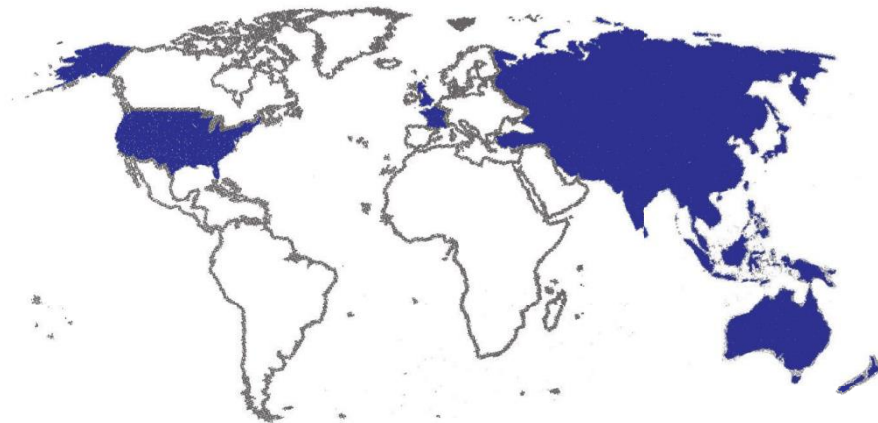


Information and Communication Technologies (ICT) for Trade and Transport facilitation:

**ICT related requirements and gaps
in implementing
Trade and Transport facilitation systems**

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¹ <http://www.unescap.org/events/meeting-review-ict-related-gaps-trade-and-transport-facilitation-asia-pacific-region>.

Abbreviations

| | |
|----------------|--|
| ACTS | ASEAN Customs Transit System |
| AEO | Authorized Economic Operator |
| ASEAN | Association of Southeast Asian Nations |
| ASEAN NTR | ASEAN National trade repository |
| ASYCER | Electronic Phytosanitary Certification System |
| ASYCUDA | Automated System for Customs Data |
| BCP | Border Crossing Point |
| BI | Business Intelligence |
| BPM | Business Process Management |
| CCL | Core Component Library |
| CDPS | Customs Declaration Processing System |
| CDS | Custom Developed Software |
| CoO | Certificates of Origin |
| COTS | Commercial-off-the-shelf |
| CPU | Central Processing Unit – processor |
| CUSCAR | UN/EDIFACT Message Type |
| DMZ | Demilitarized Zone (perimeter Network) |
| DR | Disaster Recovery |
| DTI | Direct Trader Input |
| ECM | Enterprise Content Management |
| e-CSD | e-Cargo Security Document |
| EDI | Electronic Data Interchange |
| EPZ | Export Processing Zones |
| ESB | Enterprise Service Bus |
| ETL | Extract, Transform and Load |
| FAL Convention | Convention of Facilitation of International Maritime Traffic |
| G2G | Government to government |
| HDD | Hard Disk Drive |
| HR | Human Resources |
| HSPA | High Speed Packet Access |
| IATA | International Air Transport Association |
| ICT | Information and Communications Technology - or Technologies |
| IDC | International Data Corporation |
| iOS | originally iPhone Operating System |
| IPsec | Internet Protocol Security |
| IRM | Integrated Risk Management |
| ISO | International Standards |
| ISP | Internet Service Provider |
| KPI | Key Performance Indicators |
| KRC | WCO Revised Kyoto Convention |
| LEITS | Law Enforcement IT System |
| MoU | Memorandum of Understanding |
| MPLS | Multiprotocol Label Switching |
| NCTS | New Computerized Transit System |
| NTM | Non-Tariff Measures |

| | |
|------------|--|
| OGA | Other Government Agency |
| OSS | Open Source Software |
| PC | Personal Computer |
| PKI | Public Key Infrastructure |
| QR Code | Quick Response Code |
| RCP | Rich Client Platform |
| RM | Risk management |
| ROI | Return on Investment |
| RTAs | Regional trade agreements |
| SaaS | Software as a Service |
| SAN | Storage Area Network |
| SLA | Service-level Agreement |
| SMS | Short Message Service |
| SOA | Service Oriented Architecture |
| SSD | Solid State Drive |
| SSL | Secure Sockets Layer |
| SW | Single Window |
| TCO | Total Cost of Ownership |
| TF | Trade Facilitation |
| TIR | International Road Transport |
| TTF | Trade and Transport Facilitation |
| TTFS | Trade and Transport Facilitation System |
| UN | United Nations |
| UN/CEFACT | United Nations Centre for Trade Facilitation and Electronic Business |
| UN/EDIFACT | Electronic Data Interchange For Administration, Commerce and Transport |
| UNECE | United Nations Economic Commission for Europe |
| UNESCAP | United Nations Economic and Social Commission for Asia and the Pacific |
| VAT | Value Added Tax |
| VOIP | Voice over Internet Protocol |
| VPN | Virtual Private Network |
| WAN | Wide Area Network |
| WCO | World Customs Organization |
| WEB | World Wide Web (WWW) |
| WSDL | Web Services Description Language |
| WSS | Web Services Security |
| WTO | World Trade Organization |
| XML | eXtensible Markup Language |

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1 Introduction

Trade and transport facilitation require governments, administrations and businesses to improve efficiency and effectiveness, to simplify, standardize and harmonize processes, documents and formalities, to foster partnership and cooperation, and to increase transparency. Information and Communications Technology (ICT) can support many trade and transport facilitation concepts and objectives. The value of ICT for trade and transport facilitation goes beyond concepts such as Single Windows. Automated business processes, digitalization of procedures, simpler interaction and transmission of data, and faster decision-making abilities deliver advantages in many trade and transport facilitation areas.

Taking an abstract generic perspective, this paper studies the linkage between trade and transport facilitation and ICT. It looks into the business needs of trade and transport facilitation (TTF) and how ICT can respond to these needs. Neither trade and transport facilitation, nor IT systems in public administration are new phenomena. But, so the paper argues, new policy and regulatory directions for trade and transport facilitation and new operational requirements have emerged in recent years. Thus the design of ICT architecture and its organizational underpinnings has to change to respond to these new requirements.

In recent years, many new ICT developments for trade and transport facilitation have been piloted. But in the overall, the approach to IT support in the area of trade and transport facilitation remains a piecemeal and silo approach that not only fails to deliver on efficiency and organizational re-design but also increases development and maintenance costs. This paper presents a broad perspective on TTF ICT business needs and describes the requirements of an architectural model to support TTF. Integration and modernization of ICT systems and architecture are the two essential directions for improvement so that ICT can deliver better service to its clients, the users in governments and private businesses, for trade and transport facilitation.

Based on an understanding that IT developments necessarily follows business, meaning operational, needs, this paper will talk about trade and transport facilitation business needs as well as ICT architecture and organizational requirements. IT architecture concepts are often difficult to understand for policy makers. This paper therefore is a description on a functional high level, which, we hope, will contribute to a better understanding from a business and technological point of view.

The paper will first present current trade and transport facilitation trends and the impact they have regarding ICT support. It will then present an architectural model for the integration and modernization of trade and transport facilitation systems and describe some of its features. A discussion of organizational and legal requirements supplements this discussion and completes the framework for Trade and Transport Facilitation ICT systems described in this paper. Some information on the state of preparedness of selected least and landlocked developing countries (Nepal, Kyrgyzstan, Mongolia and Myanmar) towards the implementation of a National Single Window for paperless trade is provided in annex for reference.

2 Mapping of trade and transport facilitation ICT requirements

The international regulatory framework for trade and transport facilitation changed in recent years. Modern trade facilitation solutions and measures bring in innovative approaches to simplifying administering procedures and operational practices. These approaches are based on cross-government integration, paperless trade, partnership with traders, an effective risk management, and a client, efficiency and integrity oriented public administration. Many of these practices call for the use of “modern technology” and rely on data exchange across organizational and geographical boundaries, and fast processing and data analysis capabilities. ICT is an enabler of trade and transport facilitation solutions and it can support efficiency, effectiveness client orientation and

security objectives in many areas. This chapter presents the key drivers for trade facilitation reforms and the scope of application of ICT for trade and transport facilitation objectives.

2.1 Changes in the TF regulatory and policy framework

2.1.1 Increased international cooperation

International cooperation on trade facilitation pre-dates the World Trade Organisation (WTO) but has been given more attention since the inclusion of trade facilitation as a topic under the WTO in 1992. Two multilateral agreements, the WCO Revised Kyoto Convention (RKC) and the WTO Trade Facilitation Agreement (TFA), have been negotiated² in the past years and now constitute a multilateral framework for a core set of trade facilitation measures and disciplines to be implemented and respected globally. They complement older legal instruments such as the UNECE Convention of Harmonization of Frontier Controls (1982), and the International Customs convention TIR (1975), the FAL Convention (1962) as well as other regional or transport mode specific agreements.

By way of creating these instruments, namely the WCO RKC and the WTO TFA, governments have deepened and strengthened their commitment to implement trade facilitation. The WCO RKC provides standards and recommendations to harmonize and simplify Customs procedures and practices. The WTO TF is a more horizontal Agreement that covers a wide range of government activities such as:

- Transparency and participation in policy making of non-state actors;
- Access to and administrative and judicial review;
- Simplification of Customs clearance procedures;
- Non-discrimination and simplification of non-Customs control measures;
- Administrative simplification;
- Use of information technology for processing and data exchange;
- Agency cooperation and cross-border cooperation;
- Transit traffic; and
- Customs cooperation.

Implementation of the Agreement will require WTO Members to take legislative and non-legislative, i.e. organizational or practical measures. Although the Agreements may not directly call for specific ICT systems or applications, the implementation of large parts of the Agreement rely on established practices as well as future ICT developments.

Older agreements, such as the TIR and the FAL Convention, have recently been amended or are in the process of revision to accommodate technology changes, namely the use of electronic instead of paper documents. The 2005 changes of the FAL Convention respond to electronic document requirements and define electronic data message equivalents of the so-called FAL Documents, including the widely used CUSCAR for the cargo declaration. The Convention does not require but recommends use of electronic data information exchange in whatever format, including XML. The computerization of the TIR procedure and replacement of paper TIR carnet has been a focus of phase III of the TIR revision and several IT applications for the TIR procedure have been developed, including for the electronic pre-arrival document submission, and for monitoring and requesting TIR carnet status information³. TIR contracting parties have also launched the e-TIR project in 2003⁴.

² The WTO TFA was adopted in November 2014 but has not yet entered into force, and the WCO RKC was adopted in 1999 but required 41 parties to ratify the Convention to enter into force. This was only achieved on 3 February 2006. Currently, August 2015, there are 102 parties to the Convention.

³ Real-time SAFE is an electronic control system for the TIR carnet and allows transmission of information on termination of the TIR operation to the IRU. TIR – EPD application allows TIR Carnet Holders to submit TIR electronic pre-declarations to Customs offices in the EU and NCTS participating countries, and the TIR Customs Portal (see IRU website for more information on these applications).

⁴ eTIR Project”, aimed at providing an exchange platform for all actors (Customs authorities, holders and guarantee chains) involved in the TIR system, known as the “eTIR international system”. <http://www.unece.org/trans/bcf/etir/welcome.html>

2.1.2 Customs Union and trade agreements

Over the past 30 years the number of existing trade agreements⁵ has increased rapidly on a global scale. In 2010 more than 300 preferential trade agreements were notified to the WTO and were in effect⁶. The proliferation of these agreements and customs unions increase the complexity of overlapping trade rules and raise specific trade facilitation concerns with regards to the rules of origin. Irregularities, including deliberate fraud, with Certificates of Origin (CoO) are common. CoO that are rejected or need to be verified on a case by case basis through administrative cooperation channels, add to a complex and lengthy procedure. Customs administrations globally strive to improve both the certification and verification process, including through the use of ICT.

