International Trade Procedures Working Group (ITPWG – TBG15) of UN/CEFACT (http://www.unece.org/cefact/forum_grps/itp/welcome.htm), placing greater emphasis on the international trade and transport communities as well as standardized documents by stating that "a Single Window facility, that allows parties involved in trade and transport to lodge standardized information and documents with a single entry point to fulfil all import, export, and transit-related regulatory requirements".

Single Window is considered to be a means to establish a coordination mechanism between authorities involved in international trade activities, such as Customs, Tax, Veterinary Inspection, and so on. From the perspective of businesses, the Single Window may be used as a virtually single authority, where the required data for the whole trade process are exchanged only once through the SW. The different authorities may then use these data for their own specific purposes (see Chapter 2).

The benefits of Single Window are evident (UNNexT, 2009b). Some examples of achievements are:

- **Germany**: It is estimated that users of Dakosy, an electronic document exchange system for sea-port operations in Hamburg, may save approximately €22.5 million per annum simply by reducing labor costs associated with correcting errors during the preparation and submission of trade and transport documents. This €22.5 million savings is based on the assumption that the average cost to employ a person in Germany is €50,000 annually. On average a user of Dakosy can potentially save 9 person-year by reducing a typical error rate of 50% to virtually zero, assuming that an average of 10 minutes of staff time is required to correct each mistake in the paper-based process. Therefore, on one million B/Ls processed each year in Germany, this reduction in error rework equates to a savings of 450 person-years per year (Adobe, 2006).
- **Hong Kong**: The electronic platform called DTTN that facilitates information flow and services integration launched in Hong Kong leads to an operational efficiency improvement in trade and transport procedures. It is estimated that the improvement brings to the industry about HK$ 1.3 billion (~US$ 167.5 million) per annum (Economic Development and Labour Bureau, 2002).
- **Republic of Korea**: The total savings for the business community from the use of the TradeHub in the Republic of Korea are estimated to be US$ 1.819 billion. These savings are a result of cheaper e-documents transmission cost, improved productivity from the automation of administrative work, and improved management of trade information and documents (UNNexT, 2009b).
- **Singapore**: After introducing Single Window in Singapore, the time to process trade documents was reduced from 4 days to 15 minutes (Neo, King, and Applegate, 1995).
- **Sweden**: After the Swedish Customs Information System was launched, traders have enjoyed a benefit of a 20-50% decrease in compliance costs. Swedish Customs has also decreased its time spent on certain documentary controls by 50 %; the Swedish Board of Agriculture has in certain cases cut its processing time by 40 %; and the customers receive the subsidies in half the time it took before the system went operational (UN/CEFACT, 2009a).[3]
- **Thailand**: Partial implementation of Single Window in Thailand has eliminated redundant processes in the export of ordinary goods and reduced the number of days for export from 24 days in 2006 to 14 days in 2009 (Keretho, 2009).

Key objectives of Single Window implementation are: the elimination of re-keying and resubmitting identical piece of data; the management of data submission that conforms with the requirements of business processes in different stages of trade and transport in the international supply chain; and the integration of data and business processes used throughout the international supply chain. The business objectives of Single Window can be grouped as follows:

- **Efficiency improvement** (administrative burden reduction). The same data used on different documents is harmonized and can be exchanged electronically.

[3] The Swedish statistics refer in particular to the export refund scheme. This may be seen as a rather narrow application (rather than an extended Single Window), but it was resource-consuming for Swedish Customs and traders.

- **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 changes in processes, based on technical innovations as visualized by the I3 framework[4], 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 the Authorized Economic Operator (AEO) certification in the EU.

Many governments worldwide have adopted the Single Window initiative as a national Programme of work since they recognize that Single Window is a crucial instrument that can be used to eliminate inefficiency and ineffectiveness in business and government procedures and document requirements along the international supply chain, reduce trade transaction costs, as well as improve border control, compliance, and security.

1.2 Purpose of this deliverable

When it comes to Single Window implementation, governments often face complicated challenges. These challenges, as summarized in Figure 1, concern not only the technicalities of the implementation, but also organizational, managerial, financial, legal, and political issues. Single Window is about integrating data and business processes used by different stakeholders in different phases of the international supply chain. While integrating data requires the harmonization of their attributes such as definition, format, and position in the message with relevant international standards, integrating business processes may require changes and additions to laws and regulations. Because the integration is made possible by automation, new information systems that are capable of inter-operating with other information systems have to be developed. Legacy information systems that have been introduced by different stakeholders to support different business processes in different phases of the international supply chain have to be made interoperable with others.

[4] The ITAIDE Information Infrastructure (I3) Framework is one of the key outcomes of the ITAIDE research, addressing the capabilities and infrastructures that are needed to achieve end-to-end information transparency and control of the flow of goods in a “trusted trader network”. 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. Interested readers are referred to the book *Accelerating Global Supply Chains with IT-innovation: ITAIDE tools and methods* (Tan et al., 2010), in particular Chapter 9 (Henningson et al., 2010), which presents the I3 Framework and Chapter 16 (Van Stijn et al., 2010), which includes a discussion of the relation between the I3 Framework and SW implementation.

Figure 1. Challenges in Single Window implementation

These challenges are often related to enterprise-wide concerns. They typically are issues that involve stakeholders from different organizations, different sectors of the economy, different industries, and different countries of similar or different regions who come together to collaboratively pursue a common goal of putting Single Window in place. Dealing with these challenges requires strong political will, long-term commitment 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, policy managers still need to develop a strategy transforming their vision into implementation. Therefore, a strategic and holistic framework that informs how these challenges can be systematically addressed is much needed. To this end, we introduce the *Single Window Implementation Framework* (SWIF).

To initiate and manage the transformation process, SWIF recommends policy managers to use "enterprise architecture" as the strategic framework and management tool. The "architecture" helps policy managers organize challenges in Single Window implementation into smaller problems such that each component is easier to be managed. The Enterprise Architecture provides a vision for the implementation of the overall project and a framework for the different project activities. For the project management the Enterprise Architecture delivers the main components and activities that the project plan needs to implement It is an essential to plan and supervise the implementation and to ensure that the different components and implementation steps will add up to a national Single Window. Because of its strategic role, legislation in some countries even mandates government agencies to develop an Enterprise Architectures before Information Technology projects can be approved.

As a conceptual blueprint, the enterprise architecture will assist policy managers and concerned stakeholders to clearly assess, analyze, and develop a) a current picture of the enterprise and its environment; b) a target state of the enterprise in terms of its constituent components and how the components fit together; as well as c) 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 big-picture visibility and criteria for effective management and evaluation of technical decisions.
- It helps guide and optimize the involved organizations' IT investments.

It helps transform the SW vision as addressed in policy directives into implementable technology solutions as well as measurable outputs and outcomes.

A well-known standard to design Enterprise Architectures is The Open Group Application Framework (TOGAF) (The Open Group, 2009). As TOGAF Enterprise Architectures can describe the information technology aspects of a system as well as the policy and organizational components of the information system, it provides a well-adapted concept to describe the Architecture of a Single Window project. The Architecture Development Method (ADM) is a component of TOGAF that explains how the different components of the Enterprise Architecture are developed. The SWIF presented in this report is an adaptation of this Architecture Development Method of TOGAF to the specific requirements and features of Single Window projects. SWIF applies the principles of ADM to describe steps how to derive the SW architecture and the master plan for SW implementation. The SWIF also provides policy managers with guidelines in:

- Formulating visions and policies that address the need for Single Window implementation;
- Identifying performance measures;
- Systematically decomposing and structuring challenges that accompany the implementation of Single Window; and
- Planning and governing the overall implementation of Single Window by providing the foundation for developing the national Single Window Master Plan.

SWIF also serves as a template for documenting regional and national experiences in implementing Single Window. Documenting Single Window cases in a consistent manner facilitates case comparison and analysis, and thus contributes to a better understanding of the Single Window implementation process. This can assist to identify how to deal with SW implementation challenges that are country-specific, for example taking into account the differences between countries that already make use of advanced IT solutions versus those that do not yet, and for example between the political setting and way of decision-making in EU Member States versus in developing countries or in the United States.

1.3 Target audience

SWIF is intended for use by "policy managers" who are responsible for preparing holistic policy options for high-level decision-makers. Once the initial policy direction toward Single Window 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. Policy managers are typically from an organizational body with a mandate to assist the government with central strategic planning for the interests of the nation as a whole. They can themselves be from a government administration, such as Customs, or an organization closely associated with government agencies. Depending on the national circumstances, policy managers can be from different levels in these organizations, varying e.g. from assistant director to director general.

Policy managers are likely to have a background in project management and IT implementation. Even though the Enterprise Architecture and Single Window concepts have a technical background, we suggest that this report is not only of interest to those certified or skilled in these frameworks or techniques, but rather, that the SWIF provides a comprehensive overview of what is involved in successfully managing the SW implementation. It should be stressed that SWIF only identifies activities to be carried out mainly by policy managers in order to improve the efficiency and effectiveness in policy formulation and management of Single Window implementation. It does not put emphasis on describing detailed activities required to be undertaken by other stakeholders, e.g.

technical developers, computer engineers and programmers, who perform different roles in Single Window implementation initiative. For example, it is not described in detail how IT specialists derive functional requirements of the SW, only that this aspect should be managed during the SW architecture development.

1.4 Outline

Chapter 1 briefly discussed the importance of trade and transport facilitation. It introduced the concept of Single Window and how SW aims to fulfill greater efficiency, effectiveness, and strategic changes in fulfilling documentary and procedural requirements of international trade. Chapter 2 provides the conceptualization of the SWIF, adapting the principles of TOGAF Enterprise Architecture and Architecture Development Method (ADM) (The Open Group, 2009) to describe an architecture and architecture development method for Single Window development and implementation. A detailed description of guidelines and recommended techniques on how to perform selected key activities are provided in Chapter 3. These descriptions therefore do not cover all aspects of the conceptual SWIF. They are also subject to further refinement and elaboration based upon lessons learned from future SW implementations, and new studies and recommendations. The conclusions follow in Chapter 4. Two SW case studies (Thailand and The Netherlands), which illustrate how SWIF can be used as a template to describe relevant national experiences, can be found in the Appendices.

2 Part I: Single Window Implementation Framework conceptualization

In this chapter, we describe the conceptual foundation of the SWIF. First, it is explained in further detail what a Single Window is by addressing its scope and high-level IS architecture (section 2.1). Then, the core principles underpinning the SWIF are discussed, regarding phasing and alignments (section 2.2). Next, the benefits of utilizing the enterprise architecture concept to organize challenges into more easily manageable components, and the recommended Single Window Architecture are addressed (section 2.3). The chapter ends with an explanation of the SWIF methodology that guides the development of an enterprise architecture or conceptual blueprint for Single Window implementation (section 2.4). Chapter 3 provides extended techniques and guidelines on how to carry out selected key activities.

2.1 Single Window: scope and high-level architecture

A Single Window is an inter-organizational information system that, when operated in a full scale, connects information systems of stakeholders engaged in various business processes of the international supply chain from after the goods are ordered until the payment for good is made. Figure 2 provides a simplified scope of a Single Window.

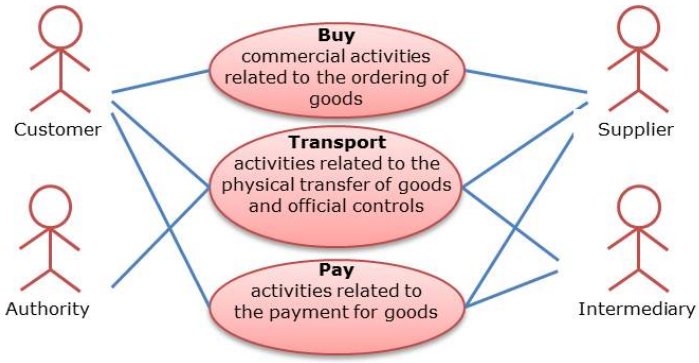


Figure 2. Scope of Single Window and International Supply Chain (UN/CEFACT, 2001)

Stakeholders of the international supply chain and thus of Single Window are categorized into four groups (UN/CEFACT, 2001). They are:

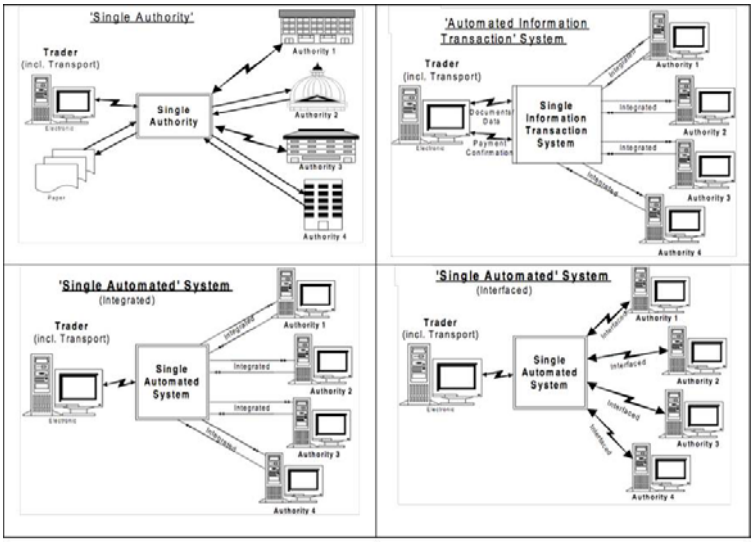
- **Authority** (including authorized private inspection agency) of exporting country, importing country, and country in transit, which monitors goods crossing borders in a way that reflects national and international public interests;
- **Supplier** (exporter/seller) who sells goods or services as stipulated in a sales contract;
- **Customer** (importer/buyer) to whom goods and services are sold as stipulated in a sales contract; and
- **Intermediary** who provides commercial, financial, and/or transport (logistic) services within an international supply chain, such as freight forwarder, customs broker, 3rd party logistics service provider, express integrator, carrier of all modes, port, terminal operator, inland container depot, bank, insurance company, IT value-added service provider, bank and financial institutions.

The focus of Single Window lies on compliance to legal requirements and procedures concerning the import, export, and transit of goods (UN/ CEFACT, 2002). By integrating information systems used to support different business processes to fulfill the regulatory requirements regarding the movement of

goods across the international supply chain, Single Window enables collaborative processing, sharing, and exchange of information among different stakeholders. One-time submission of identical pieces of data is made possible. Errors from re-keying identical pieces of data are eliminated. Integrity of data used across those business processes and compliance with regulatory requirements are enhanced. One of the objectives of Single Window is to facilitate "smooth logistics" in value networks, that is, the fulfillment 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.

Basic examples of the high-level IS architecture of SW are shown in Figure 3[5], identifying four different IS architectures, namely:

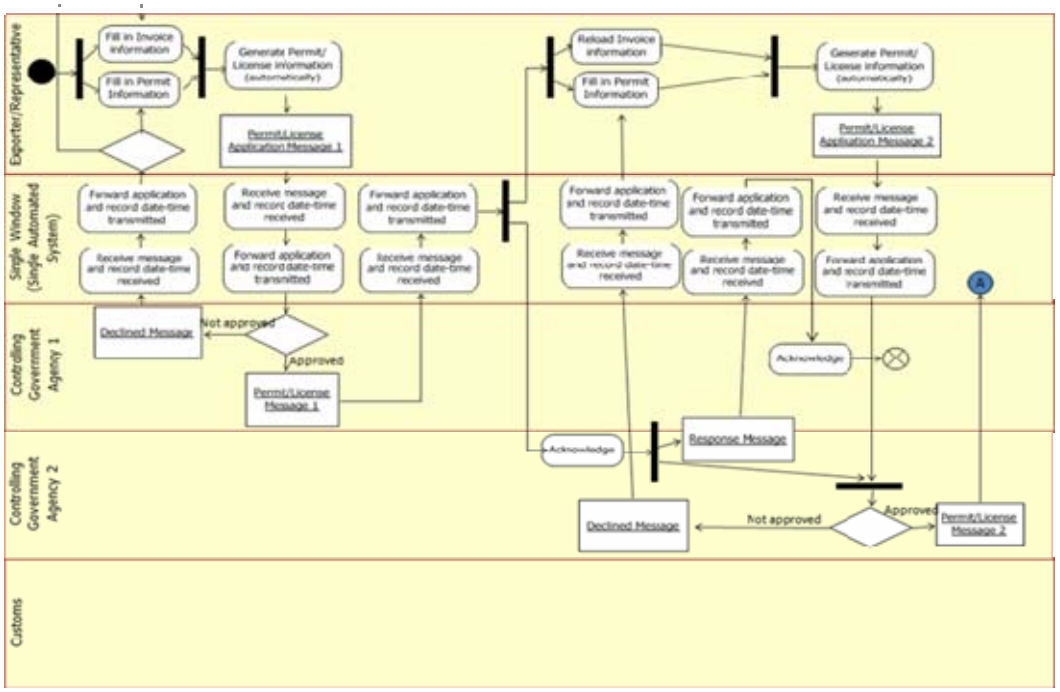
- A **Single Authority** receives information either in paper or electronic form; disseminates it to relevant parties; and co-ordinates controls to enhance regulatory compliance and prevent misconduct in the international supply chain.
- An **Automated Information Transaction System** enables traders to electronically submit trade information used in purposes such as customs declaration, application for trade permits and certificates in a single form. The system is responsible for disseminating relevant information to relevant parties for processing.
- An **Integrated Single Automated System** receives information electronically; processes it; and disseminates it to relevant parties both within and outside borders.
- An **Interfaced Single Automated System** provides an interface for information collection and dissemination. It receives information electronically; and disseminates it to relevant parties for processing (i.e. compared to the Integrated Single Automated System, here the information is not processed). As all necessary information may not be ready for submission at once, information submission therefore does not necessarily have to be performed at a single point in time. Figure 4 illustrates an example of operational process for this scenario.



[5] In this example, the way the traders in the supply chain are organized to submit the data, is not taken into account. For example, it may be the case that each trader submits its data separately. There may also be one business that submits the data, and other companies may add further data, and the SW is also used for information exchange between commercial actors. Furthermore, the extent to which the SW implements mechanisms to facilitate and synchronize mutual adjustments of the authorities (regarding e.g. inspections and certificates) and/or stakeholders in the supply chain is not shown.