CoO are still commonly paper-based, physically accompany the goods, need to be presented as original copy for customs processing. The direct exchange of CoO amongst issuing administration⁷ is an emerging trend adopted for pilot projects, such as the Senegal-CI exchange project. Another approach to secure authenticity and integrity of CoO is the self-certification. Exporter based risk management and information exchange with the issuing authorities in the foreign country are other means to limit CoO fraud.

Trade agreements vary in their depth, scope and type of commitments. They may contain trade facilitation provisions to remove administrative and operational barriers. Such TF provisions in trade agreements are however often limited in scope to customs procedures⁸ and use general language. Agreements creating a Customs Union and a single production market contain deeper and more formalized trade facilitation commitments. A Customs Union that allow goods to circulate freely once entered into the territory of the Customs Union, require a common border management that may require, amongst others, a common framework for risk management, simplifying and harmonizing policies and procedures, elimination of duplication namely with regards to control measures, and enhanced mutual administrative assistance⁹. A Customs Union also must rely on the control of transit movements across its territory. As a consequence, Custom Unions require substantial and effective ICT systems to control the movement of goods, to harmonize the procedures, exchange data across administrations in member countries. The European Union experience has shown that ICT requirements at customs union levels cannot be dealt with at each member state level. Hence Customs Unions also have different ICT architecture and organizational requirements: centralized management and a common domain architecture¹⁰.

2.1.3 Cargo security requirements

After the September 11 attacks in the U.S. many governments adopted security measures that significantly affect port, transport and border procedures worldwide. Global transport of goods is now subject to additional requirements as regulators worldwide push for the advance submission of cargo information to identify security risks easier and earlier.

Numerous countries have introduced Advance Cargo Declaration requirements for maritime container goods and / or airfreight including the EU¹¹, United States, Japan, Australia and New Zealand, Mexico, Turkey, China¹² and the Philippines. Under these requirements transport operators

⁵ The term trade agreements encompasses all forms of bilateral and regional trade agreements independent of their individual name.

⁶ WTO (2011) World Trade Report 2011. The WTO and preferential trade agreements. From co-existence to coherence

⁷ CoO are issued either by competent authorities, mainly customs authorities of the exporting country, by the exporter or by the importer http://www.wcoomd.org/en/topics/research/activities-and-programmes/~/_media/BEA1C961C9D640B3B3122DEFD9B0292A.ashx

⁸ Nora Neufeld (2014) TRADE FACILITATION PROVISIONS IN REGIONAL TRADE AGREEMENTS TRAITS AND TRENDS (accessed at https://www.wto.org/english/res_e/reser_e/ersd201401_e.pdf)

⁹ Erich Kieck and Jean-Christophe Maur « Regional Integration and Customs Union » in Gerald McLinden et al (2011) Border Management Modernization (Washington D.C, The International Bank for Reconstruction and Development/The World Bank)

¹⁰ Tom Doyle and Frank Janssens "Information and communications technology in support of customs unions" in Gerald McLinden et al (2011) Border Management Modernization (Washington D.C, The International Bank for Reconstruction and Development/The World Bank)

¹¹ Advance Cargo Declaration as provided for by EU regulation 1875/2006 can be submitted in form of Entry Summary Declaration (ENS) or Exit Summary Declaration

¹² China: Advance Filing Rules on Maritime Container Cargo Information, entered into force July 2014 Decree of the General Administration of Customs of the People's Republic of China No.172

are obliged to provide a defined set of data prior to arrival (exact time requirements differ across regulations) to Customs authorities and/or port and aviation authorities.

The WCO SAFE framework, adopted in 2005, is a benchmark for countries implementing measures to securitize trade flows and facilitating the flow of compliant or legitimate trade. It rests on core measures such as advance cargo information, risk management, customs-to-customs network and benefit programmes, known as Trusted Traders or Authorised Economic Operator schemes (AEO). Customs authorities worldwide are putting in place so-called partnership programs whereby traders and/or operators can seek certification to benefit from facilitation measures, such as customs simplification of local clearance or simplified declaration or facilitation of customs controls. Examples of such programs are the AEO of the EU¹³, or the Known Consignor (KC)¹⁴ of the EU Air freight security initiative¹⁵.

The implementation of these security requirements relies on electronic records, cross-border exchange of data, and in-depth data analysis. They therefore require ICT system to support the implementation. ICT enables the advance submission of electronic information and the risk management analysis prior to arrival allowing administrations to target high-risk shipments and traders/transporters.

2.1.4 Improving international transit and transport facilitation

Many challenges to facilitate transit and cut the costs and delays of transit movements remain. Trade costs for landlocked countries continue to be high because of little progress with cross-border integration and cooperation, infrastructure and logistics services¹⁶. In recent years, several initiatives have raised this issue at the multilateral level: The UN Almaty Programme of Action focuses on transit policy and trade facilitation; The WTO Trade Facilitation Agreement (TFA) addresses selected issues of transit facilitation. Countries also take action to put in place an effective trade and transport system, and adopt agreements and approaches to facilitate cross-border transport¹⁷ on a regional level. So-called corridor approaches are adopted to remove obstacles to address infrastructure, transport service, transit and border crossing issues in a comprehensive manner.

These initiatives and agreements call for more effective use of ICT to support cross-border transit and transport, namely with regards to information exchange and border management. Often they rest upon effective transit procedures and an IT transit system: ASEAN develops the Common Transit System, the Greater Mekong States (GMS) design the Common Transit System (CTS), and in Europe countries developed the NCTS, that has become a reference point for IT transit systems. Central to IT transit systems and initiatives are the digitalization of documents and procedures, cross-border electronic information exchange, risk management of transit flows, and guarantee management.

Even outside such comprehensive IT transit systems, incremental improvements for e-documents, and transit data exchange are implemented and modern equipment and technological solutions such as electronic seals and vehicle transit tracking systems are used to improve control of transit movements¹⁸.

¹³ http://ec.europa.eu/taxation_customs/customs/policy_issues/customs_security/aeo/index_en.htm

¹⁴ The EU Airfreight security initiative introduced with the EU Air Security regulation No. 185/2010 requires air exporters to be certified as a Known Consignor (KC) or to undergo licensed security checks at the airport. For the certification air exporters have to ensure compliance with standards for air cargo preparation, storage, infrastructure and employee training.

¹⁵ See WCO 2012 Compendium of AEO for a global overview of such programs <http://www.wcoomd.org/en/topics/research/activities-and-programmes/~media/930340C77B3740D6B3894F747AF6A7FF.ashx>

¹⁶ World Bank (2014) Improving Trade and Transport for Landlocked Developing Countries

¹⁷ See CAREC (2012) Review of International Experience in Implementing Cross -Border Transport Facilitation for an overview and review of regional initiatives

¹⁸ For a brief summary of modern equipment and technologies used for border management, including for transit cross-border movements, see UNESCAP (2012) MODEL ON INTEGRATED CONTROLS AT BORDER CROSSINGS

2.1.5 Measures to promote export competitiveness

Governments worldwide use Free Trade Zones¹⁹ and other tax and tariff exemption schemes²⁰ increase export competitiveness. The goods processed under such schemes get a different customs treatment and are placed under so-called suspensive or economic impact regimes that *“ensure goods imported for further manufacturing or for prescribed purposes (such as for exhibition) and later export are not required to pay the duties and taxes that would otherwise be applicable if they had been imported for home consumption.”*²¹

The contribution of such regimes to export development is well recognized²², but they pose additional revenue and security risks for the customs and tax authorities, that need to be controlled. A tailored IT support covering risk management, guarantee management, document processing and inventory management is needed, but is rarely provided by existing automated customs systems.

2.2 Key trends when implementing TF measures

2.2.1 Agency cooperation

Many trade facilitation instruments and concepts, including the WTO TFA, RKC and TIR, focus on the Customs administrations and the simplification of their procedures and processing. This perspective however is increasingly replaced by a more integrated vision of trade facilitation that brings in other government agencies, such as food control agencies, veterinary services, and transport bodies. Mandates, responsibilities and interventions on goods and means of transport overlap, in particular with regards to control measures applied to goods crossing the borders. Simplification for trade facilitation therefore requires integration both from the organizational and the IT perspective and stretches to risk management, border management, as well as pre-clearance formalities.

Information integration has been the driving force behind so-called Single Windows for trade. In conceptual²³ Single Window scenarios, external users—traders and other intermediaries—submit structured information to a single platform where internal users—government entities or other service providers—access the information, process it, communicate between each other, and communicate the decision back to the external user.

Information sharing and integration also underpins common / integrated border management, as can be seen in the UNESCAP integrated border management platform model. Another area of cross-agency cooperation and integration is integrated risk management. Whilst different regulatory agencies control for different risks and follow different risk parameters, there is potential for an integrated process of risk selectivity, i.e. the identification and targeting of high level risk consignments, and sharing of information for the risk assessment.

The growing awareness for cooperative solutions translates into ICT needs of shared information resources, shared services, and collaborative contribution to an overall process and workflow. ICT systems that support trade facilitation need to be designed to respond to these data and process integration requirements.

2.2.2 Cross-border Cooperation

The simplification of procedures rests to a large extent on the cooperation of neighboring countries and trading partners. Process, procedures and document alignment and harmonization across borders, cuts costs to traders who are shipping goods across several borders. Sharing data and information through point-to-point communication amongst administrations across borders provides additional security relevant information, allows for a better control of transit movement,

¹⁹ There are different types and names for such zones. A widely used one is Export Processing Zone (EPZ).

²⁰ Such schemes are known under duty relief, duty deferral, temporary admission for re-exportation in the same state; Customs warehousing, Temporary admission for inward processing; Manufacturing under bond etc.

²¹ World Bank “Duty and Tax relief and Suspensive Schemes for Improving Export Competitiveness. A reference guide and learning toolkit.” accessed at http://siteresources.worldbank.org/INTEXPOMNET/Resources/duty_and_tax_toolkit_pub_screen_2009.pdf

²² In some Latin American countries exports from EPZ account for 50-70% of total export value; in Jaime Granados (2003) Export Processing Zones and other Special regimes in the context of multilateral and regional trade negotiations, IT-STA Occasional Paper 20

²³ Conceptual is used to differentiate conceptual theory from reality.

and secures licenses and certificates that are common sources of fraud, such as the CoO or the Sanitary and Phytosanitary certificates. Cross-border exchange of data is currently pursued in many regions on different levels; for transit movements, for sharing of licenses and certificates from government to government (G2G), and for sharing of customs data (WCGO GCN etc.).

Often cross-border initiatives are slow to be implemented, but not because of technological problems. The cooperation between governments needs to be formalized in agreements that create the legal framework for sharing information and define elements such as a common data set.

2.2.3 Paperless trade

2.2.3.1 Information exchange in global supply chains

A seamless flow of information is at the center of modern supply chain management. Supply chains that are geographically fragmented and extended rest upon information processing and exchange amongst supply chain partners. Information visibility, Information timeliness, and Traceability are the three information requirements that matter most²⁴.

The information flow takes place both between supply chain partners, as well as supply chain partners and government entities. Supply chain partners already have a lot of data available in electronic format: Notifications, requests and services orders are produced and exchanged amongst transport operators, e-invoices sent between partners and to clients,²⁵ and certificates and documents exchanged with authorities. Logistics partners also use specific software and platforms for processes from warehouse management, to route planning and order management, and to increase productivity and performance²⁶.

Electronic documents and electronic messages are widely used by supply chain partners and many ICT systems and platforms have been developed as industry initiatives. But the seamless flow of information remains a challenge when communicating with government entities—for technological and legal reason. Many administrations still require paper documents to be carried for verification purposes, and different standards limit the sharing and data and messages. The multitude of IT portals developed by different government entities achieves the opposite of facilitation and costs reduction: Supply chain partners have to invest in different technology or software and comply with different data and message standards²⁷ of the multiple portals, and have to re-enter information at several points.