Figure 3. Examples of Single Window Reference Models

(UN/CEFACT, 2005)



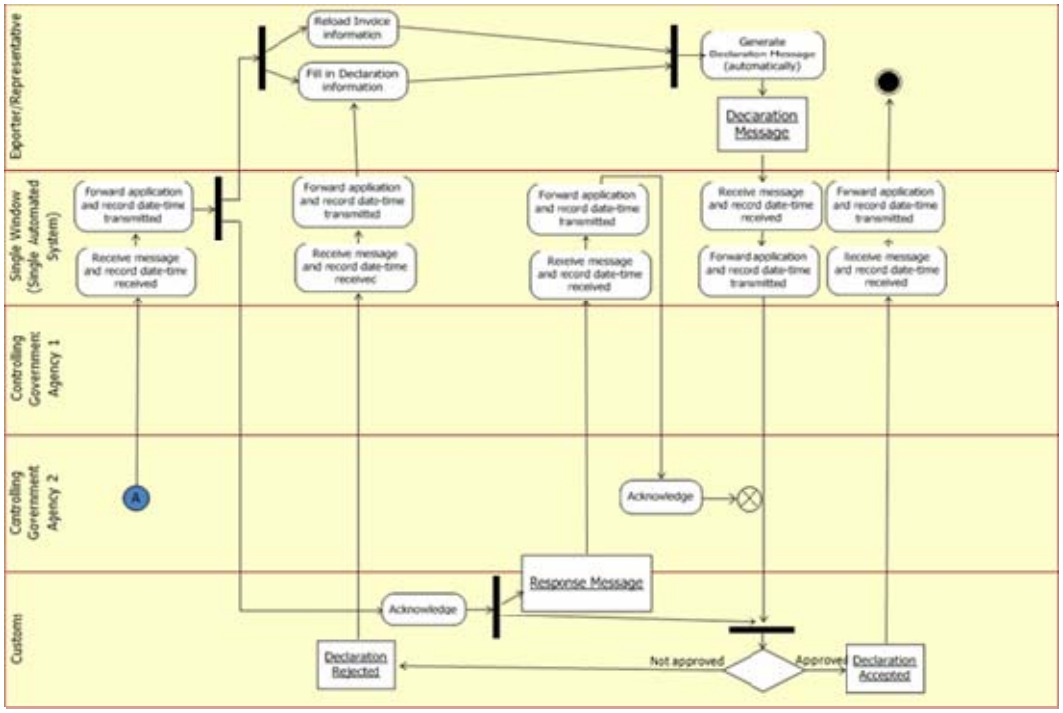


Figure 4. Example of Interfaced Single Automated System's Operational Processes

Regardless of all possible models, a Single Window consists of many interrelated and interdependent, integrated or interfaced information systems that together form the SW. On the one hand, these information systems can be characterized by their scope and the operational processes of specific participating regulatory agencies that they support. For example, one specific information system may deal with export declarations of sellers of goods; another system may be connecting the port community (intermediaries) with the authorities, not only customs, but also other government agencies in order to e.g. make (phyto-) sanitary controls, conduct checks for VAT exemption rules, or collect statistical information. On the other hand, the information systems may also be categorized into interactive functional modules that together form the Single Window:

- **Information systems of the participating parties** provide the automation of business processes and data to fulfill the business objective of the Government agency or Private Sector Company. These systems are in-house data processing systems and are managed by the participating party. For the purpose of the Single Window implementation, it is assumed that these systems already exist or are developed and implemented outside the scope of the SW Programme. Examples are the Data Processing System of the national Customs organization or the Enterprise Resource Planning System of a freight forwarder.
- **Interfaces** or **Information submission channels** provide the interface between the in-house data processing system and the central information gateway. The submission channels convert data streams between the internal data view of the in-house systems and the central information gateway. Submission channels may be provided by value-added service providers (VAS) or gateway operators which may also offer additional services such as data conversion, validation, multi-protocol support and maintenance.
- **Central information gateway** serves as a hub for the management of work-flow throughout the Single Window and thus the international supply chain as well as the sharing and exchange of information among relevant parties within a border. Its key features include (1) the module that facilitates business process management, (2) the module that administers communication protocols and enables inter-connectivity among information systems of all participating parties, (3) the module that facilitates the authentication and non-repudiation of messages and fosters the security and integrity of the system as a whole, and (4) the module that provides semantic translator and syntax validation. The Central Gateway is often considered as core of the Single Window platform.

If the national Single Window is linked to a regional/international Single Window, it has as additional component:

- An **interface** or **information submission channel**, that exchanges data between the national central information gateway and a central information gateway in another country which can be either another national central gateway (country to country data exchange) or a regional gateway that connects to a set of national gateways.

2.2 Core principles of the Single Window Implementation Framework

2.2.1 Phasing of SW implementations

The full scope of a national Single Window project is often far reaching. Typically the Single Window is not implemented in one run but rather in a step-wise approach. The division of the overall project in steps and the decision which stakeholders, business processes and components of the Single Window are included and developed in the different phases are subject to priorities, readiness and available resources in each country. The national SW Master Plan is a document that defines how the overall SW Programme and a series of projects under its domain are executed, monitored, and controlled. Key important steps in developing this national SW Master Plan involve definitions of the project steps,

identification of Single Window Components and stakeholders' involvement in each phase. In many cases scoping decisions about national SW initiatives have to be aligned with SW initiatives of other countries, strategic trading partners, or member states of regional communities. These other countries should be acknowledged as key stakeholders and should be involved for consultation. Although such international consultation is a daunting task, it is considered to be essential for the success of the SW implementation in the long run.

UNECE (2006) suggests a basic roadmap that one may consider as an approach in guiding the identification of scope in step-wise implementation. The roadmap presented here is a modified version which reflects experiences gained in Single Window implementations of several countries:

Developing Single Window Components

The development of a Single Window system consists of the development of four major components:

- **Component 1**: Development of a paperless customs declaration system [as well as in-house information systems of other participating parties and information submission channels][6];
- **Component 2**: Development of central information gateway;
- **Component 3**: Integration, or interfacing, of information submission channels and information systems of all participating agencies with the central information gateway;
- **Component 4**: Integration, or interfacing, of a National Single Window (output of Component 3) into a regional information exchange system.

Stakeholders' Prioritization

Typically not all stakeholders can be included in the first phase of Single Window development. Project managers will have to prioritize the different government agencies and private sector companies for inclusion in a project phase. Also it is a fundamental scoping decision whether the SW implementation has to be aligned with the SW implementation of other countries (see section 2.2.2). Prioritization can be made 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 stakeholders that (i) typically process large amount of transactions, such as the Customs clearance system or of the Port Community Service Providers which; (ii) support export/import operations of key products for the national economy, (iii) have large number of transactions, trade volumes and high transaction value, (iv) are counterparts of the stakeholders i-iii in other countries.
- **Organizational readiness of stakeholders**: The organizational readiness of the stakeholder determines the likelihood that the stakeholder will be able to integrate into the Single Window. 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 challenges in implementing each Single Window's sub-system and forces the corresponding stakeholders to look for ways to deal with those challenges (see section 3.1.2).

Single Window Project Steps

[6] The extent to which such information systems have already been set up prior to implementing a Single Window varies, as illustrated by the Thai and Dutch cases (Appendix A and B). In Thailand, some government agencies were using paper-based procedures only, and did not have any in-house information systems yet at the start of the SW project. In contrast, the Netherlands has a long history of establishing IS-supported procedures, since in the 1960s the sheer amount of containers that were crossing the border called for new ways of inspection and control (Rukanova et al., 2009).

As illustrated in Figure 5, a Single Window is developed in iterative steps. The decision which Single Window components and stakeholders are included in the different project steps depends on the assessment of readiness and the priorities in each country.

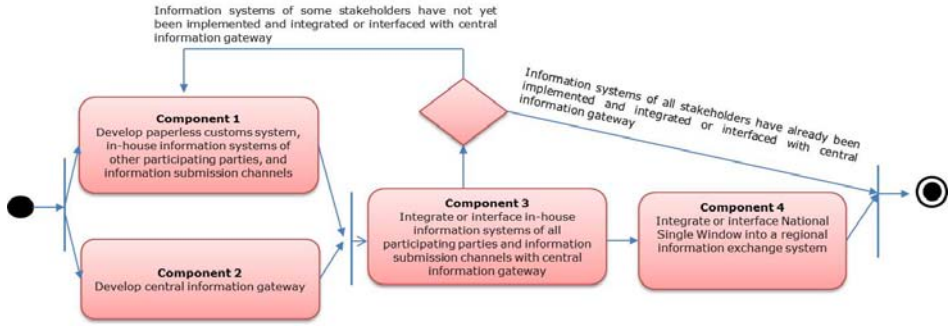


Figure 5. Example of Single Window component development

For example, a Single Window could be developed in three Steps. Step 1 of the implementation may involve:

- The development of a selected information submission channels of selected participating agencies;
- The development of central information gateway;
- The integration, or interfacing, of existing information systems and newly developed ones with the central information gateway; and

Step 2 of the implementation may involve:

- Integration of additional stakeholders;
- Diversification of options for information submission channels
- The integration, or interfacing, of newly developed information submission channels with the central information gateway;

And Step 3 of the implementation may involve:

- The integration of a national Single Window into a regional information exchange system or Single Window of another country.

Figure 6 shows a step-wise implementation approach used in the planning process of a national Single Window. The final step in the SW for cross-border paper trade presupposes alignment of the national SW development with SW development of countries at the other end of the cross-border paperless trade.

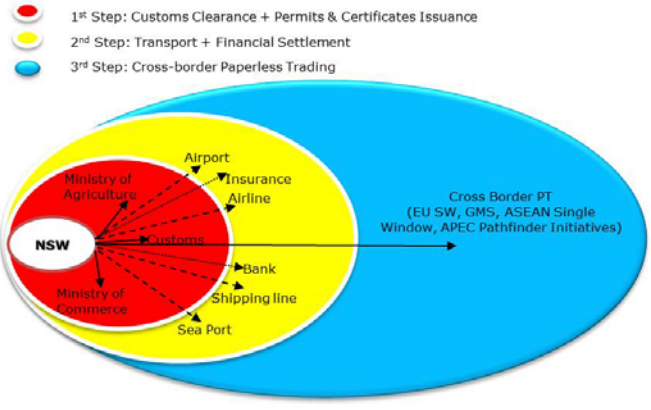


Figure 6. Example of a step-wise Single Window implementation approach

When it comes to the implementation, each component of the SW initiative is often developed and implemented in a separate project. Each project, which is shaped by a certain set of viewpoints, can be managed individually. Ensuring that the individual project is completed on time, within budget, and in accordance with coordinated specifications and objectives is the prime concern of the management at the project level. The fact that one project incorporates emerging changes does not mean that others do; they are less likely to be taken into account beyond this project level, if there is no centralized mechanism that keeps a series of those projects managed in a coordinated way, and which ensures the consistency among components. When inconsistencies occur, the integrity of the system as a whole is compromised. The proposed SWIF methodology (see section 2.4) provides such a centralized mechanism to prevent inconsistencies.

2.3 The importance of alignment

SWIF takes into account two core alignment principles adapted from Henderson and Venkatraman (1993). They are:

- The alignment of business strategy and IT strategy
- The systematic transformation of the pre-defined strategies into well-governed IT solutions

Figure 7 visualizes these two core alignment principles.

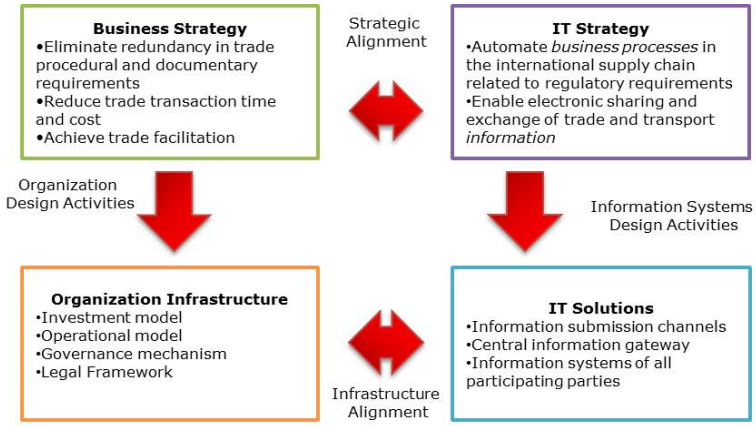


Figure 7. Core Alignment Principles of SWIF

(Adapted from Henderson and Venkatraman, 1993)

In the context of SW implementations, alignment challenges exist for example 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 policy managers are aware of such international political developments. Another international alignment issue relates to the international SW initiatives. The success of a national 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 and the EU). As mentioned for the scoping decisions, whether and how to align with other 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 compliance with established de facto standards, such as UN/CEFACT, 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 representatives may assess critical developments, and possibly influence them (see section 3.1). Some of these negotiations may take place at the legal level as well (see section 3.5). Lastly, the scoping and phasing, as discussed in the previous sections 2.1 and 2.2.1, also imply alignment issues regarding the transformation from the strategic vision to the SW implementation. For example, in terms of phasing, from the EU and Thai experiences, a pattern appears to emerge that the political process starts from Customs, and then extends to the Ministry of Agriculture, the Tax Administration, and lastly Statistics.

SWIF 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 Single Window is likely to face the techno-change risks of non-use and failure to capture benefits (Markus, 2004). These alignment challenges are the key reasons why we propose the enterprise architecture as its methodological framework.

2.3.1 The Single Window Architecture

To ensure the incorporation of these principles of phasing and alignment in the Single Window implementation, SWIF adopts enterprise architecture as conceptual and methodological framework. The merit of enterprise architecture in decomposing multi-facets of Single Window into hierarchical layers and components offers greater visibility to the implementation. The multi-facets of Single Window implementation include issues related to the management of stakeholders' expectations and viewpoints; the development of business vision; the transformation into architecture vision; the simplification of relevant business processes; the harmonization of data requirements; the identification of value propositions and corresponding services; and the establishment of IT and legal infrastructure. Given that the interrelationships among components in different level of architecture are crystallized, stakeholders' different viewpoints, needs, and requirements as addressed in visions, goals, and objectives that can be easily traced across artifacts produced in different phases of the implementation lifecycle.

The enterprise architecture approach of SWIF provides a framework to structure the different aspects of Single Window implementation into hierarchical layers, to identify the projects to develop the SW components, and to manage the SW implementation process. Figure 8 suggests the decomposition of implementation challenges into ten major components, where each component deals with a set of related issues. These SW architecture components are 1) Stakeholders' viewpoints, needs, and requirements; 2) Motivation and stakeholder collaboration; 3) Visions, goals, objectives, strategies, value propositions, master plan; 4) Business process analysis and simplification; 5) Data Harmonization and e-Documents; 6) Application architecture (service functions); 7) Technical Architecture including standards and interoperability; 8) Implementation and operation governance; 9)Legal framework; and 10) IT Infrastructure and Solutions.

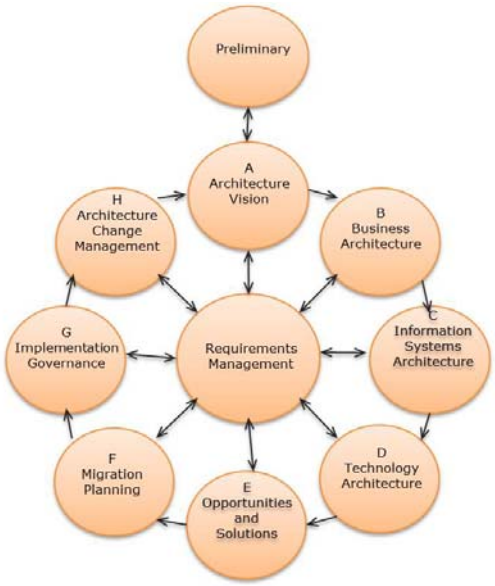
Figure 8. Key Components of the Recommended Single Window Architecture

By addressing these components and their inter-relationships, the trade facilitation vision can be transformed systematically into reality through the use of Single Window with lower risks and higher rate of success.

2.4 SWIF Methodology

2.4.1 SWIF phases

SWIF adapts the process for developing enterprise architecture as outlined in the TOGAF Architecture Development Method (ADM).[7] A full cycle of the SWIF Methodology consists of a number of phases, as illustrated in Figure 9.



[7] Some modifications are made to the activities proposed by TOGAF ADM in order to make them more applicable to the context of Single Window implementation.

Figure 9. SWIF Phases

(Adopted from The Open Group, 2009)

Each phase addresses different architecture domains. Each phase has a set of specified objectives and deliverables which are implemented through a set of activities (see Table 1). These activities and the deliverables of the phases provide the managerial tools and the artifacts required plan the SW project, to develop the components of the Single Window and ensure project control, ongoing support and smooth operation. The activities 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 SW Master Plan, and recommendations.

Table 1 outlines activities that should be carried out in each phase of SWIF. Further recommendations on how to carry out key activities are provided in Chapter 3. First, we address the notions of SWIF cycles, iterations, and sub-projects in section 2.4.2.

Table 1. SWIF Phases, Objectives, Activities and Results/ Outputs

Phase	Objective	Activity	Results/Outputs
Preliminary Phase	• Identify the rationale for the Single Window implementation • Justify the implementation	• Make use of existing facts and figures on benefits of trade and transport facilitation and Single Window • Draw on relevant policy directives and recommendations of international and regional forums • Obtain initial political will and commitment for Single Window implementation	• Top level mandate to develop a Single Window System, for example a formal decision of Prime Minister, President or Cabinet • Identification of key benefits of the Single Window • Top level performance indicators for Single Window • Lead agency appointed to develop the Architecture Vision
Phase A: Architecture Vision	• Create joint vision, strategy, objectives, and goals of the Single Window • Establish necessary environment for stakeholders' coordination and collaboration throughout Single Window project lifecycle • Ensure that major stakeholders are committed to make the project a success • Develop a Single Window Master Plan	• Identify stakeholders of the 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 in the later phases of Single Window implementation • Elaborate and refine broad vision, strategy, objectives, and goals of the Single Window • Define the scope of Single Window Implementation and constraints in terms of resources and competence availability • Define value proposition of the Single Window and demonstrate its relation to stakeholders priorities • Identify a set of key performance indicators that will serve as a benchmark to measure the success of the Single Window implementation • Assess stakeholders' readiness for Single Window implementation • Conduct a review on stakeholder IT systems that are of relevance to the project • Secure funding and develop a 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 Single Window • Obtain political will and commitment for Single Window implementation • Secure formal approval and initial funding for project implementation • Organize marketing campaign and awareness raising programmes	• A High Level Project Management Group with key stakeholders established • A High Level Master Plan that defines project phases, activities and deliverables • Key performance indicators that measure project performance established • A High Level Master Plan approved • Initial finding for following project phases secured

Phase	Objective	Activity	Results / Outputs
Phase B: Business Architecture	• Analyse existing business processes • Identify bottlenecks • Redesign and simplify business processes	• Elicit, document, and analyse the existing a export, import, and transit business processes as well as corresponding information flows and the trade documents used • Develop business case scenarios and analyse potential benefits to convey to stakeholders • Develop, propose, and seek approval for efficient business processes and a list of actions required to be carried out prior to adopting them • Start the necessary activities to establish an enabling legal framework for Single Window	• Analysis of Business Processes and documents used by the Government agencies and private sector • Agreements on simplification of processes and data • Agreements on the business processes and data to be automated
Phase C: Information Systems Architectures (consisting of Data Architecture and Application Architecture)	Data Architecture • Simplify, harmonize and standardize data used in the business processes • Develop a data model • Develop the structures for electronic messages Application Architecture • Define the major application system necessary to process the data and support business processes • Formulate a basis for estimating resources needed for implementing, deploying, and operating the Single Window Legislative Architecture • Create the required legal environment for the operation of a Single Window	Data Architecture • Identify relevant standards for harmonization and standardization of data • Identify data elements used in the business processes that are supported by the SW • Describe each data element in terms of their definition, source, type, representation format, and constraint using relevant international standards • Simplify data requirements • Analyse data elements across various documents/messages and organize them in a comparable manner • Map data elements to a reference data model Application Architecture • Provide a detailed analysis of the main in-house application systems including their relevant functions, and capabilities that will be linked to the Single Window • Identify main services to be provided by the Single Window for the connected agencies • Design a high level Application Architecture that will deliver the Single Window services Legislative Architecture • Asses existing legal environment • Identify gaps • Initiate changes in legal environment	• Agreements on standards, tools and techniques to develop, publish and maintain data and application architectures. • Published national Data Model and message structures for electronic data interchange with the Single Window • Definition of standards for Single Window applications • Documentation of the existing application architecture • Gap analysis of legal environment and legislative initiatives
Phase D: Technology Architecture	• To design a hardware and software architecture of the Single Window which will be the basis for implementation	• 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	• Blueprint of future Single Window application architecture

Phase	Objective	Activity	Results / Outputs
Phase E: Opportunities and Solutions	• Resource plan for implementing, deploying, and operating the Single Window	• Identify the Single Window sub-systems which have to be implemented in a series of step-wise, phased projects • Establish technical guidelines for developing the various Single Window components to ensure their interoperability • Identify a financial model that supports full scale roll-out and sustainable operation of the Single Window • Develop necessary legal framework for the Single Window, e.g. e-Transaction Law, Digital Signature Law, Data Privacy and Security	• Detailed implementation plan
Phase F: Migration Planning	• Prepare the implementation and ensure that the management and implementation of individual Single Window sub-systems will be coordinated with the high-level master plan	• Set up the project management groups who will manage the allocation of budget and administer the implementation of the Single Window sub-systems • Assign business value and performance criteria to each project	• Detailed implementation plan
Phase G: Implementation Governance	• Establish a framework for monitoring the implementation, deployment, and operation of Single Window and the Single Window sub-systems so that their conformance with the defined specifications, plan, policies, and recommendations can be ensured	• Oversee the project management groups who manage the allocation of budget and administer the implementation of the Single Window sub-systems • Formulate policies and recommendations (i.e. those related to procurement, contractual agreement, service quality, and charges) to govern the implementation, deployment, and operation of Single Window • Perform governance functions while Single Window sub-systems are being developed and deployed	• Project implementation oversight
Phase H: Architecture Change Management	• Identify areas where changes should be introduced to ensure a) the maximization of business value from Single Window implementation and; b) the alignment of implementation approach with relevant emerging technologies and business requirements	• Assess outputs and outcome of implemented architecture components to ensure that the defined architectures achieve the target business value • Review emerging policy directives and recommendations related to Single Window implementation that are discussed at international and regional forum • Make recommendations for changes	• Review of implementation results and impact on the High Level Implementation Plan
Requirements Management	• Ensure that a) stakeholders' requirements are addressed across artefacts 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 and assess their impact • Determine whether to implement change or defer it to the later SWIF cycle • Ensure consistencies of related work products, developed architectures and components with the requirements and objectives of the Single Window	

2.4.2 SWIF cycles, iterations, and sub-projects

SWIF considers a Single Window initiative as a system that exists in an environment formed by technology, trade and transport agreements, international relations and demands of global markets. This environment is complex and changing. Indeed, as a SW implementation project may take over a decade, there can be many unforeseen events and developments, for example, the involved stakeholder community may change, there may be new standards or technologies, and lessons will be learned about what processes will work best in a specific country's settings. Moreover, the environment generates policy directives and recommendations that influence the design, implementation, and operation of Single Window. These policy directives and recommendations need to be taken into account to enable alignment, in particular with the international context of the SW.

Given that these policy directives and recommendations are also likely to change over time, SWIF stresses the need for the management of Single Window to be dynamic and responsive to emerging changes in a timely and appropriate manner. ADM supports the adaptation to a changed environment through a concept of selective repetition of project phases which allows for the adaptation of project deliverables to the changed requirement. Therefore, SWIF supports ADM's concept of iteration at three levels.

- **Cycling around a single phase**: The execution of the activities within a phase is repeated in order to elaborate or to refine the content of artifacts in that phase.
- **Cycling between phases**: The completion of one phase leads to the commencement of linked phases in order to update the content of artifacts of these phases.
- **Cycling around the ADM**: The completion of one phase feeds into subsequent phases. The new ADM cycle begins after the completion of the previous ADM cycle. The commencement of a new ADM cycle facilitates the incorporation of changes and new visions into the enterprise architecture.

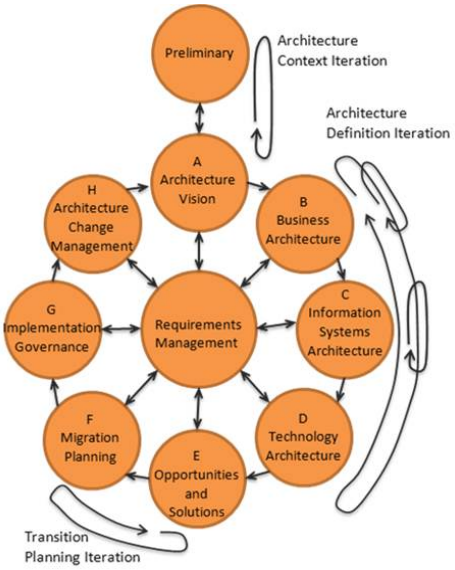


Figure 10. Examples of the Iteration Cycle

(Adapted from The Open Group, 2009)

Figure 10 suggests different iteration cycles for iterations that span across the development of enterprise architecture for Single Window implementation.

- **Architecture Context Iterations** cycle within Preliminary Phase as well as between Preliminary Phase and Phase A (Architecture Vision).
    - Several iterations of Preliminary Phase, for example, allows policy managers to discover more relevant facts, figures, policy directives, and recommendations related to trade and transport facilitation. The discovery of such information may lead to the adjustment and refinement of visions, goals, objectives, and strategies for Single Window implementation in Phase A.
    - Given that Phase A involves extensive discussions among stakeholders of Single Window, additional rationales for Single Window implementation may be drawn out from those discussions. New rationales which have been updated in the Preliminary Phase then serve as a basis for the adjustment and refinement of visions, goals, objectives, and strategies for Single Window implementation in Phase A.
- **Architecture Definition Iterations** focus on the creation of architectural content. This type of iteration also involves both cycling around a single phase and cycling between phases.
    - The scope of Single Window is large and complex. Business processes and documents used to fulfill export, import, and transit requirements are different from one country to another. They also vary across products and mode of transportation. Regulatory requirements of the importing country also alter business processes and documents used in the export processes. With limited personnel and financial resources, it is less likely that the study and redesign of all related business processes as well as the harmonization of all data requirements cannot be done at once. The cycle within Phase B (Business Architecture) and C (Data Architecture embedded in Information Systems Architecture) is therefore more practical for this reason. Also, these phases are often revisited when new information is available, and thus there is the need for refinement.
    - During the design of an Application Architecture in Phase C, inconsistencies in the Business Architecture developed in Phase B, may often be identified. If such ambiguities are found, new iterations of Phase B occur as a result.
- **Transition Planning Iterations** occur between Phase E (Opportunities and Solutions) and Phase F (Migration Planning). This type of iteration supports the development of individual plans for implementing the Single Window's components.

While the implementation of the full SWIF cycle enables the development of the SW architecture in great level of details, the introduction of a new cycle allows new requirements, new policy directives and new recommendations related to the Single Window implementation to be incorporated.

The different components of the Single Window are typically implemented through **sub-projects**. Sub-projects are individually managed projects with a reduced project scope. A sub-project could be for example a Business Process Analysis for selected export products the development of the Single Window Central Information Gateway or the connection of a specific port or airport to the Single Window. The advantage of using up sub-projects is that the specific managerial tasks can be transferred from the central project management to a specialised sub-project team, thus simplifying the overall project management. When using sub-projects it is important that an overall Single Window Architecture is in place which ensures that the deliverables of the sub-project will fit into the overall national Single Window project. Each sub-project must develop a project plan. From a management perspective the Architecture Framework that applies to the overall Single Window project as well as to the sub-projects. Each sub-project goes through the same architecture phases and deliverables as the overall Single Window project. The main difference between a sub project and the overall Single Window project is that sub-projects have limited objectives, stakeholders and outputs. Therefore the management of sub-projects should be based on a simplified and more specific description of SWIF phases which is adapted to the scope of the sub-project.

The Single Window Architecture defines the specific components that need to be developed for the future Single Window system and how they will be developed. It delivers a set of project plans that describe the sequence and delivery schedule of the architecture components, the planning for the sub-projects and the activity diagrams. The next sub-section provides a brief discussion of the development of the overall SW Master Plan.

2.4.3 From SWIF methodology to the national SW Master Plan

A national SW Master Plan encompasses (UN/CEFACT, 2005, p. 25):

- "A clear statement of the project's scope, goals and objectives;
- A statement on key deliverables, responsibility for delivery, time frame and milestones for completion;
- Definition of the roles and responsibilities of the various participants, including a clear agreement on who is in charge of the project and the level of authority;
- Specification of the management and monitoring responsibilities of the project manager and the line of authority and communication between the project manager, Project Management Group and the Task Force;
- A clear strategy for communicating with project stakeholders and potential users on a regular basis throughout the implementation, including an agreement on what information needs to be communicated with what groups and in what manner and frequency;
- A clear and agreed project budget, including financial and human resources; it is essential that the necessary funds and personnel be allocated to the project from the outset;
- A clear statement of the project risks (such as a cutback in budget, delay in required legal reforms, etc.) and an agreed response plan (to the best extent possible) to manage these risks, including contingency plans for high-level risks;
- Agreement on the criteria for measuring the project success;
- An agreed project review and feedback mechanism to provide ongoing monitoring of the project process and to deal with any changes in the implementation that may be required."

The Single Window Implementation Framework (SWIF) recognizes the Single Window environment as a facility and a system. This system consists of stakeholders of international supply chains who collaborate to simplify and automate the supply chain, in particular focusing on the fulfillment of regulatory requirements for the movement of goods in the international supply chain. It also consists of interconnected, interacting components, which include: 1) Single Window's components; sub-parts of the SW which have different scopes and may be implementations of different SW components that are implemented in different phases of the overall SW implementation, 2) Artifacts that serve as inputs for the development of the SW components (e.g., the results from the Business Process Analysis (see section 3.2), a harmonized data set, a data model (see section 3.3); and 3) Artifacts to support sound implementation and operation of Single Window (e.g., a master plan, enterprise architectures, business models, legal framework (see section 3.4), and governance mechanisms).

Part I of the SWIF has addressed how these key components can be managed in a holistic, incremental, and iterative manner by further defining Single Window (scope and IS architecture), introducing the SW Architecture and the SWIF method, possible iterations and cycles that can take place, and the organization of the project in sub-projects. Part I thus aimed to provide a sound concept for the development of a national SW Master Plan. Part II of the SWIF consists of guidelines and techniques, to support five key activity areas that are typically challenging in SW implementations. Part II further exemplifies how these relate to the SWIF method and as such provides further pointers how the Master Plan can be derived. The adoption of the SWIF to the specific objectives, needs and requirements of a national SW project delivers the National Master Plan for the Single Window implementation. This plan constitutes Part III of the SWIF. As the development of such

a master plan is specific for each country, it is not discussed in this document.

3 Part II: SWIF guidelines and techniques

Chapter 3 describes five selected key activity areas that are considered essential for the successful implementation of Single Window and that differ substantially from other information system implementation because of the nature of SW. The activity areas are: 1) stakeholder management and interagency collaboration, 2) business process analysis, 3) data analysis and harmonization, 4) interoperability, and 5) realization of the legal framework.

3.1 Stakeholder management and interagency collaboration

This sub-section discusses the rationale for Stakeholder Management and Interagency Collaboration (SMIC), the key steps of SMIC, and ends with a summary as to how the SMIC is positioned in the SWIF.

3.1.1 Rationale for Stakeholder Management and Interagency Collaboration

SWIF uses an adaptation of Stakeholder Management as discussed in TOGAF[8]. TOGAF provides a step-to-step approach to Stakeholder Management which addresses how stakeholders can be engaged in order to establish the master plan for Single Window Implementation. It is focused on securing top management commitment, resources and input from all relevant parties during the development and implementation of Single Window implementation within the organizations involved.

In TOGAF (The Open Group, 2009, p. 281), successful Stakeholder Management is seen to achieve the following benefits:

- "The most powerful stakeholders can be identified early and their input can then be used to shape the architecture; this ensures their support and improves the quality of the models produced.
- Support from the more powerful stakeholders will help the engagement win more resource, thus making the Single Window engagement more likely to succeed.
- By communicating with stakeholders early and frequently, the [SW steering committee] can ensure that they fully understand the architecture process, and the benefits of enterprise architecture: this means they can support [the taskforce] more actively when necessary.
- The architecture engagement team can more effectively anticipate likely reactions to the architecture models and reports, and can build into the plan the actions that will be needed to capitalize on positive reactions whilst avoiding or addressing any negative reactions."

TOGAF deals with the issue of obtaining agreement from large numbers of stakeholders touched by the Single Window implementation throughout the life cycle. Thus, consensus-building and alignment are stressed. Compared to enterprise architectures initiatives that take place in single organizations, SW initiatives are carried out in a complex inter-organizational setting (with characteristics of B2B, B2G, and G2G information systems implementations), where players at national and international levels impact and are impacted by the SW implementation. For example, Ministries need to create a platform for harmonization of procedures and data) and decisions have to be made regarding the participation in international organizations like the EU, APEC, or UN/CEFACT). Therefore, there is a strong need to create an environment for interagency coordination and collaboration.

SWIF stresses the following considerations underpinning the Stakeholder Management and Interagency Collaboration (SMIC) approach:

[8] See also TOGAF Chapter 24, Stakeholder Management (The Open Group, 2009).

- Use the recommendations on Stakeholder Management provided in TOGAF (2009); these are directed at systematically identifying stakeholders and their involvement throughout the ADM cycles.
- In SW implementations, there is an inter-organizational group of stakeholders, which is characterized by its diversity and dynamics, and whose participation and involvement will shift during the course of the SWIF cycles. The TOGAF recommendations focus primarily on the individual (personal) level. For the SWIF, we have adapted the recommendations to take into account this international, inter-organizational level.
- Government agencies are central in the group of stakeholders; they have to organize successful interagency coordination and collaboration amongst themselves and with the other stakeholder groups.
- There is a need to establish political will and obtain a permanent mandate for SW implementation, at the highest policy maker level. How the political will gets established may depend on a mixture of influences of stakeholders that vary per country. In some, the national government may be most instrumental, but for example in the EU, both the EC commitment as well as the commitment of businesses may have impact on the political will of the government to move forward. The permanent mandate is geared towards formalizing political will. This is certainly essential in countries where there is a risk that oral agreements are made otherwise, which can be hard to maintain at tactical and operational levels.
- The influence of regional, supranational, and international stakeholders needs to be considered. Decisions have to be made regarding collaboration between various government agencies/ ministries outside the country. Also, the national SW initiative needs to be aligned with international SW initiatives, e.g. from trading partner countries, regional communities (e.g. APEC, European Community, etc.), and world-wide standardization initiatives (e.g. UNECE, UN/CEFACT, WCO, ISO, GS1, etc.).

All in all, Stakeholder Management and Interagency Collaboration is a key activity area in the SWIF that focuses on identifying, analyzing and managing the commitment and cooperation of the stakeholders that participate in or are influenced by the SW initiative.

3.1.2 SMIC steps

The following steps are identified as core of Stakeholder Management and Interagency Collaboration:

Step 1. Obtain political will and a permanent mandate for SW 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 SW 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 SW 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 SW initiative at its start, but also once the SW components are deployed. The role of KPIs for Single Window development is discussed in APEC (2009).

It is important to recognize that the ambition of the SW implementation in a particular country can differ substantially. 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 amount 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). 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 wider 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 Core Components.

By aligning the SW rationale with the views and concerns of high-level policy makers on trade facilitation, political will and commitment can be achieved for the broad SW vision. *Obtaining a high-level policy mandate* is important to formalize such political will and commitment to undertake a SW implementation and get formal authorization of the SW Programme. It is important to consider that the mandate should remain valid long term, as the SW implementation project can take more than ten years and therefore likely needs to survive multiple governments.

Step 2. Appoint a Single Window steering committee

The Single Window steering committee, or taskforce, is responsible for the management of the SW implementation programme. In this step, *policy managers have to decide which organization will be the lead agency(ies).* It is crucial that the taskforce includes a strong lead agency. It is common that Customs and another government organization will take a joint leadership role. A lead agency can be Customs alone, but it may also be together with Port Authorities, the Chamber of Commerce, or even in the form of a public-private partnership. In all cases, Customs is seen to play 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 necessarily 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)

Second, *the members of the SW steering committee have to be selected and mandated*. The SW steering committee should include high-level policy implementers, but also people from middle management, as they are a relatively stable group over a long period. Furthermore, members of the SW 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 SW initiative.

Step 3. Determine Stakeholder Management approach

Identify who the main SW stakeholders are (all the organizations/ people who are affected by it, who have influence or power over it, or have an interest in its successful or unsuccessful conclusion) and identify who is impacted by the SW implementation project (The Open Group, 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 existence of the system (Phuaphanthong et al., 2009; Pouloudi and Whitley, 1997). Informal stakeholder groups should also be taken into account (The Open Group, 2009). For SW implementations, we can distinguish four levels of stakeholders, namely 1) national stakeholders, 2) stakeholders in the same or another region/ economic zone, 3) stakeholders at the regional or economic zone, 4) international stakeholders (cf. Rukanova et al., 2009; Van Stijn et al., 2009). These can be divided in stakeholders that directly participate in the SW Programme (i.e. take part in the (management of) the development and implementation), and stakeholders that influence or are affected by the SW initiative. 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. The United Nations (e.g. UNECE and UN/CEFACT), the World Customs Organization (WCO), the international Organization for Standards (ISO), and other international standardization organizations such as EPCIS, GS1, IATA, FIATA, and IMO are examples of stakeholders at level 4. Figure 11 provides an example of the inter-organizational stakeholder groups at the four levels.

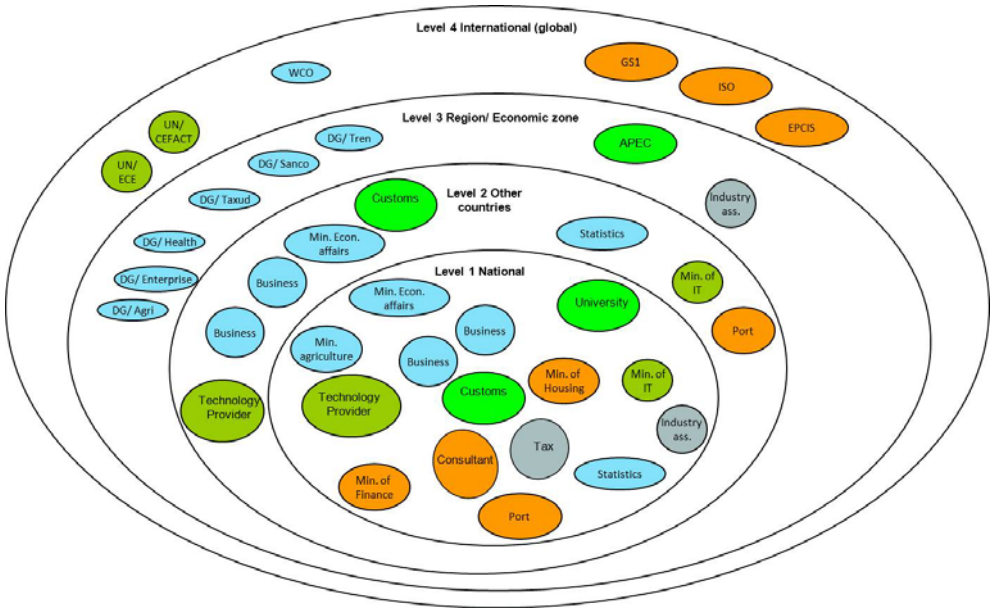


Figure 11. A multi-level network overview of inter-organizational SW stakeholders

(Adapted from Rukanova et al., 2009)

We recognize that the involvement and consultation of the domestic stakeholders alone may already be a daunting task. However, it is in our opinion imperative to also take into account stakeholders at the regional and international levels. Depending on the country-specific circumstances, this might not need to take place early on during the SW implementation, though also from the Dutch and Thai cases, the role of for example the European Union or APEC is imperative and it will be important to align with these stakeholders, for example to ensure that the resulting national Single Windows are interoperable with each other. The exact involvement and consultation will differ depending on the objectives. For example, in The Netherlands, there is a pro-active attitude in order to influence for example EU regulation (cf. Van Stijn et al., 2009) and system requirements set by the EU (cf. Rukanova et al., 2009). This is not necessarily applicable for other countries, and may also depend on such aspects as financial and human resources available, participation in regional trade agreements, and so forth.

The previous step yields a list of organizations, that in some way affect or are affected by the SW Programme. 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 refresh during the project.* It is also important to *assess the readiness of each stakeholder to behave in a supportive manner* (i.e., demonstrate commitment to the SW architecture initiative). TOGAF (The Open Group, 2009) recommends the use of readiness factors developed under the Canadian Government's Business Transformation Enablement Program (BTEP) to determine stakeholders' readiness. These factors,

adapted for the implementation of Single Window components, 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 SW Programme.* Involvement can range from minimal, or keeping informed, to keeping satisfied or being a key player (The Open Group, 2009).

Table 2. Readiness factors for SW implementation

(Adapted from BTEP)

Readiness Factor	Description
Vision	• Objectives of the Single Window and it's components to be achieved and the benefits that it will bring are clearly identified. • There is a clear link between the vision of Single Window's components and the overall Single Window vision.
Desire and Willingness	• Concerned parties understand the need for the targeted SW. • There is a presence of 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 sub-projects (relating to specific activities in the SW implementation) and the program (Single Window implementation initiative as a whole).
Sponsorship and Leadership	• The executive and the 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.
Governance	• Roles and responsibilities of concerned parties in the project are clearly identified.
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.

Step 4. Establish environment for stakeholder coordination and collaboration

The objective of this step is to further tailor 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 SW initiative.

The SW Steering Committee is responsible to *develop and maintain the Master Plan*, which is the guiding project management document. In the context of SMIC, 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.

With respect to SMIC activities, the taskforce needs to *gain insights how the ambition level of the SW will influence the collaboration needed between stakeholders*. Regarding G2G collaboration, if the SW 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 SW 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) (ITAIDE, forthcoming 2010). This would require the most extensive cooperation, 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 to on the one hand understand their influence on the SW initiative and on the other hand, to decide and manage the active involvement by and in such 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 SW 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.

- *Analyze the interdependencies between the national and regional Single Window*

  A Single Window links national trade with the international supply chain. The interdependencies between the national SW 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 SW steering committee.