Progress with paperless trade depends on progress made with ICT architecture integration and standardization, shared cross-agency approach, and the deepening of e-procedures from Customs processing to border crossing, port entry and exist and en-route transport movements. Deepening of e-procedures progresses with the introduction of modern equipment and technology for control and facilitation at border points, and clearance facilities. Customs administrations tap m-services, use barcode and QR codes to retrieve information, and technologies such as license plate number reading for vehicle control at border stations.

²⁴ Integrity, 2008; Van Stijn et al., 2011; Tsanos and Zografos, 2012 cited in UNECE (2013) Roadmap to Enhancing Information Exchange in International Supply Chains (Executive Summary), Geneva, February 2013

²⁵ To date, adoption rates of e-invoices are relatively low and vary widely among Member States. While 23 % of enterprises say they receive or send e-invoices (ranging from 8 % to 41 % in EU27), the number of exchanged structured e-invoices still remains low, particularly among SMEs. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0712&from=EN>

²⁶ Electronic invoicing – e-Invoicing – is electronic transfer of invoicing information (billing and payment) between business partners (supplier and buyer). From UNECE (2013) Roadmap to Enhancing Information Exchange in International Supply Chains (Executive Summary), Geneva, February 2013

There is a large variety “platforms such as Enterprise Resource Planning (ERP) systems (ii) data acquisition technologies such as RFID, GPS, and container scanning, iii) data exchange and integration technologies and iv) data processing and decision making systems to improve information acquisition, exchange, processing, and accuracy (Integrity, 2008; TRANSLOG, 2003)

²⁷ Interviews have shown that shipping companies submitting manifest data have not seen a gain in time when using Single Windows as they have to retype the information from the manifest as they cannot import directly, or the importation results in so many errors that the checking is lengthier than typing it. This is due to data quality issues but also different data definitions and standards.

2.2.3.2 Data and messaging harmonization

Many current trade facilitation initiatives call for more cooperation and integration across agencies, across borders, and between ICT systems. To allow this integration to happen data harmonization initiatives abound on global, regional and industry level. The use of reference models and standards for data and messaging ensure consistency and compatibility and therewith interoperability.

The UNTDED and UNCEFACT code lists are widely used for unambiguous identification of data elements that can be integrated into data models. Two hierarchical data models, the WCO data model and the UN CCL, constitute de facto standards for data harmonization for trade and transport facilitation. National and regional data harmonization efforts align their data models to both data models. The WCO data model incorporates non-Customs requirements of other agencies and can accommodate a large type of data and messages from supply chain partners.

In addition to the global initiatives and instruments, initiatives also emerge at industry level and for specific transport sectors, such as for the advance cargo information (IATA cargo xml message²⁸), and standards for electronic documents (e-Cargo Security Document (e-CSD)). In Europe, projects, such as e-freight and the National Single Window (NSW) for transport, build a framework for information exchange based on common data and message standards and the *“necessary administrative, governance and legal provisions in order to ensure effective and harmonized implementation of standards.”*²⁹

2.2.4 **Client orientation in Public Administration**

Public administration leverages the benefits of automation and faster and processing through ICT. Improved process speed and efficiency provide an answer to resource scarcity and growing trade volumes. But there are two additional elements for which ICT can and increasingly is leveraged: the reduction of physical and time barriers for service delivery, and improved information provision.

In the real world, administrations physically located in different places have different operating times, and responsibilities and mandates are fragmented over various bodies. By using ICT, this geographic, procedure and time fragmentation can be overcome. Physical presence is not necessary for obtaining information and submitting documents, and services provided by different entities can be accessed in a single location at any time. There is the trend across in government affairs to set up online portals that regroup different services from different entities and that allow citizens to interact with one access point without physical contact.

These portals are designed from the point of view of the customers, meaning that they follow formalities from a user perspective and not the organizational perspective and that they are designed as “life event” portals, providing services for one specific life event or segregated issue. In trade facilitation, Single Windows and so-called information portals are examples of how public administration uses ICT to facilitate communication and availability of information. Another trend is the use of IT to make public information available, including regulatory requirements and data for statistical purposes. Integrated databases are made available online and have improved in user-friendliness and accessibility.

This integration of processes and services can take varying degrees of integration on the front-end and back-end side, from providing only a front-end integrated information portal to offering an IT portal that is based on back-end sharing of process and information.

2.3 **New TTF ICT business needs**

These changes in the nature of trade facilitation requirements and solutions, lead to changes with regards to how ICT can support trade facilitation and require new (different) ICT system architecture. ICT systems are developed or customized to respond to specific circumstances (legal)

²⁸ <http://www.iata.org/whatwedo/cargo/e/Pages/cargo-xml.aspx>

²⁹ <http://www.efreightproject.eu/default.aspx?articleID=1120>

and business needs. Changes on the operational and legal level necessarily lead to changes on the IT architecture level.

2.3.1 Changes of ICT requirements

ICT systems to support Customs clearance and trade statistics have been developed and deployed effectively worldwide since the 80s, and public administrations have used IT since the 60s for internal processing and storage of data. Modern trade facilitation needs, such as agency cooperation, risk management, advanced cargo information, simplified customs procedures, and cross border exchange of data, require different ICT functionalities and technology. This ICT architecture now needs to accommodate integration of actors, data and processes, complex and faster data analysis, exchange of data and sharing of resources. Technology that is currently still dominant such as client server architecture, cannot support interoperability and interconnectivity, obsolete technology lacks the necessary processing power and cannot be made to respond to new requirements potentially creating conflicts of technology, and data exchange is lacking defined rules and supportive technology

Large ICT systems that focus on automation of frequently used and standardized business processes, such as customs clearance, are no longer sufficient. More business processes and government services need to be automated or digitalized, and cooperation through sharing information and processes needs to be supported. The table below shows selected implementation areas of trade and transport facilitation where new IT business needs emerge. These areas are:

- Risk management
- Transit facilitation, and Guarantee management (for transit),
- Licenses, certificates and quota management,
- Coordinated Border Management,
- Transparency/administrative facilitation,
- Customs processing,
- Decision-making support systems,
- Cross-border exchange of information.

IT Business needs in this context are understood as the way IT should be used to support work process and services in view of effectively delivering trade and transport facilitation objectives. For each of the areas, and where available, the table presents current ICT systems or initiatives that respond, partially or fully, to the new business needs.

On a high level, the TF IT business needs can be summarized as the need for more integrated and user-friendly solutions that are resource efficient and flexible, and can support more business areas and processes. When comparing these business needs with the functionalities and services currently supported by existing IT systems and applications, it becomes apparent that the full potential of ICT for process or organization re-structuring and design is not yet used. Deepening and integration are the two necessary directions. This means extending ICT to more business processes and areas at the agency level followed by development of integrated applications at the general level.

Table 1: TF IT business needs

| Business areas | Business needs |
|--|---|
| Risk management | <ul style="list-style-type: none"> Gathering and analysis of various data sources to evaluate of risks and develop risk criteria and profiles using structured and non-structured data from multiple sources. This includes analysis of behavioral patterns, interaction with Law Enforcement IT System to support RM, feedback from Customs control, and Cooperation with neighboring countries (intelligence and risk indicators to manage common cross border risks) Fast Selectivity/ screening in an automated environment using multiple risk parameters and indicators Monitoring risk selectivity process and analyzing the profiling performance Identify risk shipments Prior to arrival Intra / Inter Agency risk management through a Common Risk Management “repository” and active participation of OGA in the creation, management, feedback analysis |
| Examples of systems/initiatives | Kosovo Customs EU-China Smart and Secure Trade Lanes (EU-China SSTL Pilot, Phase 2) |
| Transit facilitation | <ul style="list-style-type: none"> Replace paper declarations with e-procedures Data exchanged to all points of exit and entry allowing for information prior to arrival Removal of paper documents presented en route (m-technology) More secure and faster guarantee management (See below) Traceability of changes of means of transport during a transit procedure/movement Application of additional security measures on movement of high risks consignments Application of risk management to transit traffic |
| Examples of systems/initiatives | NCTS and ACTS |
| Guarantee management (for transit) | <p>Automate the guarantee process from registration to release, revocation and cancellation for all excepted type of guarantees. Functionalities that the guarantee management system should support are:</p> <p>Guarantee Management (transit): Register of the guarantee, Check guarantee integrity, Register guarantee usage, Release guarantee, Credit reference amount, Cancel guarantee usage.</p> |
| Examples of systems/initiatives | As part of the NCTS and ACTS |
| Licenses, certificates and quota management | <ul style="list-style-type: none"> Remove paper based procedures Automate application procedures decisions (where possible) Automate license/quota management (example of process requirements) from balance updates, Exhaustion; Re-opening after exhaustion; Blocking/unblocking; to Quota suspension. Exchanging licenses across borders |
| Examples of systems/ | Most of the commonly used SW |

| | | |
|---|---------------|---|
| initiatives | | |
| Coordinated Management | Border | Sharing of data amongst agencies to remove document / date requirements and make risk information available to all agencies |
| Examples of systems/initiatives | | Montenegro-Albania Kosovo – Albania |
| Transparency/administrative facilitation | | <u>Transparency</u> <ul style="list-style-type: none"> • Tariff and or regulatory requirements (NTM) information • Provide client relevant procedure information • Help desk and contact point facilities that allows lodging of questions and communication of questions and answers <u>Administrative processing facilitation</u> <ul style="list-style-type: none"> • Electronic submission of regulatory data/information from business to government entities (for different procedures, including licenses, customs clearance, and security requirements) • Provide 24/7 process status information, warning and alert system • E-payment and e-invoicing facility • Single access point |
| Examples of systems/initiatives | | Lao Trade portal ASEAN National trade repository (NTR) Most of the common SW, or PCS |
| Cross-border exchange of information | | <ul style="list-style-type: none"> • Systematic sharing of data that is generated and transferred automatically. (see risk management, see transit management, license management) |
| Examples of systems/initiatives | | <u>For Customs record exchange</u> INDIRA of Mercosur - Customs Records Information Exchange Digital Data Exchange program (RADDEx2.0) Systematic Electronic Exchange of Data (SEED) <u>For licensees and certificates</u> Senegal. Ivory Coast exchange of CoO e-CoO (ICC) ³⁰ ASYCER electronic phytosanitary certification system, based on the ASYCUDA technology and developed in collaboration with the Dutch and Rwanda Government. APEC Pathfinder on Self-Certification of Origin / EU-REX ³¹ |

³⁰ Many chambers of commerce already provide online CO services to speed up the application and issuance process and provide a more secure documentation environment. Indeed, eCO systems are able to include security features such as online verification of the authenticity of COs and optical watermarking technology. eCO systems also provide electronic application as well as issuance, complete with digital rubber stamps of the chamber and signatures of authorized officials.

| | |
|---------------------------------------|--|
| Customs processing | <ul style="list-style-type: none"> • Support Electronic submission of the goods declaration using different technologies (EDIFACT, XML³²) through email or web services, web form (enterprise portal) or in case of approved trader's declaration application, system to system submission of declaration. • e-clearance (from submission to release, payment information and clearance) with automated process steps where possible (validity and credibility checks³³, automated acceptance etc.) • Facilitate a wide range of payment options • Interact and interface with other systems (guarantee, quotas and licensing management systems and risk assessment); • Support of Post release/clearance support (Law Enforcement IT System) from planning of audits, to results and final reporting • Tariff Management (classification rules, preferential tariff rates, details of licenses and certificates requirements, trade remedies measures in place, publication and enquiry facility • Use of valuation databases • Support of Advance Ruling from tracking and processing to vertical communication to frontline officers, internal storage, support to information request from frontline officers, online submission to request) • Guarantee management (suspensive regimes) (see guarantee management below) • Support for authorized traders programs from receiving AT applications, to grant, suspend or revoke AT certification, and control criteria) • Integration with other document submission platforms (Port Community Systems, SWs, Tax authorities) |
| Decision making support system | <ul style="list-style-type: none"> • Provide more comprehensive and better data available at moment of decision and evaluating and monitoring (ISM) for the purpose of trade statistics, Business intelligence³⁴, and Key Performance Indicator management. |

³¹ A new self-certification system by exporters will replace the system of certification of origin by public authorities as of 1 January 2017 using registered exporter system (REX)

³² XML, the eXtensible Markup Language, has become the standard for defining data interchange formats in Internet applications. The XML also enters the field of electronic data interchange (EDI). In the past decades EDI standards, like UN/EDIFACT or ANSI X12 have been the dominant ways of interchanging data between applications, but is too early to say that it will replace EDIFACT. Almost 99% of today's TF ICT systems are using XML standard for electronic data interchange. Still many legacy systems use EDIFACT, many converter modules are developed to interconnect and exchange data between XML and EDIFACT based ICT Systems.