The SW taskforce is recommended to *decide whether to set-up one or more pilot projects.* The ITAIDE project implemented these pilot projects through so-called Living Labs, which have found to be especially suited to deliver “proofs-of-concept” and to develop and pilot innovative components of the SW (Tan et al., 2010). Living Labs bring together stakeholders from government, industry, IT providers, as well as academics. Because of their research nature, Living Labs can provide a neutral ground as the basis for joint innovation and collaboration. In particular, they shape a context to come to win-win solutions for trade and government.

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 (The Open Group, 2009). The taskforce should also address the *formal organization of the SW (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 are likely to exist or arise during the SW implementation. If these are not addressed, they may hamper cooperation and the SW 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 purposeful meetings; frequent mediated communications; client-centered focus; and leadership that promotes shared vision (Imel, 1995)
- Interagency collaboration capacity, i.e., formal agreements; 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 SW initiatives, i.e., there is not one project, but groups of activities will be conducted as projects and each project will implement a component of the SW. The Master Plan will provide the planning for the overarching SW 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 SW Programme, and provides a coordination means to ensure continuance as well as consistency of the efforts over time.

3.1.3 Summary and positioning SMIC steps in the SWIF

The SMIC provides input to assess which stakeholders should be involved in which manner, and addresses how the taskforce (or project management) can manage the collaboration and coordination of the key players and other stakeholders. The execution of specific activities involves a shifting group of stakeholders as well as changes in collaboration and coordination forms. Moreover, the set of stakeholders is dynamic over time.

Figure 12 provides an overview of how the SMIC activities can be positioned in the SWIF. Step 1 and 2 are conducted in the preliminary phase of the SW initiative; steps 3 and 4 are conducted throughout Phase A – E, and requirement management. The underlined steps should be executed in all phases, depending on the specific scope of the activities at hand. With each iteration of a phase, the results of SMIC should be reviewed and, where applicable, adaptations should be made, as they may involve a different set of stakeholders.

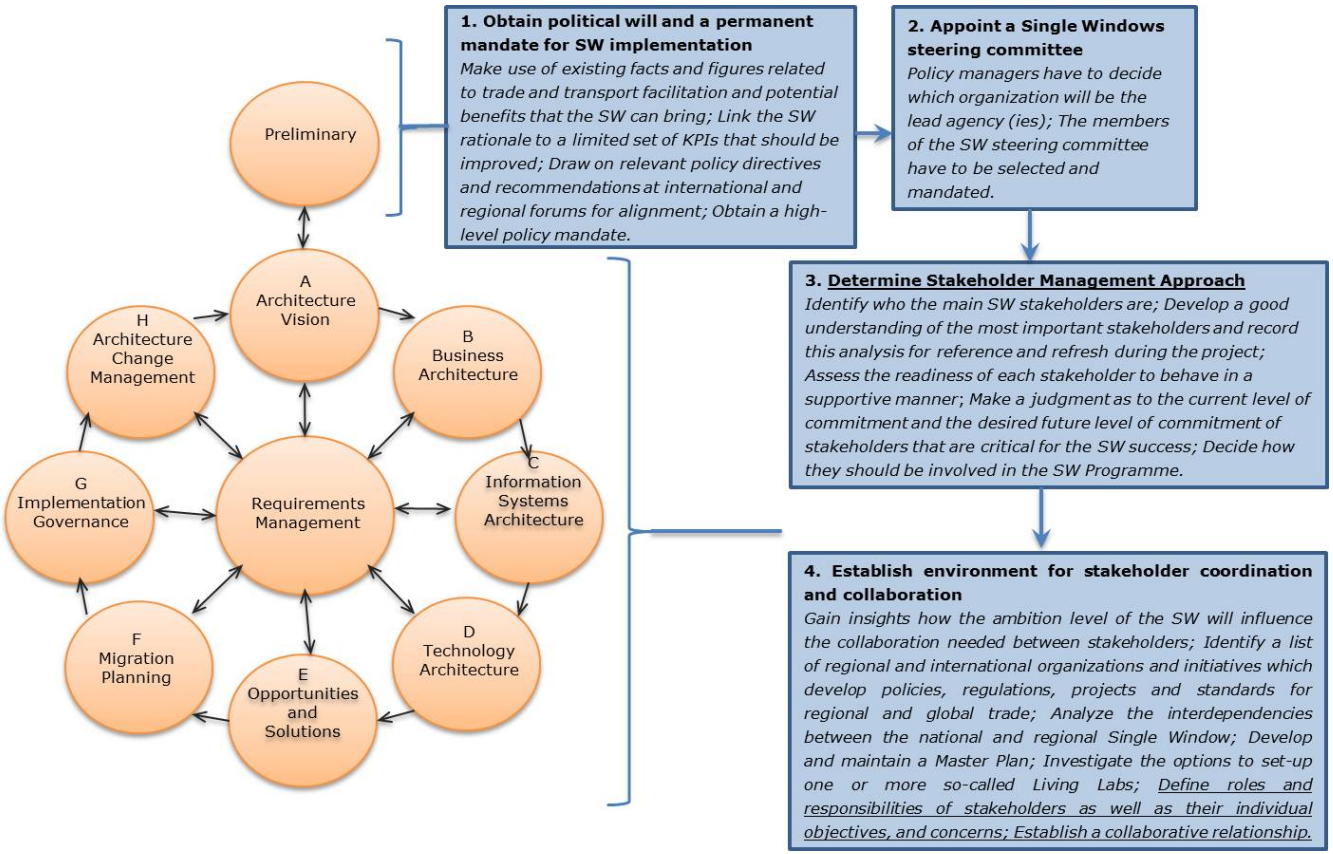


Figure 12. Positioning SMIC steps in the SWIF

3.2 Business process analysis and simplification

This sub-section discusses the rationale for business process analysis and simplification, how business modeling can be used as an approach, the key process steps, and reusing the defined processes and their elements. It ends with a summary as to how the business process analysis and simplification is positioned in the SWIF.

3.2.1 Rationale for business process analysis and simplification

To reduce the complexity of the international trade transaction and costs related to it, UN/CEFACT (2006) recommends the implementation of the following measures:

- The simplification and harmonization of trade procedures and where possible, eliminate unnecessary ones;
- The simplification and coordination of administrative procedures at border crossings;
- The simplification of payment systems;
- The simplification, standardization and harmonization of documents required for a trade transaction;
- The facilitation of flow of information that controls the movement of goods throughout the transaction (e.g. by applying information and communication technology); and
- The enhancement of trust assessment through a better exchange of information.

Business process analysis allows stakeholders to gain a better understanding about the operational aspects of international trade transaction. It informs stakeholders how business processes under the scope of the study are carried out; how business processes relate to one another; who are responsible for executing them; what documents, electronic messages, rules, and regulations are involved; and how the information flows.

The documentation of existing business processes in simple diagrams and brief descriptions that are agreed upon by all stakeholders then serve as a baseline for:

- The simplification of the analyzed existing business processes;
- The simplification and harmonization of documentary requirements; and
- The automation of international trade transaction for Single Window.

3.2.2 Business process modeling as an approach for business process analysis and simplification

Business process modeling is a technique that has been widely used to document the business processes for the analysis. It is a visual documentation of process attributes which include:

- Activities that come in a specific order and decision points;
- Actors who perform those activities;
- Defined inputs and outputs of each activity;
- Criteria for entering and exiting the business process;
- How actors relate to one another;
- How information flows throughout the business process;
- Associated rules and regulations; and
- Quantitative indicators such as number of steps, as well as time and cost required to complete a particular business process.

UN/CEFACT has developed the UN/CEFACT Modeling Methodology (UMM) to provide a guideline for modeling inter-organizational business processes from a global perspective. 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 on how process analysts should document knowledge on process attributes that they capture from business experts. It also provides a

set of example worksheets with predefined meta-model of business process and business information that process analysts may consider in adopting when eliciting necessary information.[9]

UMM applies the Unified Modeling Language (UML) which provides a set of standard graphical notations to visualize the different aspects of the business process. Unified Modeling Language (UML) provides a set of standard graphical notations that UMM applies in visualizing business knowledge in different aspects. The use of common notations allows communication between business experts and technical experts. The consistency in modeling technique not only produces results in a form that are easily understood, analyzed and validated by experts, but also allows international comparison and benchmarking of the national procedures. In addition, reusable processes and best practices can then be distilled which simplifies the automation.

3.2.3 Business process analysis and simplification process steps

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 13). 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.

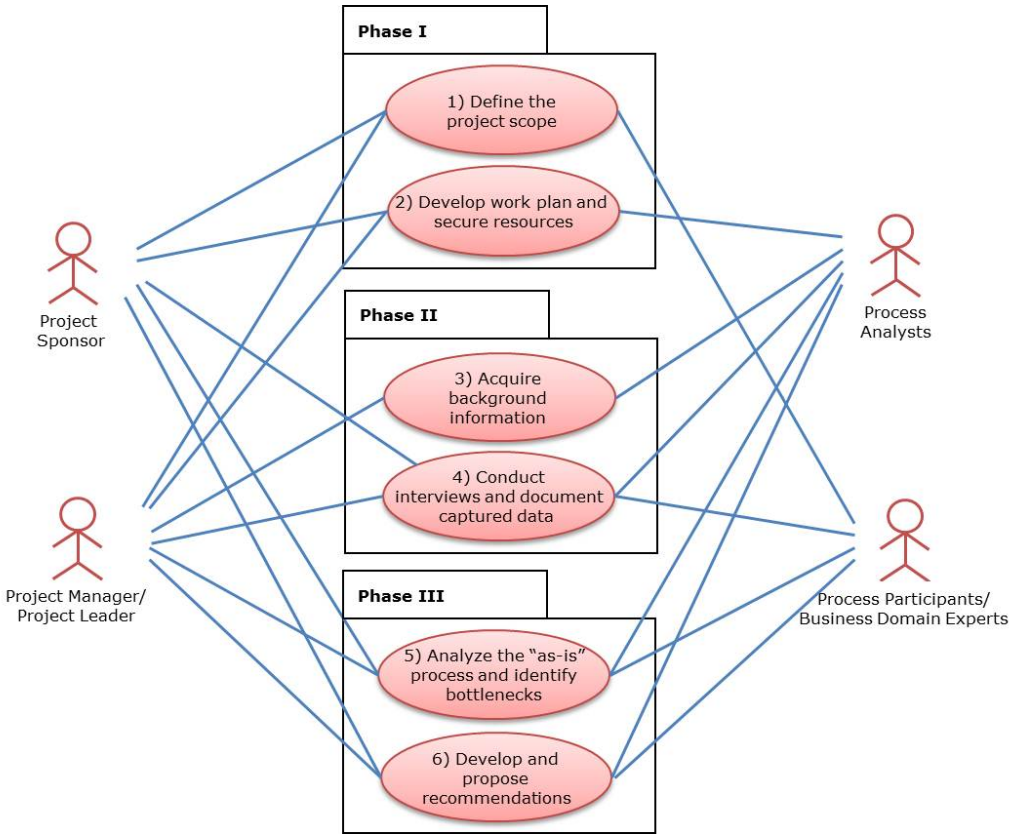


Figure 13. Key Steps and Stakeholders in Business Process Analysis and Simplification

[9] http://umm-dev.org/wp-content/uploads/2007/11/worksheets-v02-templates.zip

Step 1: Define the project scope

In order to implement Single Window in its full scale, it is necessary to understand all business processes that constitute the international supply chain. These business processes, which often vary across products, mode of transportation, agreement between trading partners, and national regulations of trading partner, range from:

- The establishment of commercial contracts (commercial procedures);
- The arrangement of inland and cross-border transportation of goods (transport procedures);
- The completion of export, import, and transit formalities to meet regulatory requirements (regulatory procedures); and
- The payment for purchased goods (financial procedures).

Nevertheless, the conduct of business process analysis and simplification does not have to cover all business processes at once. Its scope, rather, corresponds to the scope of Single Window identified in the master plan. If Single Window is to be implemented in phases, the scope of each iteration of business process analysis and simplification will then correspond to the scope of each phase of Single Window implementation. As such, different sub-projects can be executed, each with a different scope and stakeholders involved, re-using the results of previous analyses (see 3.2.4).

UNNexT (2009a) suggests that the scope of business process analysis and simplification is visualized in a use case diagram. In business process analysis, the use case diagram serves as a project's frame of reference. Its purpose is to present a graphical overview of core business processes that are subject to further examination at a greater depth. It indicates all stakeholders that are involved in these business processes and demonstrates all actual associations between these business processes and stakeholders. An example of a use case diagram which is shown in Figure 14 illustrates major business processes required to be executed in order to export a full container load of jasmine rice under the CIF (Cost, Insurance, Freight) term of delivery from Thailand using ocean vessels to major importing countries.

Step 2: Develop a work plan and secure resources

The agreed-upon scope provides a basis for the development of a detailed work plan that guides and manages the implementation of the business process analysis and simplification. Based on the use case diagram developed in Step 1 the project manager will develop a detailed work plan that guides and manages the implementation of the business process analysis. This includes a work breakdown structure that anticipates all project activities described in step 3 and following steps. This work breakdown structure then provides a starting point for estimating project costs, staffing and scheduling.

Step 3: Acquire background information

To prepare for the interviews with business process experts the business process analysts will acquire as much background information on the business processes under examination as possible. The background information not only provides useful leads to the preparation of interview questions, but also enhances the efficiency and effectiveness of the interview. Background information can be obtained via desk research through information publicly available on the Internet, information portals, and at inquiry points of the agencies or businesses involved in the business domain of interest.

Step 4: Conduct interviews and document captured data

The face-to-face interviews are the most commonly used data collection method for the business process analysis exercise. This process aims to confirm the accuracy of the previously collected background information in order to gain an in-depth understanding of each use case or core business

process in question. Such comprehensive information is necessary for creating a visual representation as well as descriptive explanation for each use case.

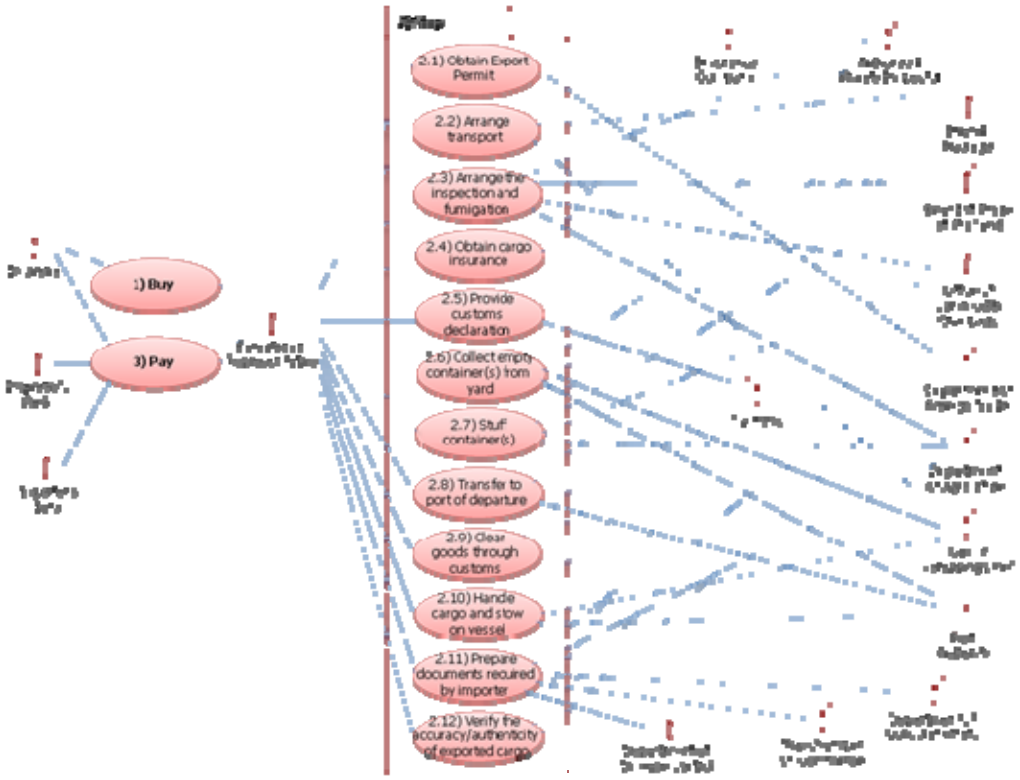


Figure 14. Example of Use Case Diagram Illustrating the Scope of Business Process Analysis and Simplification

(UNNeXT, 2009a)

Once the face-to-face interview sessions with the relevant business process participants have been conducted, process analysts consolidate all inputs from interviewees and document them if forms of 1) UML activity diagrams, 2) textual process descriptions including a list of relevant forms and documents as well as laws, rules and regulations, and 3) time-procedure chart.

The activity diagram is an elaboration of each business process displayed in the use case diagram. Figure 15, for example, is a use case representing one core business process involved in the export of jasmine rice. This use case is extracted from the use case diagram in Figure 14. Figure 16 is a corresponding activity diagram of Figure 15. It portrays a sequence of activities and information flows from one responsible party to another. It informs who is doing what in which order. It outlines documentary inputs that serve as prerequisites to activities and documentary outputs obtained as a result of carrying out certain activities. By integrating all activity diagrams that explain all use cases in the use case diagram, relationships between core business processes, process participants, and information flow throughout the area under the scope of the study can be better understood.

Figure 15. Example of a Use Case representing a single Core Business Process of the Use Case Diagram

(UNNeXT, 2009a)

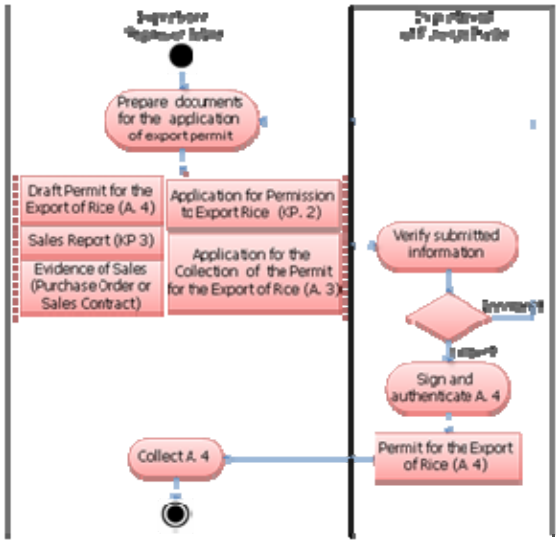


Figure 16. Example of an Activity Diagram describing the Core Use Case

(UNNext, 2009a)

The time-procedure chart, as shown in Figure 17, is an illustration of the time required to complete each business process in the scope of study. It helps identify where possible bottlenecks are. While each bar on the *x axis* represents an individual procedure within a business process, the *y axis* represents the average total time (number of days, in this case) required to complete that particular procedure.

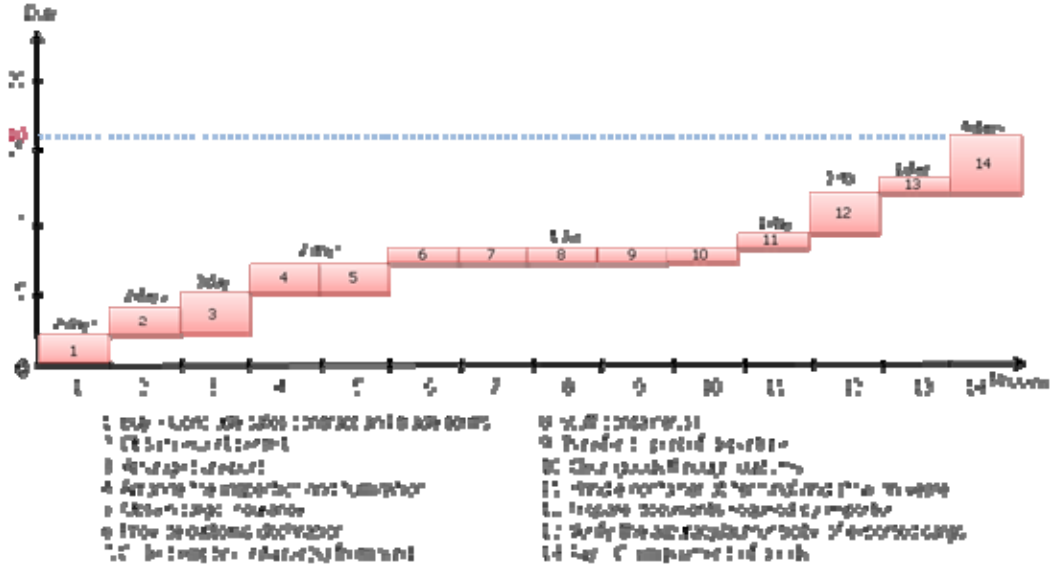


Figure 17. Example of a Time-Procedure Chart

Step 5: Analyze the "as-is" processes and identify bottlenecks

UNNexT (2009a) recommends that the analysis of the "as-is" processes and the identification of bottlenecks should begin with the review of the time-procedure chart, where business processes that require extensive time to complete can be easily spotted. It is then followed by a close examination of relevant activity diagrams together with the associated process descriptions to identify the cause of delays.

In addition to the analysis of the time-procedure chart, a review shall be conducted on each activity diagram, its accompanied process description, and relevant forms and documents. This review may identify redundancies and non-value-added activities in procedural and documentary requirements as well as outdated laws or unnecessary regulations.

Step 6: Develop and propose recommendations.

The last step deals with the development of recommendations that help eliminate bottlenecks and inefficiencies of procedures and documentary requirements within the examined business process.
The recommendations should contribute to a) a reduction in time and cost in the international trade; b) an increase in trade; c) enhanced transparency in trade procedures; and d) improved security measures that would not be contradictory to the principles of trade facilitation.

Examples of recommendations include a) merging some procedures; b) eliminating redundant procedures and unnecessary documentary requirements; c) automating procedures to promote the sharing of trade and transport data among relevant stakeholders; and d) modifying related laws and regulations to facilitate the operation of the newly designed business processes. Future scenarios after the recommendations are put in place can be demonstrated in a series of activity diagrams.

3.2.4 Reusing previously defined business processes and their elements

Relevant elements of business processes (such as individual actor  , individual use case  , individual activity ), use case diagram, activity diagram, and business process description should be reused where possible in the iterations of the Phase B (Business Architecture) of the Single Window implementation. Business processes related to the declaration of goods and customs clearance which are quite similar for most products are examples of areas where use case diagram and activity diagram can be reused.

The benefits of reusing previously defined business processes and their elements include:

- Shorter time required to complete the tasks;
- Consistency in the documentation of business processes;
- Consistency in practice based on previous works; and
- Reduced maintenance efforts.

3.2.5 Summary and positioning business process analysis and simplification in the SWIF

The business process analysis and simplification described here builds upon the SWIF Architecture Vision activities (Phase A) and takes place during Phase B Business Analysis. It provides requirements and input for establishing the Information Systems Architecture (Phase C), including the Data Harmonization (see section 3.3). Depending on the scoping and phasing of the SW implementation, the business process analysis and simplification is an iterative process, where sub-projects will focus on a specific sub-set of processes, involving different stakeholder groups (see section 3.1). Re-using the results of the analyses conducted in these sub-projects is essential to achieve a consistent

architecture, ease maintenance of this architecture, and to address interoperability (see section 3.4). Furthermore, the analyses will provide indications as to the extent that legal changes may be needed.

3.3 Data harmonization

This sub-section presents the rationale for data harmonization, the evaluation and selection of a data model, the data harmonization process, and the maintenance of data harmonization work products. It ends with a summary as to how data harmonization is positioned in the SWIF.

3.3.1 Rationale for data harmonization

Full scale Single Window operation involves G2G, G2B, B2G, and B2B information sharing, integration, and exchange among stakeholders of the international supply chain from both within and across national borders. To ensure interoperability, each Single Window's component has to employ common semantic rules that govern semantics, data element names, their representations, and the structure of electronic messages. To improve interoperability, international conventions and standards should be applied (ADB and ESCAP, 2009).

Semantics that are organization-specific, industry-specific, or country-specific further complicate data sharing and effective data integration across the international supply chain as they entail different semantic meaning. The lack of coordination among Single Window's stakeholders in the use of data/information/semantic standards complicates data association between different components within one Single Window. It makes data mapping and integration between different Single Window's information systems even more difficult. It is argued that the development of the mapping of a complete purchase order from an internal format to an industry-specific standard, such as RosettaNet or OAGIS for exchange with a trading partner, requires up to 10 person days (Stuhec, 2005).

It is therefore important that data requirements of Single Window are harmonized with a single set of generic semantic rules or "data model" that provides a syntax independent representation and structure of data used in the electronic exchange of data. The harmonization of data requirements using the same "data building block" increases the ability of different Single Window components to commonly interpret the exchanged data and automatically process them. Outputs of data harmonization including a set of data dictionaries and message implementation guidelines then serve as inputs for the development of the Single Window's components. These artifacts will serve as a basis for designing Single Window's information systems' user interface, exchange interface, database, and conceptual model that illustrates required information objects and relationships among them. The rationale for data harmonization is further described in the UN/CEFACT Draft Recommendation 34 (UN/CEFACT, 2009b).

3.3.2 Evaluation and selection of data model for data harmonization

Prior to harmonizing data requirements[10], a data model has to be identified, evaluated, and selected. The data model will be used to align the definition, representation, as well as the cardinality of data elements and define the structure of electronic messages. Comprehensiveness, compliance, and stability with the prevailing internationally accepted standards for electronic data exchange are criteria when selecting the data standards:

Comprehensiveness

[10] There are situations where the selection may be deferred to a later stage in the Data Harmonization process. This is dependent upon for example the extent that there are already (different) data models, and standards in use at the start. If data have to be modelled from scratch, it makes sense to identify a model to use already throughout the other steps. Otherwise, it may make more sense to defer this step until the actual mapping is done, as the selection than can also include the match with the existing model(s).

- The selected data model should be generic yet sufficiently contextualized that documentary requirements of all stakeholders in the international supply chain are covered.

Compliance with internationally accepted standards for electronic data exchange

- The selected data model should comply with relevant international recommendations and standards to ensure semantic interoperability. They include:
  - UN/CEFACT Core Component Technical Specification (CCTS: ISO 15000- 5/ebXML) which provides the methodology for the identification of dictionary entry names (data elements) in the data model and the development of a data model that in turn defines the structure of an electronic message;
  - UN/CEFACT Core Component Library (CCL) which provides reusable CCTS-compliant building blocks to represent information used in business processes.;
  - UN Trade Data Element Directory (UN/TDED, ISO 7372) which provides a list of standard data elements used in international trade and United Nations Layout Key (UNLK) which provides a standard to simplify and standardize forms.

The WCO Data Model Version 3 is an example of an available standard data model for B2G and G2G data exchange that cover data requirements needed for Customs and regulatory purposes. The WCO Data Model is based on the above standards and supports development of electronic documents in UN/EDIFACT and XML syntax.

Stability

- The selected data model is built upon on the stable version of standards.

3.3.3 Data harmonization process steps

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 18 visualizes the data harmonization steps.

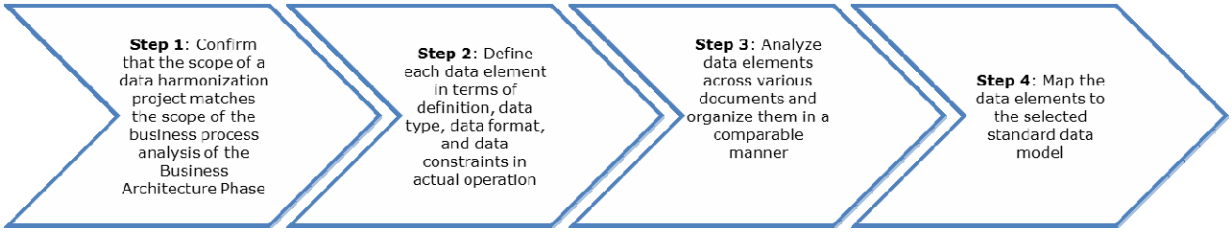


Figure 18. Data Harmonization steps

Step 1. Confirm that the scope of a data harmonization project matches the scope of the business processes analysis of the Business Architecture Phase

The output of the previously conducted business process analysis and simplification serves as a basis for the data harmonization project. The business process analysis provides important material to define data requirements such as forms, documents, and electronic messages used in the business process under investigation.

The Business Process Analysis also offers better understanding about how the information flows. It informs how the documents and data are used by the different parties in the supply chain. Such knowledge facilitates the interpretation of data requirements and thus the process of defining and structuring data elements. As the Business Process Analysis provides crucial inputs for the data harmonization, the scope of the business process analysis must cover all business processes which are included in the data harmonization. Phase B (Business Architecture) includes a simplification of

business processes and data requirements. This reduces the amount of data that needs to be harmonized (ADB and ESCAP, 2009).

Step 2. Define each data element extracted from each document in terms of definition, data type, data format, and data constraints in actual operation

The purpose of this step is to obtain a precise description of the data requirements of the users of the document using definitions that are familiar to business experts. Solid understanding of data elements under the scope of data harmonization in terms of definition, data type, data representation format, and data constraints in actual operation is crucial. Ambiguity in the meaning and the usage of each data elements not only delays the process of harmonizing the attributes of these data elements with the selected semantic rules, but also creates inconsistency in the mapping.

In close consultation with relevant stakeholders, a Data Dictionary should be created to provide sound descriptions of each application form, document, and electronic message collected. Document Data Dictionary should contain the following pieces of information:

- Document title
- Document purpose
- Name of document owner
- Identification number for each data element name such as the Box Number in the document
- Data element name used in the document to be modeled
- Data element definition in local language and/or English as given by the owner of the document and/or relevant standard, such as UNTDED and WCO Data Set
- Data representation format (alpha, numeric, alpha-numeric) and size (length of a data element value in terms of digits or characters)
- Constraint on the occurrence of each data element Occurrence (MinOccurs, MaxOccurs)
- Code lists and subsets of code lists

Table 3 provides an example of a Data Dictionary for the Certificate of Origin.

Step 3. Analyze data elements across various documents and organize them in a comparable manner (when working with data requirements from multiple sources) to create the compilation of Data Dictionaries

The purpose of this step is to organize data requirements from different documents in a comparable manner to prepare the mapping of data elements to a data model. The compilation of data requirements is based on data definition, i.e., data elements from various documents with identical definition are placed in the same row. Table 3 illustrates the Data Dictionaries Compilation.

Data elements which occur in several documents may have identical names but show differences in definition, data representation, code lists, or usage. Such difference implies that these data elements will be mapped to different data structures of the data model. To ensure consistent mapping, data dictionaries should be compiled in such a way, that they belong to the same document category. The following categories are suggested:

- Category 1 includes Data Dictionaries that are related to commercial transaction and payment.
- Category 2 includes Data Dictionaries of transport and official control documents that provide information of a single consignment (e.g., customs declaration).
- Category 3 includes Data Dictionaries of transport and official control documents that provide information of multiple consignments (e.g., manifest).

Organizing Data Dictionaries in this manner facilitates the mapping of compiled Data Dictionaries with the reference data model in Step 4. Table 4 provides an example of Data Dictionary Compilation.

Table 3. Example of a Data Dictionary for a Certificate of Origin

(APEC ECSG, 2009)

Document Title Certificate of Origin

Document Purpose A Certificate of Origin is a document/message identifying goods, in which the authority or body authorized to issue it, certifies expressly that the goods to which the certificate relates originate in a specific country.

Name of Document Owner Ministry of Commerce, Thailand

ID	Data Element Name	Data Element Definition	Format	MinOccur	MaxOccur
1	Exporter (name and address)	TDED 3336: Name (and address) of the party consigning the goods as stipulated in the contract by the party ordering the transport (This may be the exporter or seller.)	an..256	1	1
2	Consignee (name and address including country)	TDED 3132: Name and address of party to which goods are consigned	an..256	1	1
3-1	Date of shipment	TDED 2043: Date and optionally time when a consignment of goods departs from last port, airport, or border post of customs territory whence consigned (country of export).	an..19	1	1
3-2	Mode of transport	TDED 8066: Name of a mode of transport.	an..17	1	1
3	Vessel/flight no.	TDED 8028: To identify a journey of a means of transport, for example voyage number, flight number, trip number.	an..17	0	1
4	Place of departure	TDED 3214: Name of the port, airport or other type of location from which a means of transport is scheduled to depart or has departed.	an.. 256	1	1
5	Reference No	TDED 1004: Reference number assigned to a document by the issuer.	an..35	1	1
6-1	Certificate of Origin	TDED 1000: Free text name of a document such as 352 for Proforma invoice, 380 for Commercial invoice.	an..35	1	1
6-2	Ministry of Commerce, Thailand	TDED ----: The name, expressed as text, for the party that issues this exchanged document.	an..256	1	1
7	Country of destination of goods	TDED 3014: Name of the country to which a consignment of goods is to be or has been delivered.	an..35	1	1
8	Supplementary details	TDED 4142: Text related to a document.	an..512	0	1
9	Marks and numbers on packages	TDED 7102: Marks and numbers identifying individual packages	an..512	1	unbounded
10-1	**No.** and kind of packages; description of goods	TDED 7224: Number of packages per goods item packaged in such a way that they cannot be divided without first undoing the package.	n..8	1	unbounded
10-2	No. and kind of packages; **description of goods**	TDED 7002: Plain language description of the nature of a goods item sufficient to identify it for customs, statistical or transport purposes.	an..512	1	unbounded
11	Gross weight	TDED 6292: Weight (mass) of goods including packaging but excluding the carrier's equipment.	n..14	1	unbounded
12-1	Invoice **date** & no.	TDED 2377: Date of issue of an invoice.	an..19	0	unbounded
12-2	Invoice date & **no.**	TDED 1334: Reference number to identify an invoice.	an..35	0	unbounded
13-1	It is hereby certified that the above mentioned goods originate in:	TDED 3238: Name of the country in which the goods have been produced or manufactured, according to criteria laid down for the purposes of application of the Customs tariff, of quantitative restrictions, of any other measure related to trade.	an..35	1	1
13-2	**Place** and date of issue	TDED 3410: Name of the location where a document was issued and when appropriate, signed or otherwise authenticated.	an..256	1	1
13-3	Place and **date of issue**	TDED 2007: Date that a document was issued and when appropriate, signed or otherwise authenticated.	an..19	1	1

13-4	Signature and stamp of certifying authority	TDED 4426: Proof that a document has been authenticated indicating where appropriate the authentication party	an..35	1	1
13-5	Place, date, and signature of authorized signatory	TDED 4426: Proof that a document has been authenticated indicating where appropriate the authentication party	an..35	1	1

Table 4. Example of Data Dictionaries Compilation

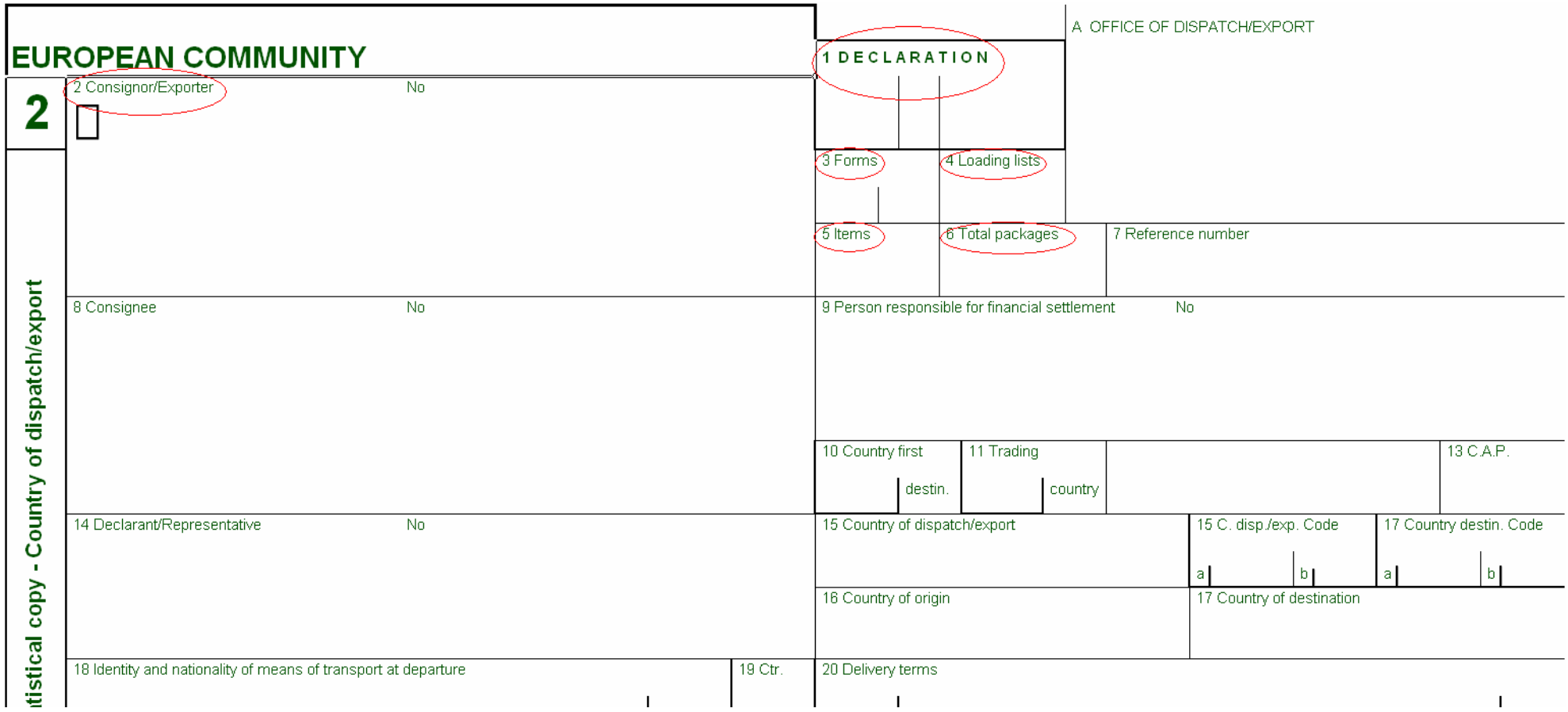
(APEC ESCG, 2009)

Certificate of Origin A Certificate of Origin certifies expressly that the goods to which the certificate relates originate in a specific country. Department of Foreign Trade, Ministry of Commerce, Thailand	**Permit for the Export of Rice (A. 4)** Permit for the Export of Rice (A. 4) is only given to rice exporters who follow the Ministry of Commerce's Regulation for Rice Exportation 1997. Department of Foreign Trade, Ministry of Commerce, Thailand	**Certificate of Standards of Products (MS. 24)** Certificate of Standards of Products (MS. 24) certifies that the rice to be exported has the quality set by importer. Board of Trade of Thailand
4 Place of departure TDED 3214: Name of the port, airport or other type of location from which a means of transport is scheduled to depart or has departed an.. 256 (Min=1, Max=1)	**11 Place of departure** TDED 3214: Name of the port, airport or other type of location from which a means of transport is scheduled to depart or has departed an.. 256 (Min = 1, Max = 1)	**20 Place of departure** TDED 3214: Name of the port, airport or other type of location from which a means of transport is scheduled to depart or has departed an.. 256 (Min = 1, Max = 1)
7 Country of destination of goods TDED 3014: Name of the country to which a consignment of goods is to be or has been delivered. an..35 (Min=1, Max=1)	**5 Destination country** TDED 3216:Name of the country to which the goods are to be delivered to the final consignee or buyer an..35 (Min = 1, Max = 1)	**21 Country of destination of goods** TDED 3014: Name of the country to which a consignment of goods is to be or has been delivered. an..35 (Min = 1, Max = 1)
8 Supplementary details TDED 4142: Text related to a document. an..512 (Min=0, Max=1)		
	12 Line item TDED 1082: An identifier differentiating an individual line item from within a series an..6 (Min = 1, Max = unbounded)	
	17 Price (FOB) TDED 5032: Amount declared for customs purposes of those goods in a consignment which are subject to the same customs procedure, and have the same tariff/statistical heading, country information and duty regime n..18 (Min = 1, Max = unbounded)	**13 FOB Amount** TDED 5032: Amount declared for customs purposes of those goods in a consignment which are subject to the same customs procedure, and have the same tariff/statistical heading, country information and duty regime n..18 (Min = 1, Max = unbounded)
9 Marks and numbers on packages TDED 7102: Marks and numbers identifying individual packages an..512 (Min=1, Max= unbounded)		**18 Marks and numbers on packages** TDED 7102: Marks and numbers identifying individual packages an..512 (Min = 1, Max = unbounded)
10-2 Description of goods TDED 7002: Plain language description of the nature of a goods item sufficient to identify it for customs, statistical or transport purposes an..512 (Min=1, Max= unbounded)	**13 Description of goods** TDED 7002: Plain language description of the nature of a goods item sufficient to identify it for customs, statistical or transport purposes an..512 (Min = 1, Max = unbounded)	

Step 4: Map the data elements to the selected standard data model

The purpose of this step is to associate the data requirements with a reference data model from which the structure of electronic documents can be generated. The mapping shall start after the Data Dictionary Compilation developed in Step 3 is verified by the owners of the documents and agreed upon by all relevant stakeholders. An example of data mapping to a standard data model is shown in Table 5.