³³ Such as, data format, codes and relationships between data fields

³⁴ This provides for Strategic, tactical, administrative, and forecasting analysis

2.3.2 Existing challenges

As the table above shows, many new initiatives and ICT systems are currently being developed to improve the way ICT supports trade facilitation objectives. This is an evolution from the long focus of automation of frequently used and highly standardized business processes and the development of large standalone IT systems such as Customs Declaration Processing systems. Challenges however remain in tapping the full potential of ICT for TF – challenges on the technological and organizational level. Existing ICT systems need to be changed and updated, and new services and applications need to be developed. This however requires a rethinking of how ICT can support trade facilitation, and a different ICT architecture and organizational approach (see following chapter 3).

Obsolete technologies struggle to cope with increased volumes of transactions and data analysis needed for effective risk management. Despite new developments, ICT systems remain isolated systems that only offer a limited set of services and do not use the full ICT potential to redesign process delivery and collaboration. Often new technologies are used to replace paper-based procedures with electronic procedures but only with respect to the submission of documents. The back office processing is not changed or automated and the full potential of using ICT to simplify and speed up processes therefore does not emerge.

IT projects are often implemented without alignment to core business processes requirements. This comes from the fact that laws and regulation aren't translated into a process flow and user requirements that can be used for the design of ICT systems. IT projects and systems do not take into account flexibility and scalability, and there is a lack of systematic use of a systematic and standardized project management methodology that is based on business-driven Business Process Management (BPM).

IT expertise and operational knowledge should be integrated at the very beginning of the project management cycle to define user requirements and analyze the business process with relevant IT perspective. Instead, IT expertise is often only brought at a late stage to define technical specifications, and vendor solutions are already identified at the very beginning of the project cycle.

The existing challenges can be summarized as follows:

- IT projects are still primarily designed from a technical perspective and are structured to support vertical (silo) business processes and applications;
- Many ICT systems, so-called legacy systems, were developed quite a while ago and are based on outdated centralized architecture that is slow, paper-based and resource and data intensive. Some of the database technologies are not supported anymore and programming language may be old and do not support the new application and services. These legacy systems are inflexible, costly to maintain and cannot easily be adopted in response to new requirements;
- TF ICT systems very often only support a limited number of operational processes and needs; mainly on the declaration and licensing processing side, and do not offer the same level of support for data exchange, pre-clearance and post clearance activities, or for enforcement work;
- Risk management capabilities of these systems are generally not very advanced, despite risk management at all functional level is a key requirements of many trade facilitation measures;
- Systems are not sufficiently integrated from the user's point of view which means that users have to deal and interact with a variety of systems. Processing is not seamless and data needs to be re-submitted;
- Staff knowledge, processes and requirements are compartmentalized in operational and IT silos.

3 Integration and Modernization of Trade Facilitation ICT Systems

This chapter explains how ICT should be designed and used in order to support trade facilitation objectives in the areas outlined in chapter 1. Following the growing regulatory and business needs, the TTF should no longer offer stand-alone applications restricted to the clients' requirements. Most of the TTF information systems are developed independently, using different technology platforms and having non-standardized interfaces. Thus there is a need for a TTF Architecture that would serve as a bridge between different agencies and information systems, enabling the trader data to be stored, managed and maintained in one place and to request it over the internet / intranet by other agencies only when needed. This chapter explores two directions of changes to TTF ICT architecture:

- Integration - to provide definition of the business domain and functional areas of TTF systems;
- Modernization - processes to achieve greater efficiency, improve the access to the TTF services and at the same time, TTF systems to be open to future extensions according to longer term trends and needs.

3.1 Evolution in ICT systems and technology trends

ICT has become a vital part of trade and transport facilitation. From a technological point of view, a supportive TTFS architecture is however rather complex and need to evolve constantly to respond to improvements and innovation to remain effective and efficient. The future of a modern TTFS architecture is underpinned by innovations and trends in a number of core technologies.

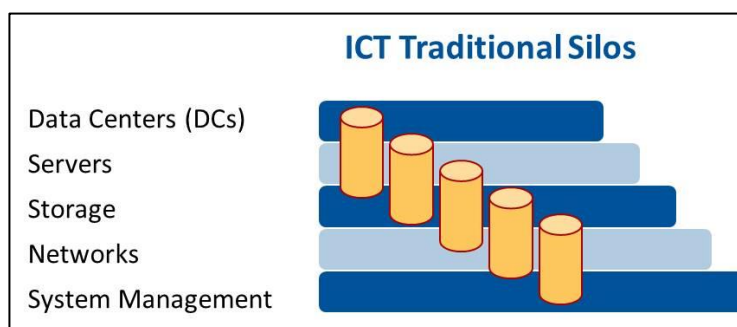
There are a number of technical and conceptual developments, which are evolving and changing the IT context. There has been a major evolution in ICT architecture: from mainframe to the heterogeneity we know today. The current heterogeneity constitutes challenges for ICT system as well as opportunities as TTF systems need to be accessible from a variety of different devices.

3.1.1 General TTF System architecture evolution

The mainframe era (approx. 1944-1995) is characterized by large and extremely expensive but powerful mainframe technology, which required specialized experts to build the simplest application. This was followed by the PC-centric / client-server Infrastructure (approx. 1990-2005) which emerged in response to budget restrictions, security and compliance and support to the end users instead of business requirements. The legacy of the client-server centric infrastructure is the silo oriented architecture, collection of isolated and data locked silos with little or no governance of standards as with see it today in the case of many TTFS. The systems are supported by diverse hardware infrastructure and technologies and therefore require a lot of resources, both human and ICT, to maintain and operate and does not allow modernization or implementing innovative technologies.

The IT Traditional Silos, PC-centric and client-server architecture made IT projects difficult and expensive to deploy and manage, resulting in a desire to just spent less. Security and compliance requirements often sacrifice productivity and innovation for the purpose of risk avoidance.

Figure 1: Silo oriented Architecture



Source: Authors

The key determinant of the post-PC³⁵ (2010 onwards) era is heterogeneity. Heterogeneity describes an environment that is characterized by many different hardware and software platforms, such as traditional Windows desktop apps, Software as a Service (SaaS) apps, Mobile apps, Enterprise Web application that need to be accessible from a variety of different devices from traditional Windows, Linux and Mac based desktops, laptops, thin and zero clients, iOS and Android tablets and smartphones (mobile Internet access and mobile commerce / m-commerce). A modern TTF ICT Architecture should allow for the technological heterogeneity and independence from TTF legacy applications in a common service environment.

3.1.2 Technology Trends

In addition to the general evolution of ICT architecture, there are also specific trends in ICT that can contribute to the modernization of TTF information systems.

3.1.2.1 Architectural Pattern

The TTF architecture should be based on open principles of an architectural pattern in which the components offer well-defined services that can be reused across TFFS domain architecture. An example of a service is data entry and validation. Such a service is required for multiple business process by different agencies. Instead of developing a separate modules for each agency, one service can be designed, if needed slightly customized to the specific regulatory requirements of each agency and therewith re-used developed to support business process.

3.1.2.2 Application and Service Architecture

The TFFS should include a range of management tools designed to serve specific functions and at the same time to support the service architecture, such as Decision Support System (DSS), Knowledge Management (KM) tools, Customer Relationship Management (CRM), Data Management System (DMS), Enterprise Content Management System (ECMS), BPM Business Process Management (BPM—Workflow Management System), and Identity Management System—Security (IMS). Such systems should be set up by agencies that need to find solutions to critical problems in their information and knowledge processes and traders relations.

3.1.2.3 Data Architecture

Big data will introduce new opportunities for TTF Enterprise Data Architecture to extract insight from databases in real time and across various relational and non-relational data layers. The big data architecture is based on less expensive and heterogeneous infrastructures than the traditional monolithic and hugely expensive options that exist currently. The architectures for realizing big data solutions are composed of heterogeneous infrastructures, databases, and visualization and analytics tools. However, heterogeneity brings with it multiple options for solving the same problem, as well the need to evaluate balance between the desirable but incompatible structures and validate the solution.

3.1.2.4 Interoperability

Scalable Interoperability - Agencies are starting to increasingly rely on data exchange with external partners in order to optimize their service delivery networks and business functions, such as cross-boundary collaboration and service coordination, monitoring and outcome reporting. Traders should no longer have to navigate among various agencies and programs through vertical, first generation agencies Web portals in order to locate the services they seek. A digital government platform incorporates service-oriented architecture (SOA) design patterns for the provision and use of enterprise services across multiple domains, systems and processes³⁶.

³⁵The term "post PC" was first used by David D. Clark in 1999; considering the future of computing to be "inevitably heterogeneous" and a "network full of services". Clark described a world where "everything" would be able to connect to the internet, computing would primarily be done through information appliances, and data would be stored by centralized hosting services instead of on physical disks.

³⁶Gartner - Top 10 technology trends for Governments -<http://www.gartner.com/newsroom/id/3069117>

3.1.2.5 Interconnectivity

Extreme innovative middleware—or transaction processing platform (such as complex event processing engines or cloud-enabled application platforms—CEAP) and increasingly, packaged applications, have been contributing to familiarizing the industry with XTP—style architectures. XTP—middleware style architecture is providing cost-optimized, elastic scalability that will support the most demanding TTF Systems quality-of-service requirements on hardware and low-cost software technologies, enabling on-premises cloud-style architectures (private cloud)³⁷.

3.1.2.6 Storage Infrastructure

According to the latest storage technological trends, the data layer shall reside on two or more partitionable storage systems that exploit virtualization technologies offered by the operating system for the same reasons described in the case of application layer. This approach, combined with virtualization, allows horizontal scalability without adding new hardware at any time and at any point. Consequently, one can allocate new partitions and / or virtual systems to increase the processing power and to achieve the separation of logic environments. The processors must have a multi-core and multi-thread architecture, which guarantees better performance especially for such data intensive systems like TTFS. The investment in spending on ICT hardware, software, services, telecommunications and staff that could be considered the “infrastructure” of the digital universe and telecommunications will grow by 40% between 2012 and 2020. As a result, the investment in storage per gigabyte (GB) during that same period will drop from \$2.00 to \$0.20. Of course, investment in targeted areas like storage management, security, big data, and cloud computing will grow considerably faster. By 2020, nearly 40% of the information in the digital universe will be “touched” by cloud computing providers—meaning that a byte will be stored or processed in a cloud somewhere in its journey from originator to disposal.

3.1.2.7 Security Architecture

The enterprise network firewall is the most appropriate TTFS security infrastructure, composed primarily of appliances or servers for securing TTFS Enterprise networks.

3.2 TTF Integration Framework

As mentioned above, integration and modernization are the two directions into which TTFS have to evolve. The TTFS Integration Framework presented in this document provides the conceptual framework for the integration and interoperability requirements that are necessary to support a cross-agency trade and transport facilitation strategy at the business level. The TTF integration framework combines business patterns to form solutions for interoperability and interconnectivity.

The scope of the framework covers organization, knowledge, processes, information and technology and their relationships to one another. It is suited for implementation within a national domain environment and allows connectivity with and from external environments. It is the strategic underpinning that allows proper planning and allocation of resources. It also allows for the continuous integration of ICT technology changes in the existing TTFS Architecture. Model driven frameworks are needed to integrate other TTF systems (CDPS, Single Window, Port Management Systems etc.) in a flexible, adaptable and logical way driven and shaped by the relevant business process. It clearly puts the focus on business first and technology second.