Table 5. Example of a mapping of data elements of a Single Administrative Document (SAD) to the WCO Data Model v3



Box number	UNTDED Nr	Description	Format of codes	WCO ID	Name	Description	Data Model Class	WCO Dictionary Entry Name
1 / 1	1001	Code specifying the name of a document such as 352 for proforma invoice, 380 for commercial invoice.	an..3	D013	Declaration name, coded	Code specifying the name of a document.	Declaration	Declaration. Type. Code
2	3336	Name of the party consigning goods as stipulated in the transport contract by the party ordering transport	an..512	R020	Consignor - name	Name [and address] of the party consigning goods as stipulated in the transport contract by the party ordering transport.	Consignor	Consignor. Name. Text
3	1212	To identify a page number	n..3	X		NOT USED IN ELECTRONIC ENVIRONMENT. USED FOR PAPER-BASED FALLBACK PROCEDURES.		
3	1046	Total number of pages in a document	n..3	X		NOT USED IN ELECTRONIC ENVIRONMENT. USED FOR PAPER-BASED FALLBACK PROCEDURES.		
4	6061	Numeric representation of a quantity value.	n..16	013	Number of loading lists	The number of loading lists, manifests or similar documents.	Declaration	Declaration. Loading List. Quantity
5	6061	Numeric representation of a quantity value.	n..16	228	Total number of items	Count of the total number of goods items within a declaration	Declaration	Declaration. Goods Item. Quantity
6	6061	Numeric representation of a quantity value.	n..16	146	Total number of packages	Count of total number of packages of the entire declaration/ consignment.	Consignment Declaration	Consignment. Total Package. Quantity; Declaration. Total Package. Quantity

Using the compiled Data Dictionary for the mapping has the advantage that data elements with an identical definition but which come from different documents are mapped only once to the data model. This ensures consistency in the mapping across documents.

3.3.4 Maintaining the work products of data harmonization

The work products of data harmonization are always subject to modification and update for three main reasons.

- Inappropriate mappings between data elements from the Data Dictionaries and UN/CEFACT CCL's Dictionary Entry Names (DENs) from the reference data model are uncovered.
- New data requirements are discovered after extending the analysis of business process to new business domain, e.g. export, import, transit process of a new product and/or using new mode of transportation.
- Newer version of the reference data model is introduced.

These changes should be more or less incorporated to the existing work products of data harmonization. However, given that any introduced changes are likely to impact user interface, exchange interface, database, and structure of Single Window's information systems that have already been implemented. Careful consideration and impact assessment should be made prior to incorporating those changes.

3.3.5 Summary and positioning of data harmonization in the SWIF

A summary of the four key steps of data harmonization is provided in Table 6.

Table 6. Data Harmonization steps

Step	Step 1	Step 2	Step 3	Step 4
Objective	To agree upon the scope of data harmonization at a particular point in time	To gain better understanding about each data requirement	To synchronize the description of identical data requirements from different sources	To align data requirements with the reference data model
Input	Business Process Analysis: description of documents, data and processes	Written agreement on scope of data harmonization e.g. UN/CEFACT Core Component Library (CCL)	Data Dictionary for each individual source of data requirements	Compiled Data Dictionaries
Output	Written agreement on scope of data harmonization	Data Dictionary for each individual source of data requirements	Compiled Data Dictionaries	Message Implementation Guide

In order to execute step 4, a reference data model has to be selected. Depending on the specific situation, this may be done prior to step 2 or later, when the data are actually mapped. The maintenance of work products is important to ensure that changes in a later stage, due to changing standards and requirements, can be effectively incorporated in an updated data model. The Data Harmonization process is part of Phase C of the SWIF. The resulting Data Architecture provides essential input for the technical Architecture of the system. It also has its consequences for both stakeholder cooperation (see section 3.1), as agreement has to be achieved as to which data are required and which are shared amongst stakeholders, and possibly the legal framework has to be amended or elaborated to facilitate sharing of specific data amongst government agencies and throughout the international supply chain (see section 3.5).

3.4 Interoperability

This section discusses the rationale for interoperability, options to establish interoperability, and ends with a summary as to how interoperability is positioned in the SWIF.

3.4.1 Rationale for interoperability

Interoperability is a multi-faceted concept that relates to (The Open Group, 2009):

- The ability to share information and services.
- The ability of two or more systems or components to exchange and use information.
- The ability of systems to provide and receive services from other systems and to use the services so interchanged to enable them to operate effectively together.

Different aspects of interoperability are shown in Table 7.

Table 7. Different aspects of Interoperability

Aspect of Interoperability	Description
Process/Operational/Business Interoperability	• Analyze and streamline relevant business processes to enhance process sharing and process efficiency
Information/Data/Semantic Interoperability	• Ensure the use of common definition for individual data elements, common structure for complex data elements, and common structure of individual electronic messages by aligning them with an internationally accepted standard that covers documentary requirements of the international supply chain • Ensure that information is seamlessly shared among Single Window's sub-systems
Technical Interoperability	• Define common technical communication protocol, method for data processing and storage, and security strategies to be used by Single Window's sub-systems • Define how services are to be shared or connected with each other
Presentation Interoperability	• Use common look-and-feel approach through a common portal-like solution guides the user to the underlying functionality of the set of systems
Application Interoperability	• Ensure that all Single Window's sub-systems are seamlessly linked • Ensure that identical functionalities are sharable among all Single Window's sub-systems (e.g., one change of address service/component; not one for every application)

As we discussed in section 2.1, how a Single Window facilitates the information sharing can be designed in different ways. The success of a Single Window highly depends on the ability of Single Window's components and interfaced or integrated information systems to interoperate and the ease in which data can be shared, integrated, and exchanged among stakeholders of the international supply chain residing both within and outside national boundary (UN/CEFACT, 2006). In the end, a SW entails that the traders face only one single online authority to deal with the formalities regarding the flow of the goods.

3.4.2 Options to establish interoperability

Many countries/ economies have already developed an interoperability framework that addresses these different aspects of interoperability. Examples of interoperability frameworks are provided in Table 8. These frameworks are mostly for domestic implementation purposes and as a result they are not necessarily providing for interoperability at an international level.

Table 8. Examples of Interoperability Frameworks

Countries/Economies	Available at URL
Australia	http://www.finance.gov.au/e-government/service-improvement-and-delivery/australian-government-information-interoperability-framework.html
European Union	http://ec.europa.eu/idabc/en/document/1439
Hong Kong	http://www.ogcio.gov.hk/eng/infra/eif.htm
Malaysia	http://www.mampu.gov.my/mampu/pdf/ISPlan/ispdoc/Interoperability%20Framework.pdf
New Zealand	http://www.e.govt.nz/standards/e-gif
United Kingdom	http://www.cabinetoffice.gov.uk/govtalk.aspx

As we have stated before, the development that we see that there is a vision to interface national Single Window systems with each other, means that it is important to consider interoperability also at the international level. To the extent that there are interoperability frameworks available, such as in the EU, we still see that there is a need to further consider how to ensure interoperability at the national level as well. There are different options to bring about the interoperability that is needed to achieve a functional Single Window:

- **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 (see Appendix B).
  - 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** (see section 3.3). 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.

These options have to be evaluated and selected based upon for example the current situation in a specific country and the objectives of the SW implementation.

3.4.3 Summary and positioning of interoperability in the SWIF

In general, the realization of different aspects of interoperability can be facilitated by two means. First, it is considered essential to use common development approaches and standards. With that respect, the SWIF supports the interoperability of Single Window by providing a systematic way of approaching the development and implementation of the SW. It can be used as a coordination mechanism, between the different Phases and the inputs/ outputs of these Phases. Moreover, the guidelines and techniques offered in the other sections of this chapter have addressed several common approaches and standards. Second, we have discussed interoperability of Single Window in a more narrow sense, pointing to the interoperability of the SW itself, which can be realized through the use of common communications and computing infrastructure including operating systems, database management, data interchange, network services, network management, and user interfaces that are based on open systems. The options discussed, namely technical interoperability, semantic interoperability, data re-use, and business interoperability, relate in particular to Phase B Business Architecture and Phase C Information System Architecture of the SWIF and Requirements Management. Business Process Analysis and Simplification (see 3.2) as well as Data Harmonization (see 3.3) are underpinning the implementation of these options. Furthermore, the way interoperability is realized may also have legal consequences. The next section deals with the realization of the legal framework.

3.5 Realization of the Legal Framework

This sub-section discusses the rationale for realization of the Legal Framework (RLF), key RLF steps, and ends with a summary as to how RLF is positioned in the SWIF.

3.5.1 Rationale for realization of the Legal Framework

The international trade environment is a highly regulated environment (Henriksen et al., 2008). The current legal environment in many countries regarding trade procedures and the flow of trade-related information consists of a complicated network of written agreements including memoranda of understanding, service-level agreements, legislation, policy and procedures that exist in order to manage and regulate the data currently collected, stored and shared (UN/CEFACT, 2006). The use of the SW has to be in alignment and compliance with the national and international legal setting with respect to the processes in which the SW is introduced as well as the electronic data exchange in these processes. With the introduction of a Single Window facility, the legal environment will need to be reviewed and streamlined. The legal framework (LF) refers to the set of measures to address legal issues related to national and cross-border exchange of trade data required for Single Window operations (UN/CEFACT, 2009c).[11] The objective of the realization of the legal framework (RLF) is to identify and implement this set of measures.

There are several key considerations for RLF in the context of the SWIF, namely:

- In the context of cross-border trade, the legal environment encompasses the national and international level, which can be divided into the bi-/ multi-lateral level, the regional/ economic zone, and the global sub-level (comparable to the levels addressed in SMIC (see Figure 11)). Changes in the legal environment are complex and time-consuming, even more so at the regional/ economic and international level. Development choices need to be made in line with the existing legal environment, where applicable, and vice versa, the enterprise architecture of the SW will give rise to legal challenges that will need to be addressed.
- The regional and international initiatives and developments (see also 3.1) and SW vision, will influence the extent to which there is a need to establish bi-lateral or multi-lateral agreements to govern the operations of the SW. Legal interoperability and the terms for mutual recognition will be key concerns in the establishment of such agreements (UN/CEFACT, 2009c).
- It is important, to the extent possible, to incorporate “international standards” and best practices when developing legislation and regulations at the national level in order to be in a position to achieve international “legal interoperability” as trade through the national Single Window grows. For example, the principles of ‘non-discrimination’ between paper and electronic documents or messages and ‘technology neutrality’ are important considerations for both a domestic legal framework and for legal interoperability at the international level (UN/CEFACT, 2009c).

[11] The development and implementation process of the SW itself also gives rise to certain legal questions, for example regarding legal agreements between project partners, intellectual property rights, piloting new technologies, etc. These also have to be addressed in the SW development and implementation; however, they are referring to compliance and contractual agreements in the context of IT project management, rather than the actual international trade environment. The guidelines regarding the establishment of the LF do not further address this in detail.

3.5.2 RLF steps

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 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 SW enterprise architecture), and/ or at the different levels of the legal environment (i.e. need to take specific legal measures). Depending on the SW vision, the current legislation for use of IT, the use of innovative technologies for the SW 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 SW. 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, 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 SW 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 SW components) is made obligatory by the EU. Again, there are different degrees of freedom how SW components 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 SW (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 SW, or components thereof, 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 SW 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 SW 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.

3.5.3 Summary and positioning of RLF in the SWIF

Typically, TOGAF (2009) considers the legal aspects of an Enterprise Architecture in Phase E (Opportunities and solutions). However, given that SW implementations also involve implementing legal changes, activities pertaining to the regional and international context and assessment of necessary additions/ modifications in the law should be started up as early as possible in the SW implementation, because such legal processes may take considerable time.

Figure 19 visualizes the positioning of the RLF steps in the SWIF. The RLF depends on the architecture components, developed in the different phases, to assess compatibility/ compliance with the existing framework and to assess which changes would be needed in the legal setting. As the architectures become more detailed, the review and measures can be further detailed where necessary. As such, an assessment of the legal environment may take place as early as the Preliminary Phase and the Architecture Vision Phase A and show for example, that there is a need for mutual recognition of certificates. Initial debates and negotiations may then already be started up. Legal issues should also be considered at the Business Architecture Phase B, since in this phase, the current trade (transport & regulatory) procedures are examined, and where current rules, regulations and laws provide barriers and bottlenecks, suggestions for improvements can be made. The improvement suggestions could include the necessary legal framework, e.g. e-transaction law to support and legalize electronic documents and electronic signatures.

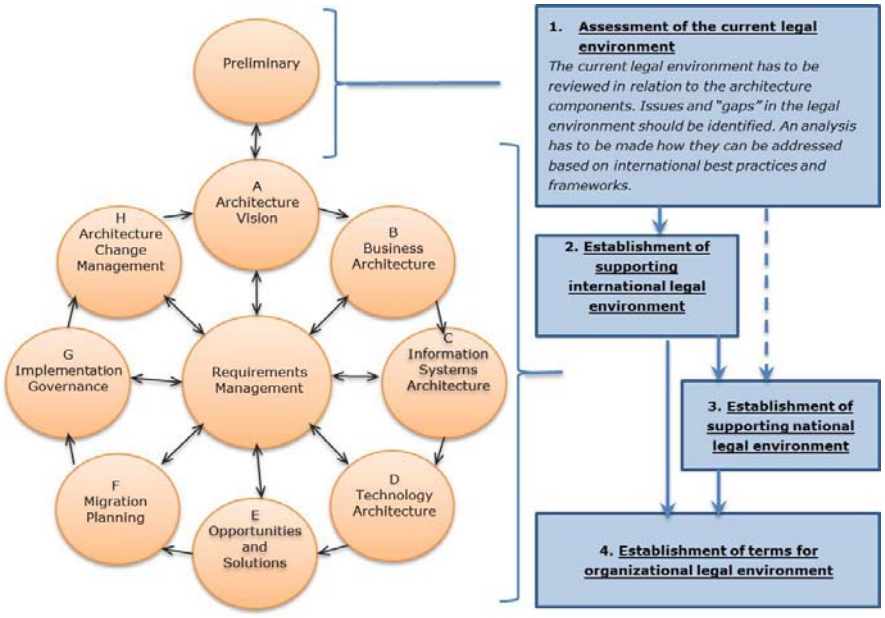


Figure 19. Positioning the RLF steps in the SWIF

RLF also provides input regarding feasibility and concerns relate to other activities (e.g. data harmonization, information systems architecture) and specific legal input for change management, as well as implementation governance.

4 Conclusions

Many governments worldwide have adopted the Single Window initiative as a national Programme of work since they recognize that Single Window is a crucial instrument that can be used to eliminate inefficiency and ineffectiveness in business and government procedures and document requirements along the international supply chain, reduce trade transaction costs, as well as improve border control, compliance, and security. Single Window systems are considered to be a means to establish improved information sharing between government agencies and businesses involved in cross-border trade. A Single Window can be used as a "one-stop shop" for traders and other commercial organizations to exchange information with the government agencies that, based on regulation and control procedures, require data on a variety of aspects of the trade transactions and the flow of goods through the international supply chain.

Single Windows were initially envisaged as a facility to expedite and simplify information flows between trade and government (UN/CEFACT, 2005). However, in many countries, Single Window projects have taken a much broader approach and are a strategic effort to simplify and automate cross-border trade usually at the national level and in some countries at the regional level. In implementing a Single Window, a Government aims to achieve a set of strategic objectives, including to increase revenue and transparency, to increase the competitiveness of the national economy, to achieve better integration into regional and global supply chains, or to meet wider policy agendas such as implementation of regional trade agreements. While these objectives and their importance are different in each country, the Single Window projects have certain features in common.

Moreover, they all face similar challenges that relate not only to the technical aspects of SW systems, but also to the organizational and inter-organizational, managerial, financial, political, legal, and national and international settings. Dealing with these challenges requires strong political will, long-term commitment 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, policy managers still need to develop a strategy transforming their vision into implementation. Therefore, a strategic and holistic framework that informs how these challenges can be systematically addressed is much needed.

For this purpose, we have introduced the *Single Window Implementation Framework* (SWIF). It builds upon the use of "enterprise architecture" to decompose and structure the challenges that accompany a SW implementation. The SWIF is an adaptation of the TOGAF Architecture Development Method to the specific requirements and features of Single Window projects. SWIF applies the principles of ADM to describe steps how to derive the SW architecture. It also provides the foundation for developing the national SW Master Plan.

Part I of the SWIF has provided a conceptualization of Single Window and the SWIF. The guiding principles underpinning the SWIF are phasing and alignment. SW implementations need to align IS and business strategies within the national but also international setting and developments for the long-run success. SW implementations usually follow a step-wise, phased approach and the SWIF provides a coordination mechanism between the overall SW Programme and sub-projects. Sub-projects typically involve a smaller set of stakeholders, based on prioritization and impact, and may focus on a sub-set of activities of the SWIF method (e.g. business process analysis and simplification for a sector with high trade volumes). It may also focus on a specific component that comprises the SW, such as interfacing or integrating one or more in-house information systems. Through cycling and

iterations, as well as the (re-) use of artifacts related to the SW architecture, these sub-projects are coordinated with the overall SW implementation.

Part II of the SWIF has presented a set of guidelines and techniques related to five areas that are essential for SW implementation, and that differ substantially from other information system implementation, thus requiring further adaptation of the TOGAF work. These areas are stakeholder management and interagency collaboration, business process analysis and simplification, data harmonization, interoperability, and the realization of the legal framework. We have provided a discussion of steps and considerations that need to be taken into account, and we have demonstrated where these fit in in the SWIF method.

The SWIF can also be seen as a useful structure for case comparison, as we have found for the SW implementation cases of Thailand and The Netherlands, which helps to synthesize lessons learned from prior and on-going SW implementations. For the future, this also facilitates the SWIF to the contexts of Single Window implementations in specific countries. The adoption of the SWIF to the specific objectives, needs and requirements of a national SW project delivers the National Master Plan for the Single Window implementation. The National Master Plan is seen as one of the essential coordination mechanisms, and the SWIF already provides ample input for their development.

Additional work on the SWIF can be used to further evaluate, adapt and tailor the SWIF. For example, we have already started to relate the SWIF to other results of the ITAIDE research, and to tailor the discussion further to the European context (Van Stijn et al., 2010). Moreover, the UN is also preparing “A Manager’s Guide to Single Window Implementation” based on the ideas presented in this deliverable. Future work on the SWIF could also focus on the development of a series of blueprints to prepare the National Master Plans, which we see as Part III of the SWIF, in order to facilitate the application of the SWIF during SW implementations.

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Appendix A: Thailand's Single Window e-Logistics[12]

A.1 Brief introduction to the case

The establishment of a National Single Window (NSW) is recognized as a strategy to improve the efficiency in documentary procedures required to expedite the movement of goods in and out of Thailand. It allows Thailand to pursue its agenda on Trade Facilitation Enhancement under Thailand Logistics Development Strategy (2007-2011) and the national long-term vision to become the world class logistics hub for Indochina as firstly identified in Thailand Logistics Master Plan (2005-2009) with an aim to achieve:

- A reduction in average trade transaction cycle time from 24 (World Bank, 2004) to 14 days by 2011.
- A reduction in trade logistics costs from 19% of GDP in 2005 to 16% by 2011.