3.2.1 Integration

The underpinning for integration is that existing ICT systems continue to be operational but that there is an integration layer on the business processes and information level that allows multiple users to share data, processes, and services and enables a single access point and creates opportunities for dematerialization and re-organization of various back office processes

³⁷ Gartner - Hype Cycle for Emerging Technologies - <http://www.gartner.com/newsroom/id/3114217>

Integration can refer to front-end or back-end integration. Front-end integration (access to application / services integration) focuses on providing seamless and reliable access to business functions - single sign-on, digital signature, two way communication, etc.; Back-end integration (application / service integration) - dedicated on connecting, interfacing, or integrating TTF data layer and sub-systems from business perspective - based on functionalities, mode, type and level of integration, and by topology.

The logical reasons to push for TTF integration are to transform IT into an integration point for business by offering better alignment of business and IT, to deliver more flexibility by re-using services with high reduction in costs; to manage complexity better by mitigating risk and aiding overall decision-making; to establish the common services and communication layer with traders B2G2B – external domain³⁸ and to provide for cross border information exchange from a single secure technical infrastructure and regional trade integration – common domain³⁹

3.2.1.1 Interoperability

The term interoperability has different meanings in different contexts. In its broad sense, it describes the ability of agencies to work together and the ability to share information and services. At a technical level, it is the ability of two or more diverse TTF information systems or components to meaningfully and seamlessly exchange information and use the information that has been exchanged. Interoperability in the context of the TTF integration framework can be categorized as follows:

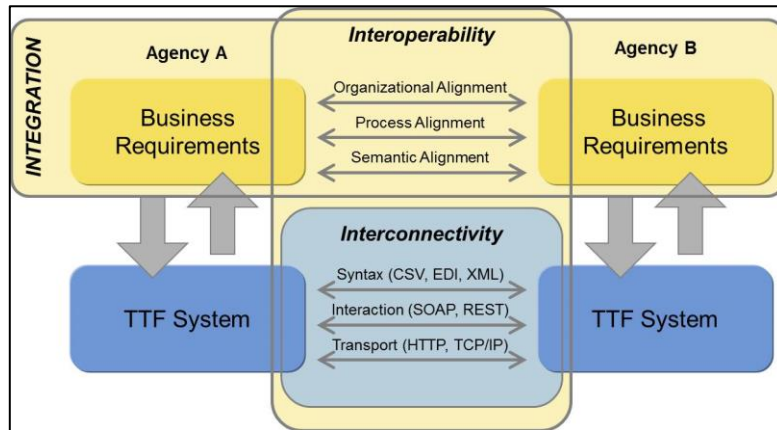
- **Operational or Business Interoperability** - includes the business strategy, policies, legal and organizational elements that define the interactions between agencies;
- **Information Interoperability** - defines how information is to be shared; definition of the components that agencies use to align document payloads and business processes. Components include processes, taxonomies, data dictionaries etc.;
- **Technical Interoperability** – elements that includes communication protocols, security standards, messaging standards, share infrastructural resources and services, apart from technology or application which is used, or vendor which has supplied the principal system;

The TTF technical Interoperability should include common methods and shared services for the communication, storage, processing, and access to data primarily in the application platform and communications infrastructure.

³⁸ The external domain is the interface to the traders that integrate functionalities such as: heterogeneity, security standards, communication standards, message standards and harmonized data requirements.

³⁹ The common domain containing common services and applications, as well as the communication between the participants countries

Figure 2: TTFS Interoperability and Interconnectivity Logical Concept



Source: Authors

3.2.1.2 Interconnectivity

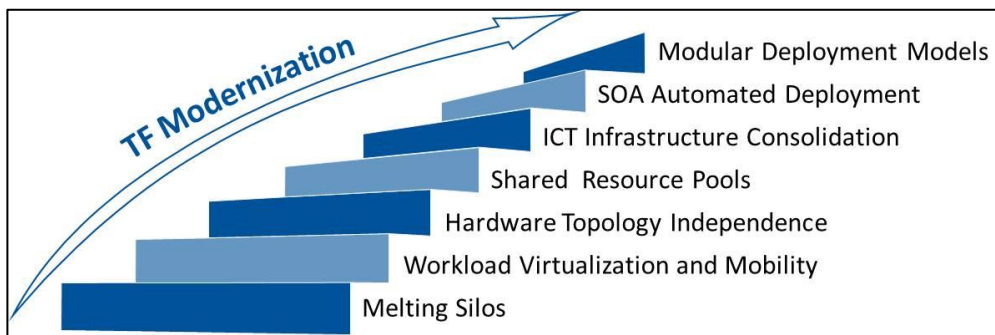
Interconnectivity represents the backbone of the TTF Systems interoperability, defined as a middleware standards and technologies for connecting TTF systems that is an intermediary between other applications or devices. During the past 5 to 10 years, interconnectivity technologies (such as distributed caching platforms) have been gradually integrated with middleware layer such as variety of middleware solution (web services and Enterprise Service Buses).

The provision of infrastructure middleware services which will be facilitated by the means of interoperability is equally referring to both use of TTF information systems and the delivery of information internally, as well as the delivery and use of TTF services to traders.

3.2.2 Modernization

Important features of a TTFS architecture modernization are the use of a strategic approach, compliance with international standards (ISO), and application of vendor's off-the-shelf (COTS) solutions. With this approach, current legacy systems or newly (planned) applications and services can support and host the interconnectivity and interoperability requirements.

Figure 3: TTFS Architecture Modernization



Source: Authors

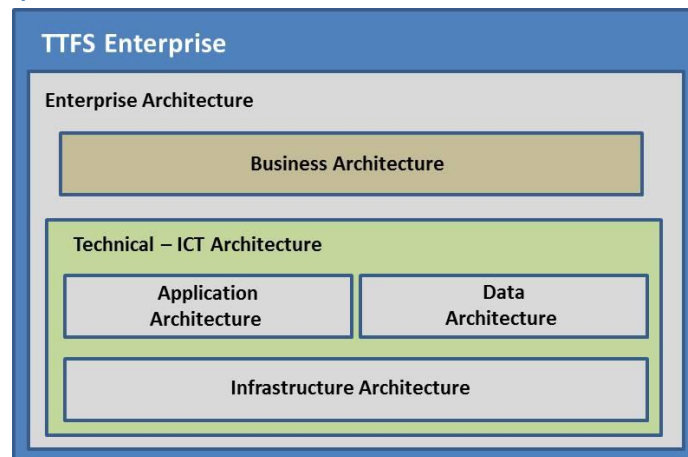
To achieve modernization it is first necessary to melt the existing organizational and ICT system silos. This can practically be done by developing an IT Strategy focused on rationalization of existing architecture, vertical and horizontal infrastructure consolidation and integration aligned to the TTF business goals and objectives. Taking into account that the TTFS Infrastructure is considered "mission critical", it is strongly recommended to rely on ICT modular deployment infrastructure combined with virtualization. The virtualization concept results in hardware topology independence, which leads to ICT infrastructure consolidation. This refers to complex systems such as CDPS and SW where modularity is increasingly playing a greater role. In the instance of CDPS, this practically means a logical and physical modular separation in Export, Import, Transit and Common Services.

This significantly changes the development approach, especially concerning the need for changes or implementation of new functionalities – services.

3.3 TTFS Integration framework: Architecture Design

The architecture design considers business and technology viewpoints. The technology domains are supported by a complex infrastructure that must be business-driven and not technology-driven. The TTFS Architecture should allow multiple independent providers of solutions to supply system and service components that can be integrated seamlessly on a platform of choice. It is partitioned into four subsets (see figure below) that are explained in more detail in the following text.

Figure 4: The TTFS Enterprise Architecture sub-sets



Source: Authors

3.3.1 Business Architecture

The Business Architecture defines the structure of the TTFS Enterprise in terms of its governance structure, business processes, business information and resources. It describes actors, business rules, business roles, business interactions, etc. It is driven by business strategy, organizational and business processes and defines requirements regarding customers, budget, products and services, partners and suppliers, organization, and capabilities.

3.3.2 Application and Service Architecture

The application or service architecture outlines the applications /services to be integrated and deployed and their boundaries and dependencies with the business processes. The design of application and service infrastructure responds to business requirements and design patterns. Issues such as availability, security, scalability, and manageability must be addressed while accommodating the prerequisites of application and service deployment and data exchange / message transaction within national and external domains.

These design choices respond to specific TTF business requirements and need to be catalogued in a comprehensive manner to avoid negative consequences for the application and service design. For example, some techniques for increasing availability or scalability of an application and services require replicating layers of the application on multiple, virtual nodes. However, implementing replication can introduce security challenges and increase the complexity of managing the deployed application and service. The sharing of data in a secure manner is therefore the biggest challenge at the level of the application and service architecture. The security and access control mechanisms on TTF data should be defined in dedicated security policies.

The evaluation and selection of application and software services must be guided by clear procedures that are based on a comparison of available software packages, systems and equipment. Available approaches are i) Build - Custom Developed Software (CDS), ii) Borrow - Open Source Software (OSS), iii) Buy - Commercial off the Shelf Software (COTS), iv) Rent - Software as a Service (SaaS). COTS appear to be most suitable requirements for the integrated TTF Architecture for the following reasons:

- Proven integration and experience in the same or similar ICT Architecture;
- Minimized development costs and low implementation / deployment timeframe
- Codified best practices;
- Outsourced technology and business obsolescence.

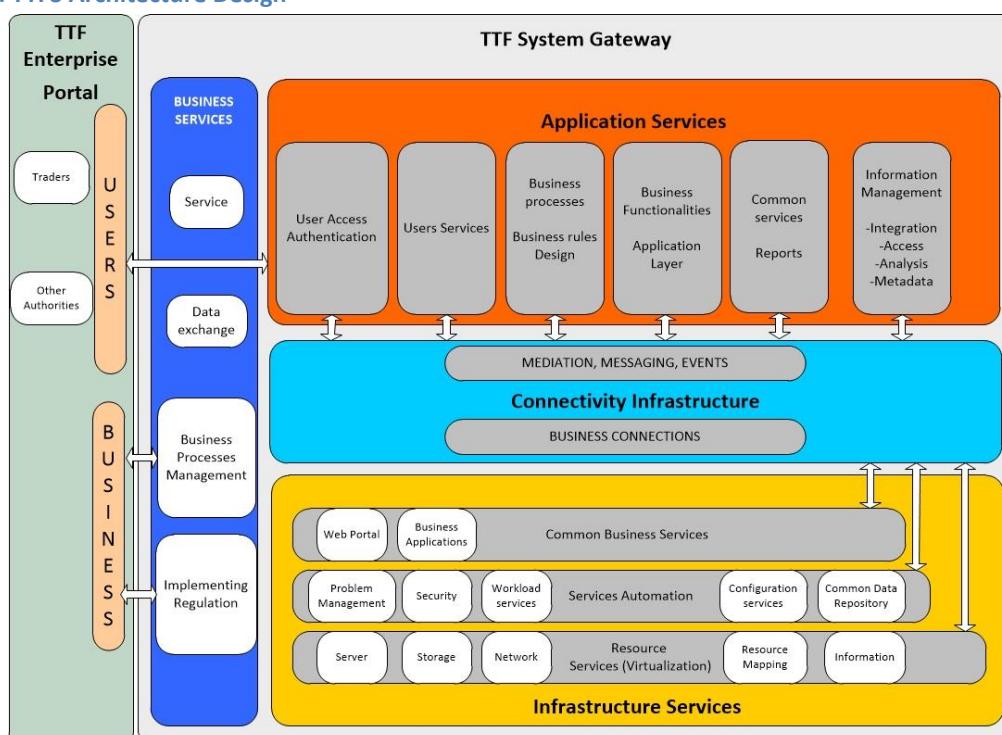
Additional principles of the selection process are quality credibility of vendor; long-term engagement with a limited number of selected suppliers, commitment in terms of upgrade and further development, and competition to avoid reliance on one supplier or single solution.