In addition to the responses toward national policy directives, the NSW implementation in Thailand also reflects the need to foster regional integration and realization of an ASEAN Economic Community by 2020. In this regard, the Thai government together with governments of ASEAN member countries signed the "Agreement to Establish and Implement the ASEAN Single Window". According to the Agreement, Thailand is obligated to develop the system as well as make necessary procedural changes and regulatory reforms to enable the operation of National Single Window by the year 2008.
The collaborative effort of Royal Thai Customs, Ministry of Information and Communication Technology, and other government agencies and business stakeholders in simplifying procedural and documentary requirements as well as automating all import/export-related process as part of National Single Window initiative since 2004 yielded remarkable outcomes, including an annual cost saving of about 46 billion Baht (~ 1.53 billion US$). Table 9 summarizes Thailand's achievement in its attempt to increase an efficiency in the facilitation of cross-border trade to date.

Table 9. Thailand in Trading across the Border

(World Bank, Doing Business Report 2007 and 2010)

Year	Rank	Export			Import		
		Document*	Time**	Cost***	Document*	Time**	Cost***
2007	103	9	24	848	12	22	1,042
2010	12	4	14	625	3	13	795

* Number of official documents involved in exporting/ importing a standardized shipment of goods
** Number of days needed starting from the final contractual agreement between the two parties, ending with the delivery of the goods
*** US$ per Container

The implementation of Single Window nevertheless faced a number of challenges that lied in:

- The seeking of cooperation and support from all relevant stakeholders;
- The establishment of a common understanding among the stakeholders in all aspects of the initiative;
- The simplification and standardization of procedural requirements as they often require changes in existing laws and regulations;
- The selection of standards for the harmonization of documentary requirements and approaches for electronic exchange of information; and

[12] **Disclaimer**: The case study on Thailand's Single-Window e-Logistics was prepared by independent authors. The presentation of the case does not represent an official message of any organizations, administration or government agencies. It is based on authors' experience and involvement as consultants of some NSW stakeholders.

- The harmonization of documentary requirements especially when an approved standard is not available.

A.2 Decisions made about scoping, phasing and alignment

Consistent with the ASEAN's view of National Single Windows, Thailand's NSW is designed to support a single entry of identical data; a single synchronous processing of data; a decision-making for the clearance and release of cargoes at a single point; and a compilation of statistics for economic analysis and management. Thailand's NSW consists of ten components outlined below. Figure 20 demonstrates how these components fit together.

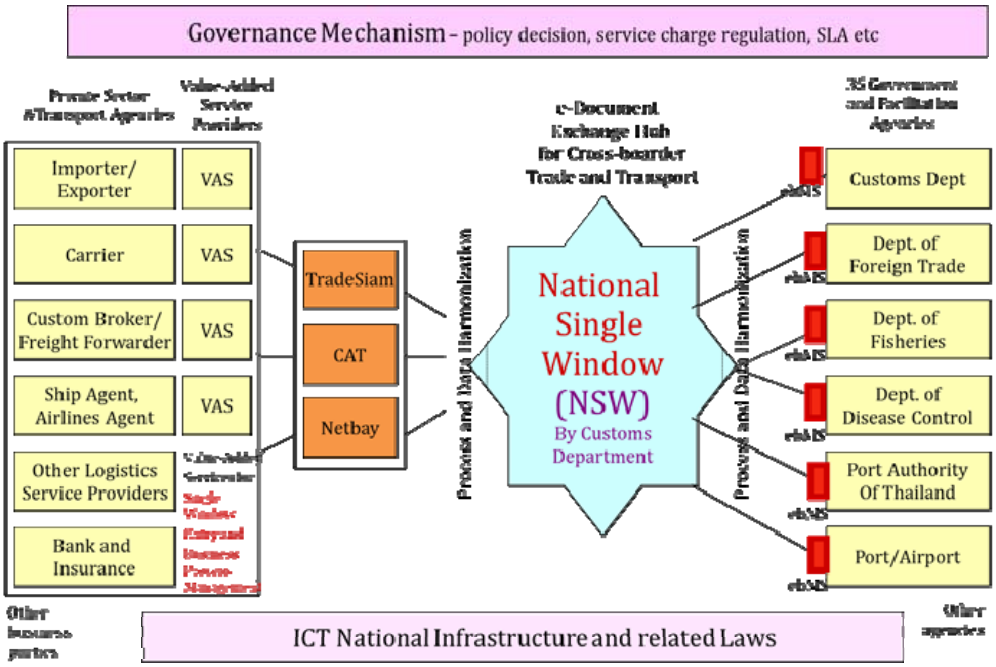

Figure 20. Thailand's NSW high-level Architecture

(Kerotho, 2009)

- The NSW exchange system that serves as a hub for electronic documents sharing and exchange, especially for G2G, G2B, and B2B interconnectivity. Its key features include an interface for sending and receiving messages in different protocols, authentication, non-repudiation, semantic translator, syntax validation, and ebXML Messaging Service (ebMS)[13].
- 40 import/export-related permit/license/certificate systems issuing by many government and regulatory agencies with additional modules that facilitate back-end integration and service arrangements with the NSW central exchange hub. The Paperless Customs system is included.
- Information systems that serve as communication interface between domestic traders, trade/transport intermediaries, and government agencies
- Information system that facilitates the application and issuance of permit/license/certificate for controlling government agencies who do not have permit/license/certificate issuing systems, trade/transport intermediaries
- Module that facilitates the interconnectivity between domestic permit/license/certificate issuing

[13] *ISO*/TS 15000-2:2004. Electronic business eXtensible Markup Language (ebXML) -- Part 2: Message service specification (*ebMS*)

systems and those overseas NSW systems, e.g. ASEAN member countries
- Module that facilitates the interconnectivity between members of domestic trade/transport community and their counterparts
- National Standard Data Set
- Message Implementation Guides
- Governance mechanism and criteria for the determination of transaction fee and quality of service
- IT physical infrastructure, Thailand's e-Government Interoperability Framework (TH eGIF), and legal framework

The development of Single Window in Thailand has been carried out in three phases.
- Phase 1 focuses on 1) the establishment of mutual understanding between Royal Thai Customs and other participating 35 controlling agencies; 2) the simplification of procedural and documentary requirements; 3) the development of Paperless Customs or e-Customs system[14] that also facilitates the electronic payment of duty and fee; and 4) the development of system that facilitates secured integration of electronic information.
- Phase 2 aims at offering full services for Paperless Trade where local traders can 1) use the information that they prepare in one single form to acquire any permit/license/certificate needed as well as seek approval for expediting the movement of goods across border; and 2) track the status of documents and the movement of goods via internet. The secured integration of electronic information among domestic stakeholders and their counterparts in the region is achieved.[15] In this phase, it is also expected that National Standard Data Set is incorporated by all domestic stakeholders.
- Phase 3 enables the compilation of statistics for economic analysis and management.

The next sub-section discusses the Single Window implementation efforts in terms of the SWIF.

A.3 SWIF phases, objectives, and activities

A.3.1 Stakeholder Management and Interagency Collaboration

Activities that aim at managing stakeholders and ensuring interagency collaboration span throughout the life cycle of NSW implementation. Efforts to achieve such objectives, however, are extensively spent in what SWIF recognizes as the preliminary and architecture phase.

A.3.1.1 Preliminary Phase

In year 2004, the National Competitiveness Development Committee (NCDC)[16] identified and reported to the Cabinet the needs to improve efficiency, reliability, security, and responsiveness of Thailand's logistics sector. The Cabinet consequently assigned top priority to the enhancement of the logistics sector and commissioned the development of the Thailand Logistics Master Plan (2005-2009). Thailand Logistics Master Plan (2005-2009) was later refined to better reflect economic and social changes and renamed Thailand's Logistics Development Strategy (2007-2011).

[14] Royal Thai Customs developed Paperless Customs using ebXML technology to replace its traditional EDI system which had been used since 1998.

[15] The interconnectivity between Paperless Customs and information systems of permit/license/ certificate agencies is the first target. The implementation timeline depends on the readiness of each individual agency.

[16] The National Competitiveness Development Committee (NCDC) is a high-level committee chaired by Thailand's Prime Minister. NCDC comprises all economic-related Ministers as well as representatives from key industry sectors.

In addition to the responses toward national policy directives, the NSW implementation in Thailand also reflects the need to foster regional integration and realization of an ASEAN Economic Community by 2020. In this regard, the Thai government together with governments of ASEAN member countries signed the "Agreement to Establish and Implement the ASEAN Single Window". According to the Agreement, Thailand is obligated to develop the system as well as make necessary procedural changes and regulatory reforms to enable the operation of National Single Window by the year 2008. Such political commitment fortified the need to implement NSW. It forced the creation of a platform for interagency collaboration and strengthened the justification for budget allocation.

A.3.1.2 Architecture Vision Phase

After the need was perceived, most stakeholders of the NSW were identified. The Cabinet appointed National Committee on Logistics Development (NCLD). NCLD consists of permanent secretaries from economic-related Ministers and representatives from trade-related associations. While the engagement of NCDC in the project reinforced strategic integration and thus mutual commitment among high-level decision-makers, the appointment of NCLD brought together the high-level management to plan and monitor Single Window implementation. The commitment at this level made stakeholders accountable to the project and obligated them to render collaboration.

The National Economic and Social Development Board (NESDB) was appointed as NCDC's and NCLD's secretary. While NCDC and NCLD provided a certain level of formality to project realization, NESDB played an important role in ensuring project continuity even under the vacuum of leadership resulting from instable political situations.

The Cabinet was another actor who played an important role in fostering interagency collaboration. It appointed two government agencies, based on their organizational role, responsibility, and capability, to lead and manage cross-agency issues as well as project implementation.

- Recognizing that Royal Thai Customs possesses in-depth knowledge of the business domain and relevant technologies, the Cabinet designated Royal Thai Customs as a lead agency to coordinate/lead NSW implementation and drive the information exchange between Thailand's NSW and NSWs of other ASEAN countries.
- Given that Ministry of Information and Communication Technology (MICT) has a mandate to promote the development and uptake of e-government, the Cabinet designated it as an agency responsible for managing several related projects, handling budget allocation, providing necessary nation-wide government network infrastructure, interoperability standards and legal infrastructure, and identifying the best appropriate business model[17] options in order to ensure a smooth operation of NSW.

As a lead agency, Royal Thai Customs initiated a working group to serve as an organizational mechanism to facilitate communication and coordination among NSW stakeholders. The working group had representatives from controlling government agencies as well as relevant trade and transport community. Two sub-working groups were formed. One worked on streamlining business processes and aligning data requirements. The other dealt with technical communication protocols and related security issues. With close communication among stakeholders, interests and expectations on the system were regularly addressed, managed and aligned by the lead agency.

[17] The business model defines the services that NSW offers to targeted customers, resources required to provide those services, how the provision of those services is financed, pricing strategies, and revenue stream.

The appropriate appointment of lead agencies and the formation of sub-working groups provided the foundation for operational integration. However, there was also confusion on how independent agencies could function as a single entity with authorities for problem-solving. The high-level architecture of Thailand's NSW in was developed and used as means to clarify project definition and roles of each stakeholder. It provided a clear overall picture and common vocabularies, promoted common understanding among stakeholders both business sectors and responsible government agencies particularly the budgeting bureau, and strengthened integration at the operational level.

Having one agency in charge of system implementation and another in charge of cross agency issues and project management, on one hand, is advantageous as the roles and areas of work of two lead agencies are complimentary. MICT pushed the development of artifacts necessary for cross-agency cooperation, such as National Standard Data Set and Thailand e-Government Interoperability Framework, which Royal Thai Customs was not ready to take early on in the project. Several findings from the studies related to the simplification of business processes as well as the development of NSW business models and governance mechanisms conducted by MICT provided information that served as crucial inputs for decision-making processes participated by Royal Thai Customs and other stakeholders.

Having two lead agencies, on the other hand, has a disadvantage. The ministerial bureaucracy in MICT held back budget allocation. It led to project implementation delay.

The roles and areas of work of two lead agencies were somehow changed later on in the project implementation. Royal Thai Customs expressed the intent to lead the revision and refinement in the following areas of work:

- The development of guidelines for system implementation and integration;
- The harmonization of data requirements;
- The development of National Standard Data Set; and
- The development of governance mechanisms and the identification of criteria for the determination of transaction fee and quality of service.

The action plan was therefore adjusted accordingly.

A.3.2 Business Process Analysis and Simplification

Business process analysis has been conducted as one of key activities in various projects under NSW initiative. The scope of study is limited to processes that are common to all traders using four modes of transport (trains, trucks, ships, and airplane), and also the export and import of national strategic products. The outputs of business process serve as input for several activities including:

- The derivation of possible investment and revenue models
- The harmonization of data requirements and the development of guidelines for electronic message
- The design the architecture of the future information systems
- The development of recommendations for business process simplification

The automation of business processes is one form of business process simplification. It allows electronic declaration of goods, electronic application for permit/license/certificate, and receipt of approval online. The electronic approval of permit and the electronic integration of permit information and goods declaration information not only fasten the clearance process but also eliminate the need for traders to travel to collect a permit at an office of a permit issuing authority and to submit the permit at a corresponding office of Royal Thai Customs. It thus abolishes some travel costs and time that traders have to spend to obtain documents required to expedite the movement of goods across borders. With electronic integration of such information, integrity and accuracy of trade information

can be improved.

It should be noted that recommendations to remove redundant and non-value added business processes cannot always be implemented as they often require the changes in certain laws and legislation. In fact, business processes that are burdensome in traders' perspective may be seen as critical and necessary in controlling government agencies' point of view. Close consultation with all relevant stakeholders are therefore crucial prior to implementing the simplification of business process.

A.3.3 Data Harmonization

The data harmonization efforts contributing to the development of Thailand's NSW have been carried out in three phases.

- Phase 1: Transport-related data requirements from 58 documents
- Phase 2: Data requirements from 189 documents used in business processes associated with the issuance of permit, license, and certificate carried out by 21 government agencies.
- Phase 3: Data requirements from other government agencies and trade community including bank and insurance.

The harmonization of data requirements in Thailand was conducted at a time where only a few standards that provide generic semantic rules and that could serve as a building block for aligning the definition, representation, as well as the cardinality and location in the electronic message of each data element were available. In line with recommendations from SWIF, the selected standard, Buy-Ship-Pay UN/CEFACT Business Standard Subset for International Trade which is previously known as UNeDocs, for data harmonization in Thailand was generic yet sufficiently contextualized to cover documentary requirements of all stakeholders in the international supply chain. It was also based on dictionary entry names from UN/CEFACT Core Component Library (CCL) and complied with UN/CEFACT Core Component Technical Specification (CCTS: ISO 15000- 5/ebXML).

As the UNeDocs project of the UN/CEFACT working party has been discontinued, Royal Thai Customs has planned the harmonization of those data requirements using WCO Data Model version 3.0 as a reference.

A.3.4 The Use of Open and International Standards for Interoperability

Thailand's e-Government Interoperability Framework (TH eGIF) was developed to provide a policy framework that promotes the integration and exchange of electronic information among government agencies using information systems that are operated on different ICT platforms. It recommends Enterprise Architecture as a methodology that guides the initiation and management of interorganization systems implementation. It provides a set of guidelines that forms a basis of interoperability among applications in respect to process, data, and technical communication protocol.

TH eGIF comprises two major parts. The first part deals with managerial aspect of applications integration and development. The second part provides a set of common rules that guides different phases of application development from the elicitation business requirements in terms of process and information to the derivation of XML Schema from information model. The common rules are based on internationally-accepted standards. They include:

- UN/CEFACT's Modeling Methodology for an analysis and modeling of process and information requirements
- UN/CEFACT Core Components Technical Specification (ISO 15000-5) for the construction of information model
- UN/CEFACT Core Components Library (CCL) as a basis for harmonizing the definition and

representation format of data requirements
- UN/CEFACT XML Naming and Design Rules for transforming CCTS-based information model to XML schema

Technical specifications including communication protocol and security measure required to ensure secure and interoperable exchange of information are also provided in the second part of TH eGIF.

A.3.5 Legal Framework Development

There has been a remarkable progress in the development of legal framework necessary to support the uptake of e-business in Thailand. Following the effective enactment of Electronic Transaction Bill with an incorporation of Electronic Signature on April 3, 2002, Electronic Transaction Commission chaired by Minister of Information and Communication Technology was founded according to Article 102 of the Bill with the mandates:
- To make sound policy recommendations to the Cabinet regarding the promotion and development of e-business as well as resolutions for any hindrance occurred;
- To monitor the operation of e-commerce;
- To propose the development of necessary royal decrees to support the enforcement of Electronic Transaction Bill;
- To issue regulations relevant to the implementation of electronic signature; and
- To handle all other matters as indicated in Electronic Transaction Bill.

Under Electronic Transaction Commission, several initiatives that provide critical foundation for the development of e-commerce have been carried out by the Sub-committee on Legal Infrastructure. Key initiatives include:
- The Royal Decree on Regulatory Practices in e-Government Implementation;
- The Royal Decree on Electronic Fund Transfer;
- The Royal Decree and Supplementary Regulation on Services Related to Electronic Certification; and,
- Computer Crime Act.

A.4 Summary and outlook

Thailand is now in the second phase of NSW implementation. Figure 21provides a snapshot of achievement so far and some of the key ongoing works.

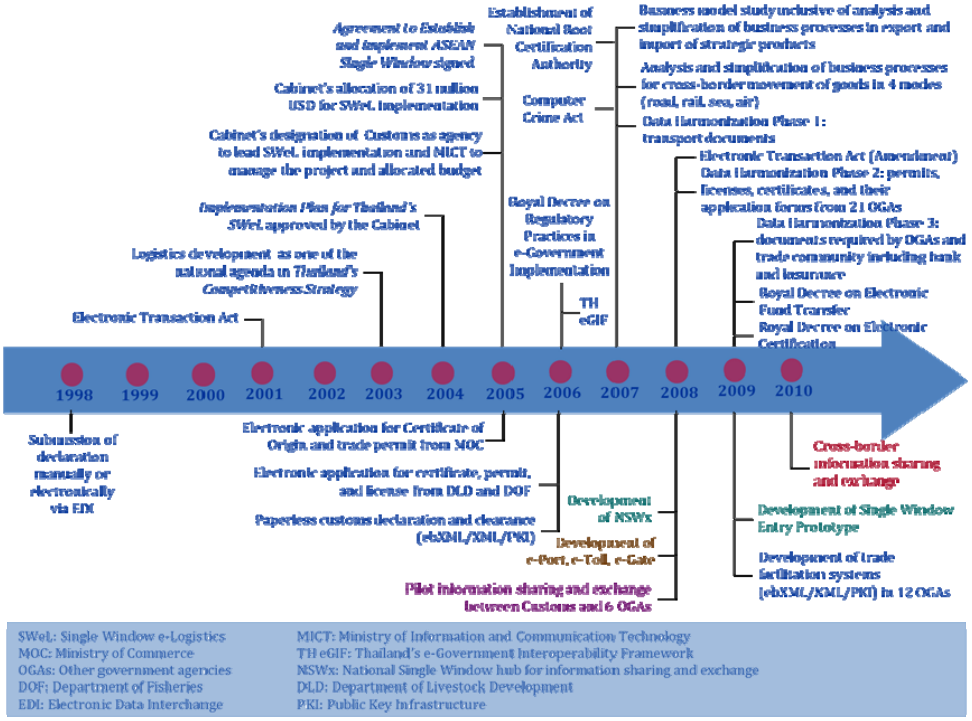

Figure 21. Thailand's NSW implementation

Participating government agencies are however in different stages of development. Some have already had the back office systems that are capable of interconnecting with e-Customs in place (but still incapable of supporting the use of e-Signature due to developers' lack of relevant knowledge and experience). Some are in the process of developing back office systems. Some are in the process of testing the interconnectivity with e-Customs. Some are now working with Royal Thai Customs on identifying a set of data to be exchanged. Some expressed the need to use NSW as a channel to issue permit/license/certificate.

Value-added service providers (VAS) have developed software that supports the preparation of documents and the management of export and import procedures. The available services are unfortunately limited and do not respond fully to business needs.

Appendix B: Single Window implementation in The Netherlands

B.1 Brief introduction to the case

Dutch customs has a long history in developing and implementing EDI (Electronic Data Interchange) to support customs declarations. They have implemented their specific EDI messages for import and export declaration before international message standards became available. The last ten years, they have implemented EU systems like NCTS (New Computerized Transit System) and systems for border management. It implies that all customs declarations are largely processed electronically and the use of paper documents has been omitted for customs procedures. Currently, Dutch customs' information systems are under revision and are to be replaced by new IT systems.