3.3.3 Enterprise application integration

Integrating applications and services is a challenging task facing Enterprise Application Architecture. The requirements for up-to-date information available 24/7 and developing business to business solutions requires architects to find solutions for integrating various applications and services, developed on different architectures and platforms and at the same time, to follow the heterogeneity pattern. Business processes and information technology need to be connected in a flexible and universal way. One of possible answers to the architecture requirements is the concept of Service Oriented Architecture (SOA), and the introduction of an additional layer the middleware connectivity infrastructure, that allows for the integration of applications and services with the infrastructure services.

The figure below shows such an SOA with the middleware connectivity layer, and a communication layer, the TTF Enterprise portal that allows single data entry, ensuring that data is entered into the system only once, verified and following the business services. The business services represents complex taxonomy layer that is delivering the data to the application / service layer channeled by implementing regulation thought the BPM.

Figure 5: TTFs Architecture Design



Source: Authors

3.3.4 Data Architecture

The data architecture defines the logical and data layer. Integration on the data architecture is an essential feature of the TTF architecture. Not only do various agencies have specific dataset requirements, they also need to share and exchange the records and data with others for various processes. The ideal way to manage data is to have a shared and single transaction related dataset

that incorporates all the agency specific data requirements. Furthermore it is necessary to provide for centralized data storage and design customized services that allow each of the users to view and access the relevant data for their specific processes.

This means that unlike point-to-point data integration, data/information services are decoupled from data storage, security, and mode of delivery and individual applications / services are designed to deliver the data to the right user at the right time. These applications/services may or may not be connected via a registry or composite processing framework. The requirements for data and information services require a technology such as Enterprise Service Bus (ESB) that, based on business rules and processing routines, provides data manipulation for data storage, access, delivery, semantic interpretation, stewardship and governance.

3.3.5 TTFS Technical Infrastructure

The infrastructure architecture consists of hardware infrastructure projected to support the business, application and data architecture. It can furthermore be divided into storage architecture, network architecture and security architecture.

3.3.5.1 Virtualization

In the past, the hardware component itself was the main factor in making decisions on what to install, change and do. With virtualization, ICT can use the computing power to the maximum, allowing proper balance and deployment of the operating systems, database layers, data processing and service delivery. Virtualization technology introduces an abstraction layer to the TTFS between the physical hardware and the operating system (OS). The key advantage is that multiple OS environments can co-exist on the same server, in strong isolation from each other. Additionally, the virtualization software provides functionality for system provisioning like aggregated pools of logical resources, CPUs, RAM Memory, HDD / SSD disks, file storage, applications and networking.

With virtualization, the TTFS can achieve a 20% to 50% cost savings with increased flexibility and speed, and improved quality of service. For example, the TTFS server virtualization yields a rewarding return on investment (ROI) in servers, power and cooling, data center space, and administration, while enabling administrators to develop business-driven policies for optimizing resources.

Virtualization is creating a logical view of many computers sharing single computing resource or that a single machine is really many individual computing resources. In practice, single server resource appears to support many smaller ones or make many smaller servers devices appear to be a single device.⁴⁰ Virtualization also allows TTFS to, whenever the capacity demands exceed the regular, in-house infrastructure, go onto the market and acquire (or rent) virtual infrastructure capacity for a period of time.

3.3.5.2 High Availability Infrastructure Requirements

High availability infrastructure requirements should not simply imply the availability of each infrastructural component of TTFS. It is important to ensure that every single components (technology and service) supports the vital business functions.

The main availability management process outputs are Business Continuity Plan, availability & recovery design criteria, identification of critical services, agreed infrastructural components for availability & maintainability, infrastructure flexibility & assessment, availability monitoring, resource requirements and vendor support on high availability standards.

3.3.5.3 Business Continuity

The TTFS business continuity methodology should be used to create and validate plans for maintaining continuous business operations before, during, and after disasters happen. The plan

⁴⁰<https://technet.microsoft.com/en-us/magazine/hh965746.aspx>

should contain detailed procedures, responsibilities and roles with restoring the TTF ICT Architecture following a disruption. TTF systems cannot tolerate any downtime (also known as a zero-downtime requirement) of the TTFS infrastructure, therefore it is necessary to implement a subset of measures for continuous availability.

Business continuity defines the requirements that will allow a TTFS infrastructure to function normally in order to provide 24/7 services and support to trade facilitation. It is often a concept that is used in evaluating various technology and operational strategies on the architectural level.

Business continuity has to do with keeping the TTF ICT infrastructure running, regardless of the potential risk, threat, or cause of an outage. Threats/hazards come in three basic categories, Human-caused hazards, accidents and technological hazards and natural hazards. According to statistics, 80% of downtime of the ICT systems is human-caused, the rest of 20% attributable to the other two.

3.3.5.4 Disaster Recovery

Disaster Recovery is the process and procedures of restoring services and operations critical to the TTF, regaining access to data and other business processes after a disaster happened. In order to implement a proper disaster recovery, TTF ICT needs at least one or multiple locations. The location should be away from normal operational activities and TTF should make a choice concerning geographical and strategic position according to international standards.

3.3.5.5 Balancing Services

Balancing Services allow for the automatic distribution of services/traffic between different infrastructure components depending on their processing capabilities, thus guaranteeing control and an adequate level of performances. This approach will also allow TTFS a better response time of service and simultaneously ensure optimum use of infrastructural resources. These services operate by checking the possible fault of the hardware components and redistributing the services/traffic. This solution makes it easier and faster to restart operations on the site of business continuity and disaster recovery.

3.3.5.6 Storage Architecture

Storage architecture is a combination of automation, control, and resource management software with a well-defined topology of virtualization, servers, storage, and networking hardware. The TTF Enterprise storage architecture design should follow a structured approach to ensure that the correct solution is adopted in the TTF domain. The three basic types of storage architectures:

- Distributed Storage;
- Hybrid (virtual and distributed) Storage;
- Centralized Storage.

Each of these storage architecture types defines a storage pattern that can be used as a starting point for providing a basis on how the storage should integrate with the business needs of TTFS Architecture. A structured design requirement for a complete TTFS Enterprise Storage consists of:

- Determining the storage requirements;
- Choosing the storage technologies, determine the data layer scope, design of the virtualization hosts, software / service infrastructure, service supportive storage infrastructure and storage network infrastructure;
- Defining fault tolerance technologies and backup and recovery technologies.

Scalability of storage architecture is also an important logical metric. The storage requirements consist of calculated physical metrics, but future requirements must be always estimates.

The TTFS agencies need to share their data storage due to reduced costs, enhanced continuity and future scalability, supported by the implementation of technology components such as server provisioning and configuration management tools, smart storage infrastructure, and virtualization

technology to create separate environments for each TTFS participant. The TTFS storage virtualization will pool the physical storage from multiple network storage devices into what appears to be a single storage device - government “private cloud”.

3.3.5.7 Network Architecture

The TTF network architecture should be determined by the business and application/service requirements. These two dictate the development of the backbone network infrastructure not only for the support of basic network services but also for the support of storage services, meaning provisioning of network infrastructure capable of supporting data and application and service resources. There is a growing need for TTF network architecture to avoid closed, proprietary platform into a proven, commoditized network platform by using agile, open, reusable and standardized components:

- Provide and support TTFS Architecture common services;
- Support exchange of data / information (EDI, DTI etc.);
- At reasonable cost, high agility, high security and business continuity.

There are two distinct TTFS Network Architecture designs that follow the best practices of hierarchy and modularity of the network architecture. The TTFS network designs should be based on the collapsed core backbone architecture in order to share common principles that will provide structure for the scalable network infrastructure. However, the designs differ in terms of scalability of advanced services that may be requested in the future and provided within the TF framework of implemented network infrastructure. The following parts describe the TTFS network architecture requirements:

- **Service Oriented Network Design** should be developed based on layer 4 switching platforms (hardware-based layer 3 switching technology) providing full integration of advanced services and provides additional datagram inspection within the TTFS Infrastructure. This approach is leading towards more efficient accommodation of application and service requirements, so it provides by far much better environment for linking the storage and accommodating consolidated TTFS Infrastructure thus providing scalable network infrastructure in terms of future growth of services;
- **Transport Oriented Network Design** should be developed based on basic requirements for the provisioning of transport and connectivity network services. It is still based on the powerful fiber channel core backbone network, followed by integrated support of additional advanced application / service and data layer. From the perspective of the core backbone network, the fiber channel does not follow the OSI model layering segment, but still, the network design should allow possibility extension of the network infrastructure in the future following the principle of modularity, treated as any other segment within the TTF Architecture.

In the early/mid '90s the Wide Area Network (WAN) bandwidth (28.8k up to 256k) was extremely limited, and the Internet was still in its infancy. The future of TTFS must be underpinned by innovations in a number of core technologies.

Not all TTFS traffic over the network requires high quality. Asynchronous exchange of data or messaging that are not time-sensitive and delivery in several seconds, as opposed to milliseconds, would be sufficient. This also applies to bulk data transfers over the network, such as backups or deployment packages of new application / services, which often run at night or in the background and human-oriented communications such as e-mail, VOIP and Intranet web applications. By allowing this non-essential traffic to flow over the Internet, the TTFS core network infrastructure could be downsized to accommodate only mission-critical traffic. In addition, some smaller, non-critical TTF sites could be migrated fully onto the Internet-based WAN. Such a virtual, secondary network would in practice be very high due to the resilient nature of the Internet itself. Security would need to be addressed and tightly managed. If properly set up, the TTFS secondary network

would be equally as secure as the core network. The TTFS secondary network should even be used as a fail-over option for the core network, allowing service levels on the core network to be reduced.

The point-to-point “superhighway” approach (fiber) is too expensive. However, today’s technology (especially mobile technology) allows traffic speed that can fulfill the TTGS network bandwidth requirements. The following table shows the typical and maximum speed values achieved with 3G and 4G mobile technology.

From technology point of view, Multiprotocol Label Switching (MPLS) is the solution for the primary choice of service for the enterprise WAN and should be used for the primary, core TTFS network. For the secondary, virtual network routed over the Internet, Internet Protocol Security (IPsec) is the most feasible technology.

3.3.5.8 Security Architecture

Security architecture becomes extremely complex as a result from highly increasing new and varied threats. These threats require innovative security solutions, reliable vendors, costly security software/hardware, and increasing complexity of the ICT environments. The ICT is under continuous pressure to do more with existing resources, both human and technological, this method becomes gradually unacceptable.

A long term TTFS security strategy must rely on identification and mitigation of potential risks for the new services that are to be introduced into its environment. It is necessary to ensure that security mechanisms can be implemented at the correct layers of the TTFS Architecture to minimize the risk of attack to its resources.

In order to meet the TTFS requirements, security infrastructure is one of the element on which the systems is based. The TTF security infrastructure should be made of a set of hardware devices and specialized enterprise security software, able to put in place all security mechanisms needed to respond to potential threats. The security architecture design should define zones that group policies and strategies in the best possible manner according to the data and tiers to be protected. Second, the security should specify the restrictions that apply to the tiers in these zones and the intra and inter-zone communications. These definitions and restrictions shall be also used as an input to the network design team to define the VLAN architecture, IPsec, tunneling etc. and selected high-risk / exposed hosts (example DMZ).

3.3.5.9 Public Key Infrastructure (PKI)

For the application of TTFS security mechanisms it is necessary to use a services of Public Key Infrastructure (PKI) for the management of the certificates needed both for platforms (for example to support SSL) and for the functions of signature electronic documents and / or e-mail messages. The PKI must also support the system-to-system digital signature, example transfer of the veterinary certificate from SW to CDPS, signature of data packages.

3.4 Elements of an integrated and modernized TTFS Architecture

This chapter outlines in brief the key elements and examples of an integrated and modernized TTFS IT architecture.

3.4.1 TTF Enterprise Portal Front-end integration

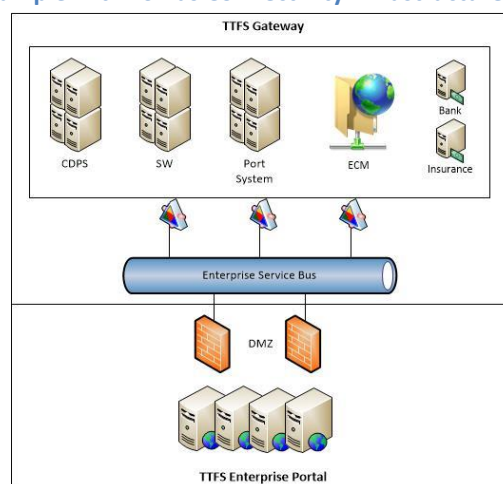
Traditionally, traders experience multiple portals (Customs, SW, Bank, OGA, appeal systems etc.), with little or no integration, and different approaches and security credentials for providing similar functionality across TTF platforms. A modern integrated TTFS architecture must attempt to solve that problem with integration and cross-service capabilities into a one Enterprise Portal that offers a consistent, integrated, multipurpose and optimized approach to interaction across a wide range of TTF services.

The TTF Enterprise Portal is the single access point that serves as the entry point of transactions and communication layer for the trades that will assist and facilitate for all businesses with Customs, Single Window, other government agencies, port operators, transport systems, banks, and insurance companies etc. All applications, for example to submit declarations, apply for permits and certifications, perform payments for import/export and warehouse movement, payment for duty or other charges, guaranty management, correspondence, and other services should be made through this portal.

TTF Enterprise Portal should be a comprehensive website providing access to and interaction with relevant information providing the bi-directional interaction between traders and TTFS (such as information / content, applications, services and business processes), knowledge assets and human assets by select targeted audiences, delivered in a highly personalized and user friendly manner. TTF Enterprise portal will provide traders with a consistent experience across many TTF IT systems, processes and interactions, security (every single interaction is digitally signed) and they provide TTF with unified platform for access and delivery of web applications and services. The functional requirements of TTF Enterprise Portal are listed below:

- To support access heterogeneity, regardless of operating system, browser and devices;
- The interface between the national and external domain must avoid the issues of technical interoperability;
- To support single sign on access to TTF Systems and services;
- Able to check the authentication of the connection and the user in a way that is not restricted i.e. the user is not restricted to a certain business area – dynamic menu;
- Check the permission / mandate of the user, i.e. what the user is allowed to do;
- To handle digital signatures;
- Verify the structure of the data and messages;
- Validate the receive, register, accept, store and transmit data entry;
- To use multiple messages encodings (e.g. EDICFACT, XML) and, if needed, be able to convert message encodings to desired formats;
- To log, digitally sign and timestamp every transaction taking place. Due to the fact that some countries have different time zones in the national domain, timestamp must be with time zone information;
- To exchange and process data and documents to the back end module of the agencies;
- To send confirmation / reply messages to traders;
- To warn traders and agencies on timeframe - legal deadlines on certain events / procedures.

Figure 6: TTFS Architecture (example with ESB as Connectivity Infrastructure)



Source: Authors

The TTF Enterprise Portal, in this example an Enterprise Service Bus ESB, is enabling data interoperability to allow a single data set to be managed by multiple TTFS sub-systems and to

exchange and use data in specified data formats and communication protocols for collaboration of cross-agency services requiring applications to exchange data in a semantically interoperable manner. Data is routed from the TTFS Enterprise Portal to a TTFS Gateway recipient(s) system and data is processed immediately upon inserting.

The TTF Enterprise Portal is premised upon the degree of rationalization of the overall ICT infrastructure, based upon standards and/or common ICT platforms. For example, multiple applications sharing one infrastructure or 100 web sites using one centralized content management / web servers – TTF Gateway, rather than hundreds of servers spread throughout the national domain⁴¹.

3.4.2 TTFS Gateway Back-end integration

TTFS system combines information from multiple data layers. The Gateway system ensures the processing of event driven data received from one or more sources in a clearly define timeframe. The TTFS Gateway (TTFSG) is a complex-event processing enterprise system that is implemented by event-driven, continuous-intelligent systems. The TTFS Gateway represents a number of services, standards, concepts, functional components, and functional assets that must be used to achieve the technological modernization of TTFS Architecture. The high level functional requirements are:

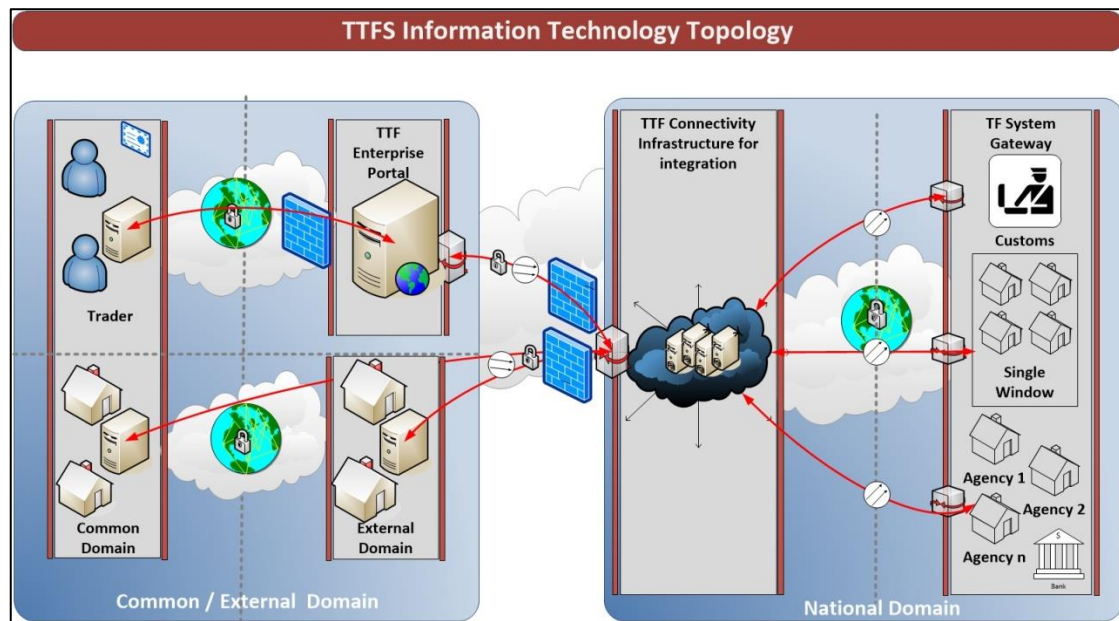
- To allow for the exchange / sharing of data and documents between agencies(back office functionalities);
- To allow for the exchange of data and documents between trader and the agencies (front office functionalities);
- To allow for a seamless flow / share of data between agencies allowing the trader where possible to provide the data only once;
- The TTFS must have capacity to handle the data / message flow at peak times. Analysis based upon the national volumes has to be done;
- Digitally sign all events and transactions (trader – TTFS and system – system);
- Enforce application and services security policies;
- Support for message enhancement and/or the complete transformation of message structure (e.g., EDI-FACT to XML and opposite) before forwarding the message to the appropriate sub-system or service;
- To support the routing of data and messages via middleware application or service (web services, ESB, received from external clients (ex. trader or system to system) to the appropriate sub-system services and vice versa (content-based routing
- Support communication with other government authorities that are not part of TTFS;
- Communication with the External Domain via single national domain interface;
- Support communication layer for cross border exchange of data with external and common domain;
- Capability to supports different models of communication and data exchange (asynchronous, synchronous, publish / subscribe, etc.);
- Recording, organizing and managing all the services;
- Use of services offered by service rules of the TTFS or any third party systems.

It is very important from an efficiency point of view to use an event-driven gateway. Processing is triggered by the arrival of data as well as time and request triggers whilst in other time-driven and request-driven systems, the data is stored when it arrives, and processing is triggered later by a timer (in a time-driven trigger) or by a request from a user or computer program / service (in a request-driven trigger).

The figure below shows the technology topology including the TTF Enterprise Portal on the front end and the TTF Gateway on the back end side.

⁴¹ The national domain is government and agencies autonomous domain and the interfaces to other parties.

Figure 7: TTFS Information Technology Topology



Source: Authors

Such a gateway needs to be easily configurable, extensible and integrated with the existing national domain and the legacy systems. It must ensure:

- Separation of presentation from the business logic providing integration services and a distinct data persistence layer;
- Business logic must be encapsulated to a pool of common reusable services and wrapped into web services and is made available to the TTFS and external sub-systems;
- TTFSG shall be based on architectural patterns and must be compliant (but not driven) with the existing applications and services and their respective domain architecture;
- TTFSG shall be on the latest standards using mostly XML and Web Services technologies supported by middleware system (example ESB);
- It must follow the Single Sign On provided in the TF Enterprise Portal front-end functionality to external users and system to system authentication;
- The TTFSG must support the planned communication load and be able to get tuned to any increases in the future without major changes;
- It must comply with national and international security and data protection standards;
- The TTFSG should be able to easily adapt to the possible variations of the legal requirements and agreement at the international and national levels;
- Communication between service consumers and service providers and between different applications /services will be ensured by validation of the data set, multiple message formats and information being exchanged.

TTFS Gateway component model should have references on overall architectural view with the presentation of the various external components as per component (sub) systems (CDPS, SW etc.). Moreover, a mapping of the components shall be developed in order to provide logical link (messaging, data exchange services) between the functional components and the system components (logical sub-systems).

3.4.3 Law Enforcement ICT System

Law Enforcement Information Communication Technology System (LEICTS) is an agency-wide ICT System of shared data, services and applications that enables the storage, retrieval, maintenance,

handling, archiving, and viewing of information pertaining to Law Enforcement operations. By providing a common data layer it supports analysis and decision-making at the strategic, operational and tactical level. The LEICTS supports the operations of all the units of Customs and Tax involved in Law Enforcement activities. IT enables its users to have access to accurate, integrated and trusted data and information relevant for law enforcement operations. The functional requirements of the LEICTS are:

- Support the overall Law Enforcement cycle (Intelligence, Investigation, Post Clearance Audit, Anti-Smuggling Unit / Scanner Unit, Risk Management and customs operations);
- Allocation of resources, both human and technical;
- Enable LE officers efficient data analysis from LEICTS;
- Improve response in timely manner based on accurate risk indicators;
- Eliminate redundant or inconsistent information;
- To improve Risk Management for commercial traffic;
- To establish Risk Management for non—commercial traffic;
- Shared information resources and expertise for use by other LE Agencies and LE Units;
- Assist in prevention of customs fraud and economic crimes based on predictable patterns;
- Provide customs officers access to the facts and relevant information;
- Boost departmental efficiency and allocating resources with strategic planning and tactical approaches;
- Cost savings by having data readily available and in a usable format.

A LEICTS supports trade and transport facilitation by effectively using new technology to focus on organized smuggling and crimes whilst facilitating the movement of legitimate trade. The main functionalities of the LEICTS are as follow:

- Data input – all possible source of information;
- Content of the data input;
- Rules on data entry;
- Workflow;
- Feedback – Results; and
- Analysis of survey—determining whether the stated requirements are clear, complete, contradictory, and then resolving these issues.

3.4.3.1 LE Analysis and Reporting Services

Below is the brief description of the reporting and analysis services that LEICTS should support:

- **Strategic Analysis** - Provides information concerning long-range enforcement problems. Strategic analysis provides - local, regional, economic, and/or other types of information concerning customs operations. Based on results – input in the Risk Management;
- **Tactical Analysis** - Ad-hoc analysis that provides information to assist customs tactical / operations personnel in the identification of specific risk indicators that require urgent to immediate reactions;
- **Administrative Analysis** - Provides information to support administrative decisions related to resource allocation (human and technology resource policy);
- **Forecasting Analysis** - A combination of tactical, strategic, and administrative analysis; Assistance to Management concerning strategic decisions - planning, budget, recourses.