Dutch government and business (shippers, consignees and logistic service providers) are keen to develop and implement a Single Window solution for all procedures, comprising data sharing between (1) government authorities in different countries and (2) companies and government authorities in the Netherlands, with the objective contribute to tripling the annual contribution of Dutch logistics and supply chain sector from 3 billion € (2007) to 10 billion € (2010) (http://www.dinalog.nl). To reach this objective, the Extended Single Window project is starting and pilots will be initiated. In the meantime, discussions are taking place at both EU (European Union) and national level. Therefore, Dutch developments always need to be seen in the perspective of EU developments and international legislation such as the EC's Modernized Customs Code.

The following case will illustrate that the development of a Dutch Single Window, which is still fully in progress, follows an evolutionary approach. The key explanation lies in the governance of developments within the Netherlands that has its root in the past. Each authority gradually automated its processes, also depending on international developments and legislation, which led to a different start for IT implementation at a different pace for those authorities. Integration over authorities as required for a Single Window requires that the maturity level of all organizations involved needs to be similar. Maturity is not only IT maturity, but also involves strategy, organization, processes, personnel and finance.

B.2 The European context

All government authorities of the Member States of the European Union have to adhere to EU legislations as defined by EC Regulations. Member States are allowed to interpret the EU Regulations for applying it in their domain, resulting in national legislation, but always have to stay within the limits of those regulations. It also implies that Member States are free to implement more functionality than required by the EU.

In the context of Single Window, the subsidiary concept is one the most important concepts for EU legislation and also IT developments. It implies that the EU can only develop laws, regulations, and IT systems solving issues common to at least two Member States and conform to EU politics. Regulations are mandatory to Member States and approved by the European Council and Parliament. These regulations might be supported by IT solutions, e.g. the regulation of the New Computerized Transit System Specific needs to be implemented according to the Design Documentation for National Transit Administrations (2003). Unless otherwise enforced by EU legislation, these IT solutions specify the minimal requirement for Member States to cooperate in shared processes, meaning that interfaces between authorities in different Member States are defined unambiguously and facilities to support these interfaces are offered by the EC.

In the context of Single Window, several directorates are involved, namely DG/TAXUD (VAT & Customs) for customs procedures together with veterinary and phyto-sanitary formalities and with agricultural import and export licenses, DG/Agri, DG/Sanco (veterinary and phyto-sanitary), DG/ Trade, and DG/MOVE (Mobility and transport for the development of a maritime Single Window and entry formalities). Furthermore, the EC has adopted the IMO FAL as the set of documents required for maritime transport and the WCO data model as a basis for developing a Single Window.

Currently EC DG/TAXUD is driving Single Window developments as defined in the Multi-Annual Strategic Plan (MASP version 9, 2008). This particular document clearly outlines the complexity of implementing Single Window for the European Union. It comprises:

- Laws and regulations. These are the Modernized Customs Code (MCC, Regulation (EC) No 450/2008) and the Electronic Customs Decision (DECISION No 70/2008/EC). The MCC recognizes the importance of IT systems and the Electronic Customs Decision is trying to establish a commitment of all Member States to support electronic communication. Whereas the MCC has to be implemented by all Member States, the Electronic Customs Decision is not mandatory.
- A governance framework with three layers of decision making:
    - Layer 1: Customs Policy Group (CPG) / Customs Code Committee (CCCommittee) / Customs 2013 Committee with senior and middle management representatives of all Member States to deal with management issues.
    - Layer 2: Electronic Customs Group (ECG)/ Other C2013 Steering Groups with middle management representatives from all Member States / Candidate Countries with competency in legal, procedural, project management, operational, planning and IT technical aspects and being mandated by their administration.
    - Layer 3: Single projects (seminars, project groups, benchmarking, etc.) with delegates from some or all Member States / Candidate Countries having expertise in a specific electronic customs related subject and having been mandated to work on the issue in accordance with the terms of reference indicated in the approved projects.
- Establishing a Trade Contact Group for exchanging views and stimulating solutions with economic operators.

EC DG/TAXUD has just initiated a Single Window initiative that intends to harmonize data of customs and veterinary goods flows for import and export procedures, based on the WCO data model 3. As there is no EU Regulation governing the implementation, this will be left to all participating national authorities.

B.3 The Dutch situation

B.3.1 Stakeholder Management and Interagency Collaboration

Dutch Customs was the first to automate electronic procedures for goods flows. Initial development started in the late 1980s until the beginning of this century. Furthermore, they perform certain tasks on behalf of other authorities, e.g. visual inspections of containers.

Later on, other authorities like the Port Authority, veterinarian and phyto-sanitarian inspections decided to automate their processes and the communication with business. Internationally, Port Authorities came to an agreement for dangerous goods declarations (PROTECT project). The Dutch Ministry of Agriculture has now the Client IT-s incoming system operational for veterinarian and phyto-sanitarian declarations, including international data exchange regarding the Certificate of Origin on a bilateral basis. Data harmonization of the Client system and the customs system for outgoing cargo has taken place, which means that common terminology and data formats are in use.

Table 10 presents an overview of all authorities involved in goods flows and the department that governs those authorities.

Table 10. Overview of involved Dutch authorities and their roles in cross-border trade

Governing department	Authority	Role
Department of Finance (Financiën)	Tax Department - Dutch Customs	Supervises cross-border goods traffic based on tax regulations and, mainly on behalf of other ministries, based on rules with respect to health, safety, the economy and the environment. http://www.douane.nl
Department of Mobility and Transport (V&W)	Directorate-General for Public Works and Water Management (RWS)	Manager of the main waterways in the Netherlands. It monitors compliance with traffic legislation and environmental requirements on these waterways. http://www.rijkswaterstaat.nl
	Transport and Water Management Inspection (IVW)	Conducts the safety and environmental supervision of seagoing and inland waterway vessels, crews and carriers, and supervises the transport of dangerous goods. http://www.ivw.nl
	Harbor masters	Responsible for the swift, safe, clean and secure handling of shipping. This involves the supervision of operational and environmental issues, high-risk activities and compliance with relevant transport legislation. http://www.portofamsterdam.nl and http://www.portofrotterdam.com
Department of Housing, Spacial Planning and the Environment (VROM)	Food and Consumer Product Safety Authority (VWA)	Supervises the import of food products, consumer products and animal feed. This authority inspects the kitchen hygiene on passenger ships. http://www.vwa.nl
	Inspectorate of VROM (VROM-I)	Monitors the rules with respect to dangerous goods, radioactive substances and waste (including shipping waste). Compliance with the EEC Regulation on the supervision and control of shipments of waste within, into and out of the EU (referred to as 'EVOA' in Dutch) is a part of this. http://www.vrominspectie.nl
Department of Agriculture (LNV)	Plant Protection Service (PD)	Supervises the import of plants and products of vegetable origin to prevent plant diseases. http://www.minlnv.nl/pd
Department of Inland Affairs (BZK)	Water Police Division of the National Police Services Agency (KLDP/DWP)	Responsible for supervision and enforcement on the main transport corridors, the main waterways, extended water surfaces, the territorial waters, the Exclusive Economic Zone up to the low waterline and the seaports with the exception of the Rotterdam port area. http://www.politie.nl/klpd
	National Coordinator for Terrorism (NCTb)	Monitoring security in chains including the individual participants in those chains.
Department of Legal Affairs (Justitie)	Royal Marechaussee (KMar)	Charged with border control in the ports with the exception of the Rotterdam port area. http://www.kmar.nl and http://www.dutch-immigration.nl
	Seaport Police	Charged with duties concerning border control, port security and crime, nautical issues, the environment and traffic. Responsible for the Port Expertise Centre (Haven expertisecentrum) for information exchange between services. http://www.politie-rijnmond.nl and http://www.dutch-immigration.nl
Department of Social Affairs (SZW)	Labour inspectorate (AI)	Monitors health and safety at work on the quayside in the port areas and aims to prevent labour market fraud. Inspection of working conditions on seagoing vessels is assigned to the Transport and Water Management Inspectorate (IVW). For inland shipping the Seaport Police (ZHP) and the National Police Services Agency (KLPD) are designated as co-supervisors. http://www.arbeidsinspectie.nl
- (private)	Alert Supervision (KRVE)	Safety regulations
- (private)	Schiphol Airport (NV Luchthaven Schiphol)	Responsible for spatial planning, (food and water) safety and security of the airport

There have been various efforts to develop a SW. One of the first has been the Electronic Government Office (ELO: Electronisch Loket Overheid) for the development of one point of contact of business with

government authorities (late 1990s). The project was driven from business and coordinated with research, but lacked sponsors within the government.

The second project, sponsored by the CEO of Dutch Customs for the Rotterdam port and various port authorities, Electronic Government File (EDO: Electronisch Dossier Overheid, 2000-2002) also lacked sufficient support of sponsoring within the responsible departments.

In parallel with EDO, the Rotterdam Port Authority initiated the development of a port system that is currently implemented by the major Dutch ports (Portbase). At the same time, The Dutch Government installed one point for communicating with government authorities (OTP, now called Digipoort), which is used by all relevant authorities. The Schiphol airport has another community system, Cargonaut, which is also used for data sharing between business and customs.

Quite recently, the Dutch Department of Economic Affairs initiated a program to reduce administrative costs for goods flows (SSGV: Slim Geregeld, Goed Verbonden), in which also other departments cooperate. It has resulted in a system called Supd@x that is going to be piloted by Dutch Customs and nVWA for veterinarian inspections. Furthermore, the Inspectieraad recognizes 24 domains of inspection, of which maritime transport is one. Within the Inspectieraad, 15 government authorities participate including Dutch Customs, nVWA (food inspection). In the domain of maritime transport, Dutch Customs (goods flow), Harbor Masters (vessel information according to IMO FAL and security), and the port police (KMar and Zeehavenpolitie) cooperate[18].

Furthermore, a research project funded by the Dutch Institute of Advanced Logistics (Dinalog) is to develop a new architecture of an Extended Single Window. The Department of Finance, Dutch Customs, Portbase, Cargonaut, Schiphol Airport, and a number of large shippers participate in this project.

B.3.2 The current architecture

Figure 22 shows the various systems, their communication interconnections, and the declaration data flows based on EDI messaging.

Figure 22 shows that Portbase and Cargonaut are Port Community Systems. At Schiphol Airport, communication with NV Luchthaven Schiphol and customs is always via Cargonaut. The ports of Amsterdam and Rotterdam have Portbase, which is not mandatory for declarations. All messaging is physically via Digipoort.

Economic operators are all those organizations that are involved in supply chains. These are shippers, consignees, forwarders, carriers, shipping lines, stevedores, etc. One organization can also have various roles implying that for instance a shipping line can be a forwarder and carrier.

Dutch Customs has information systems for import (Sagitta Invoer), export (Sagitta Uitvoer), outgoing (Manifest Uitgaan), and entry Manifest(Binnenbrengen) that are linked with NCTS for transit goods to other Member States and ECS (Export Control System) for goods exported to other Member States. The import and export system are based on proprietary EDI message formats, since there were no message formats at the time the system was implemented. The other systems are based on Message Implementation Guides for international EDI message formats. New customs declaration systems probably will probably also support XML Schema. They will make use of the WCO data model

[18] See the Water transport supervision plan 2010, available at http://www.inspectieloket.nl/domeinen/zeehavens/documenten/

version 3.0, which not only specifies mapping to EDI but also the use of XML Schema.

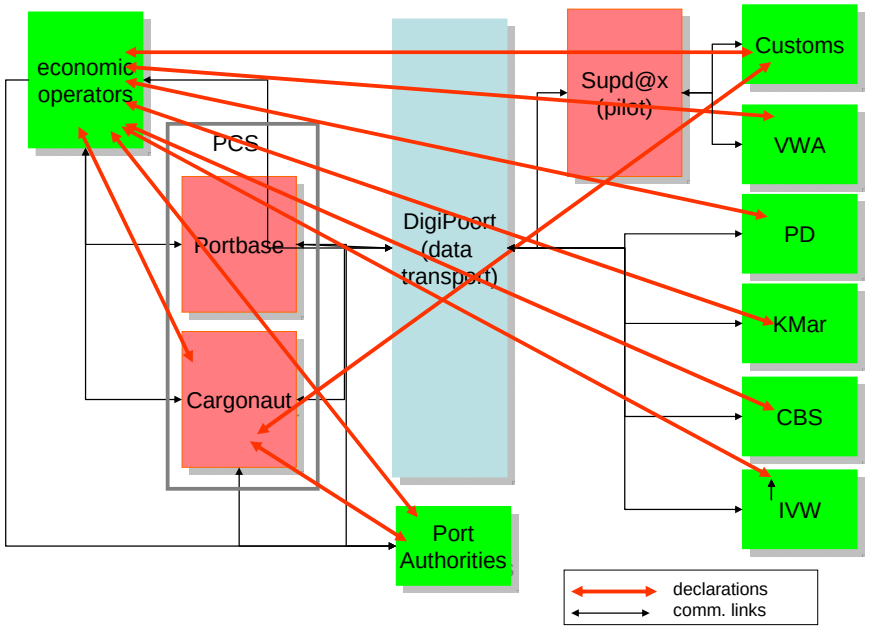

Figure 22. Current Architecture in The Netherlands

VWA and PD use the Client IT-system to support their processes veterinary and phyto-sanitary inspections. They have their specific Message Implementation Guides of which data is harmonized with those of incoming and outgoing cargo.

The maritime Port Authorities use the PROTECT messages for dangerous goods declarations. It has been agreed that all other documents confirm to the IMO FAL for maritime transport (information used for instance by KMar, IVW, and Seaport Police). Each maritime Port Authority has other messages for handling finance in for embarking.

The basic messaging for integrating with the Port Community System from Portbase are IFTMCS and IFTDGN EDIfact messages that are combined with the BERMAN and transformed into a CUSREP and CUSCAR message for communication with the Dutch Customs. The basic messaging for integrating with Cargonaut are freight forward manifest (FFM) and the electronic Airway Bill (AWB) or House-AWB defined by IATA, the International Air Transport Association.

B.3.3 The foreseen architecture

Figure 23 visualizes the proposed new architecture. The objective of the foreseen architecture is to fully implement Single Window and allow for coordinated border management. The process to realize the foreseen architecture is based on (1) coordination between all previously identified stakeholders including coordination with the EC, (2) research into a new architecture within a research project of Dinalog, the Dutch Institute of Advanced Logistics, and (3) piloting with the business. This section focuses on research aspects of the foreseen architecture.

The objective of the new architecture is coordinated border management with integration to hinterland gateways thus leading to improved logistics flows via the Netherlands. To achieve this objective, research into the application of a shared virtual data space implemented by an Event Driven – (EDA) and Service Oriented Architecture (SOA), is performed. Conceptually, each logistics service provider

and government authority is responsible for its data of the virtual data space and shares data with others by granting access to these others. A semantic framework specifying all required data in the virtual shared data space will be developed, based on existing models and components like defined by the WCO data model and the UN/CEFACT Core Components. The semantic framework is the result of data harmonization: it will specify all concepts and their associations shared amongst all logistic service providers and government authorities and the view of each role on the data, e.g. the view on the data for a stevedore will differ from the view of customs. Furthermore, these views have to be differentiated into views for data sharing and data processing: internally a stevedore will have a different data structure as the one used for sharing information with others in logistic chains. The construction of such a semantic framework is for further research.

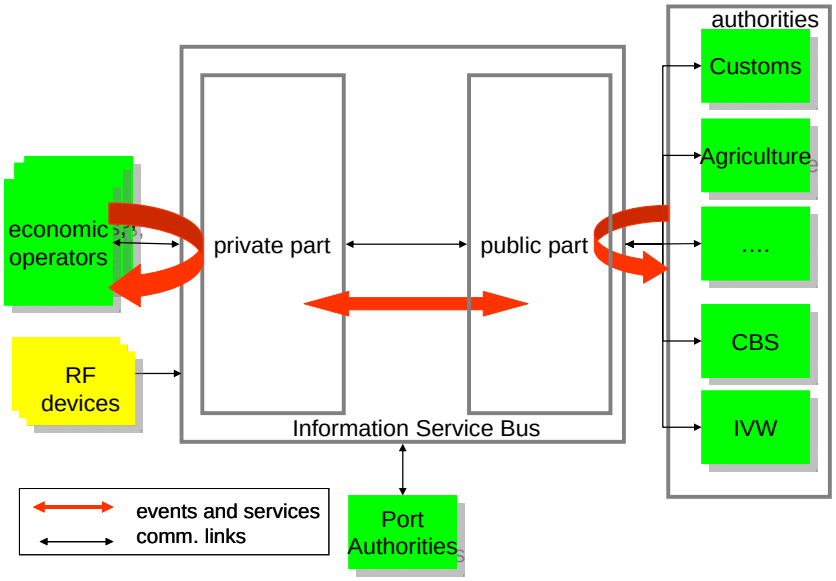

Figure 23. Foreseen Architecture in The Netherlands

Data and process synchronization can be implemented by various technologies like EDA combined with services according to SOA or a declaration based approach. EDA is based on events published by logistic service provider or authority to which others can subscribe (Overbeek et al., 2009). The architecture supports autonomy of each actor, implying that each actor can make its particular decisions with sufficient knowledge of any other actor. EDA is a means of process alignment by publishing state changes and subscribing to these state changes. It can be used for instance to inform a port authority and customs on the arrival of a vessel, upon which they can take action. Other examples of this mechanism can be used to coordinate inspection planning. Events indicating that an authority intends to perform an inspection can be retrieved by other authorities, upon which they can plan potential inspections. As each logistics service provider or government authority behaves autonomous, process synchronization based on such an event mechanism is for further research, e.g. different authorities may plan for inspection and publish the same event at a similar time.

Processing events requires data that can be retrieved by services (data pull) according the SOA paradigm. A declaration based approach based on a messaging paradigm combines process and data synchronization: each message is of a type that refers to an event and at the same time carries the data. The SOA and messaging paradigm have to be implemented by a so-called concrete syntax like XML Schema (XML: eXtensible Markup Language). Most implementations based on the messaging paradigm currently support EDIfact (Electronic Data Interchange for administration, customs and

transport). Implementation of the semantic framework in a concrete syntax is called 'grounding'. Grounding a semantic framework is another research issue.

By grounding, the foreseen architecture can both support innovative technology and the current technology, thus allowing all stakeholders to gradually migrate to a new situation. However, as coordinated border management is not yet fully implemented, new events will have to be specified and processes of authorities will have to be adjusted to cater for these events.

The so-called Information Service Bus supports the virtual shared data space and its implementation by events with services and a declaration approach. The Information Service Bus is decomposed in a public and a private part. It is expected that the public part will be implemented by government authorities, whereas the private part can be implemented by a Port Community System like Portbase and Cargonaut. The private part can also be implemented by economic operators, implying that they have to support any of the supported groundings.

The WCO data model version 3 will be used as input to construct the semantic framework of the virtual shared data space. Whereas the WCO data model is constructed as a class diagram, it is difficult to re-use without allowing any changes to international agreed classes and relations. New technology supports re-usability of referring to already constructed classes and concepts defined and maintained by a particular actor and extending them. Thus, the latest technology caters for a distributed specification of concepts and associations and sharing them. For instance, it allows customs to fully specify the semantics of its data requirements, that can be re-used by an agricultural authority, creating their requirements as a view on the customs requirements, and adding additional concepts and associations they require. Maintenance thus is also distributed.

The foreseen architecture not only needs coordination with all relevant stakeholders, but also needs to fit in all relevant international, EU, and national laws and regulations. These also imply that all cargo details need to be known 24 hours before loading on a vessel to customs. It also means that a Dutch Single Window implementation has to be viewed from the perspective of EU Single Window efforts as it needs to interface with other EC Member States Single Window implementations.

B.4 Summary and outlook

The Netherlands have taken an evolutionary approach to the development and implementation of Single Window. Business documents are still required by certain government authorities, but it is the objective to replace them with electronic data sharing, which can only be done when reaching global agreement. Furthermore, the Single Window efforts have been and are affected by the EU, in particular through the legal framework set at the EC level regarding procedures and requirements for the systems.

The Dutch Single Window developments are currently being driven by business requirements, both of the economic operators and the government. Both share the objective for improving logistic flows by coordinating inspections and reduction of administrative burden by sharing data between all stakeholders in logistic chains. Furthermore, the government authorities are driven by internal cost reduction to share data and coordinate processes.