The nature and importance of the work of LE require highly reliable and accurate reporting and analysis services. This can only be accomplished with qualitative and quantitative organization of data – Data Warehouse, Business Intelligence and data mining.

3.4.3.2 LEICT infrastructure requirements

Application / Web Layer

The application/web layer of LEICTS should reside on middleware application based on extensible programming platform (Java EE, .NET, C# etc.). Middleware application grid portfolio and is ideally suited for applications and services that need to be supported by LEICTS, requiring lightweight infrastructure with minimum two web / application nodes.

Database Layer

In order to avoid leverage of the RDBMS diversity of the databases, the integration of LEICTS should be no different than the ones in use in the national domain. The database layer for LEICTS shall consist of two nodes, an active-passive solution: the active instance handles requests and a passive instance is on standby. In addition to architectural redundancies the data protection mechanism must be implemented that will ensure high availability and disaster recovery for LEICTS data. The data protection mechanism must provide high level of encryption and a comprehensive set of services that create, maintain, manage, and monitor one or more standby databases to enable production databases to survive disasters and data corruptions.

LEICTS Security

The following are some security recommendation of the data for the LEICTS:

- Single entry (data is entered once and then reused by other LE modules as necessary);
- Interconnectivity and interoperability with other systems (CDPS, SW, other LE agencies);
- High data security standards:
- User Authentication;
- Audit logs (previous state of dataset and the new values);
- Application logs (who, what, when);
- System logs (from where, what, how);
- Restrict and control the access by LE operational staff to the LEICTS operational environment on a “need to know/access⁴²” basis;
- Ability to enter and query narrative(s) / text fields;
- Ability to access data from multiple systems from a single LE IT System workstation / web browser / interface;
- Single encrypted database and backup layer;
- Validation on data entry (logical edits, edit checks for all fields).

3.4.4 Integrated Risk Management IT support

The main purpose of IT systems for Integrated Risk Management (IRM) is to support rapid and accurate decision-making, analysis and reporting and forecasting. In addition to providing support for identifying and quantifying risk, the integrated risk ICT solution should provide unified support for the entire risk analysis process, including the feedback and evaluation.

3.4.4.1 Cross-agency Risk Management

Risk management should encompass transactional and behavioral risk analysis. Most of the existing CDPS have risk management modules that is providing transactional risk analysis⁴³. To move to more

⁴² https://en.wikipedia.org/wiki/Need_to_know

⁴³ Transactional risk analysis is a form of classification of documents and/or declarations (the data analysis objects) submitted by the trader – performed either solely on the basis of the information in the submitted document or on the basis of all available supplementary information about a trader, including the information in the declaration. The objective is essentially to classify the transactions or events (e.g. the incoming declarations or items in the declaration or request for import veterinary licenses) into a number of categories each requiring a certain type of action. The simplest example involves classification of the objects into two categories – those requiring some

comprehensive behavioral risk analysis it is necessary to gather and analyze data from various data sources in order to evaluate the risk and develop risk criteria using structured and non-structured data from multiple data. The best way to support behavioral risk analysis is by combining IT RM modules integrated within DCPS with data warehouse / business.

3.4.4.2 Behavioral Risk Analysis

The objective of behavioral risk analysis is to undertake in-depth profiling of risk entities (e.g. traders, tariff, appeals, country of origin, forwarding agent, etc.) from various risk perspectives, with a view to supporting a subsequent business process, which is dependent on this risk rating.

The analysis is performed upon user request - either on an ad-hoc basis or according to some predetermined schedule (e.g. when a trader first registers, at a particular time of the year, export with high price of commodities, top ten tariff numbers on inward / outward processing etc.). Behavioral risk analysis is used for a number of different requirements (with a separate dimension of risk being dedicated to each requirement):

- To provide qualifying input into the transactional risk analysis phase – for example, rules in the transactional risk analysis phase often invoke a rating of the trader associated with the transaction being analyzed in order to provide a greater level of precision in the transactional analysis;
- To rate the risk entity in terms of Authorized Economic Operator certification programs;
- To identify which of the risk entities need to be subjected to some form of control action, as is the case in post clearance audits and various types of quality assurance audits.

As indicated above, behavioral risk analysis is often undertaken on an on-demand basis, where the objective would be to generate a risk score and observations that could support the evaluation of the target dimension (data warehouse dimension).

Behavioral risk analysis draws on one of the extremely powerful features of the IRM system – namely its ability to work with a multi-dimensional risk model, where each dimension focuses on a specific aspect of risk, by drawing on its own set of rules to establish detailed observations and so-called ranking scores for each risk entity, in one or more dimensions - risk ratings. The number of risk dimensions and what each of the dimensions represents must be configurable and up to each agency / authority to decide by themselves.

3.4.4.3 IT Support

An integrated risk management system is not limited to a selectivity module, which allows the screening of transaction based on customs declaration data for pre-established risk profiles. Rather, agency processing systems such as CDPS and IT risk management form synergies throughout the entire risk management cycle by the IT RM being responsible for the entire risk management cycle and the other systems requesting analysis and support for specific process steps triggered by specific events. Within the context of the components necessities, the Integrated IT Risk Management should support the following requirements:

- Recognizing and understanding the potential sources and areas of risk;
- Determining policy for addressing risk;
- Identifying risk - Inter-Agency / Multi-Agency Risk Management;
- Quantifying risk and determining the control measures necessary to manage the risk;
- Addressing the risk (in a prioritized fashion and in conformance with risk policy);
- Monitoring the effect of the intervention and feedback;
- Analysis of the feedback – action taken, measurement, modus operandi etc.

form of intervention (e.g. a customs inspection) before the business cycle can resume and those that do not require any intervention before the business cycle can resume (example SW).

Key Performance Indicators (KPI's) measure the performance of risk indicators and profiles against the intervention and the feedback. It is important to encourage the exchange of information between national agencies and authorities, for example, between Customs and police or other law enforcement agencies. The risks should be managed by using the IRM System functionalities:

- Exchange of information / data related to TTF Risk;
- Systematic insert - update of risk profiles / risk indicators in the IRM;
- Analysis of risk indicators information (behavioral risk analysis);
- Decisions on possible risk and risk level;
- Creating of criteria by setting the parameters for targeted risk consignments, goods, importers vehicles, vessels etc.;
- Repeated analysis of the feedback, conducted control, based on set criteria in the IRM.

Additionally the integrated risk solution should support management and administration of the whole process, with a view to providing management with a complete picture of the ongoing process through the production of performance indicators at different levels throughout the TF ICT Architecture, starting from TTFS Enterprise portal as an entry and validating point. As a result, the agencies will be able to concentrate their compliance effort on those situations posing the highest compliance risk and to undertake effective compliance action where required.

3.4.4.4 Integrated Risk Management System Architecture

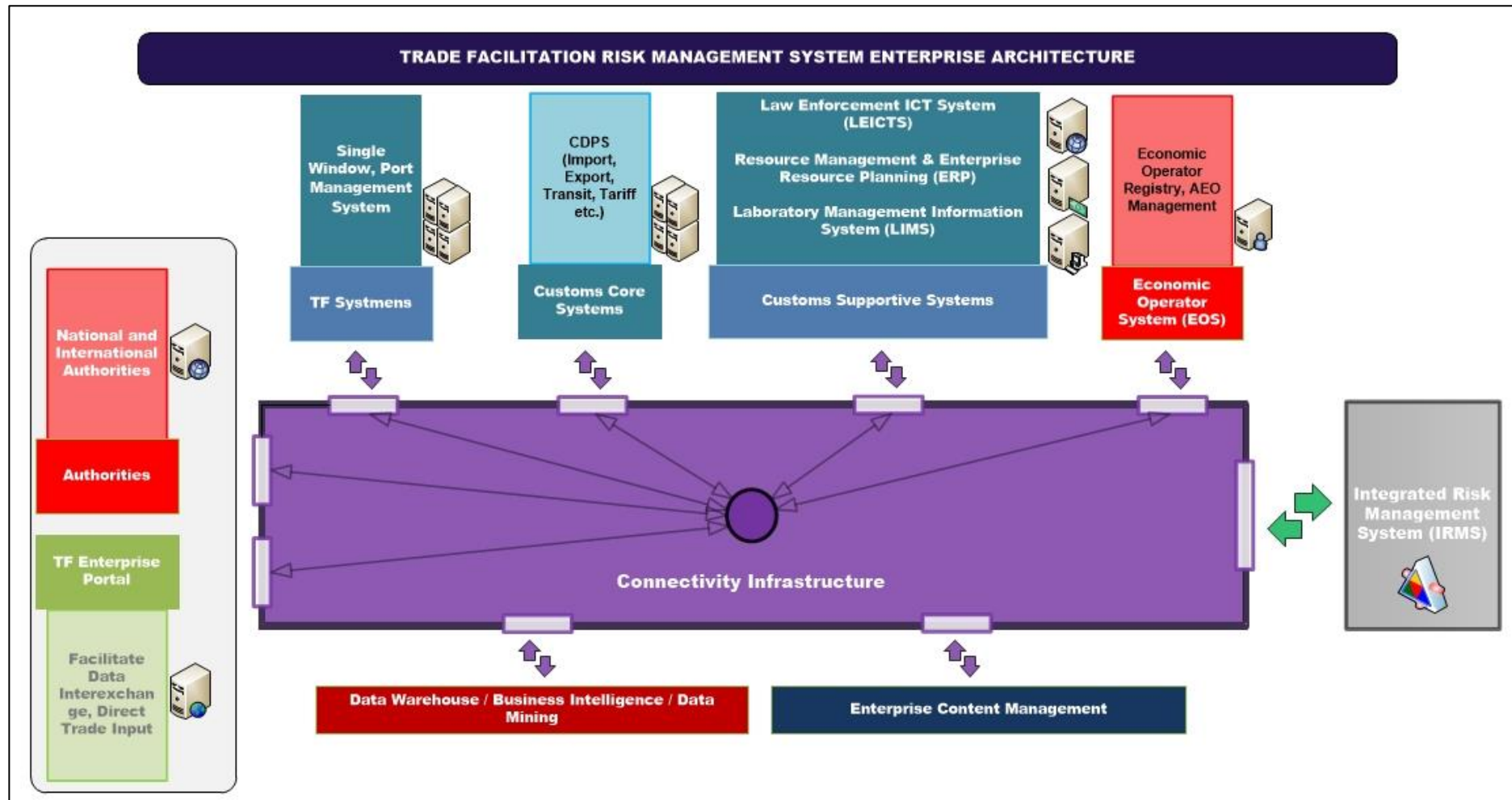
It is necessary to ensure linkages between IT RM and other TTF systems such as CDPS, SW, Law Enforcement ICT System, and Port Management Systems.

Behavioral risk analysis is potentially performed on all available data about the trader – ranging from data reflecting trading activities through to results generated by the execution of previous control measures. One of the key usages of behavioral risk analysis is to support the targeting of a certain portion of the high risk analysis objects for some form of compliance action (typically audit/investigation or some part thereof (e.g. for intelligence, post clearance audit).

The definition of rules should be based on a multi-dimensional model of the data (data cubes) to be analyzed. This data is typically accessed from data warehouse (ETL, ESB, NoSQL etc.) in one or more of the operational production systems (CDPS, SW, Port Management etc.) and in the form of a message generated by the production systems.

Different types of data are typically represented (internally within the risk solution) in different data cubes for a number of reasons, e.g. because the reporting frequency (time dimension) is different.

Figure 8: TF Integrated Risk Management System Architecture



Source: Authors

3.4.5 Business Intelligence

Business Intelligence (BI) will provide analysis and reporting layer for TTFS on strategic, tactical and operational levels to access, analyze, and use their data for decision making purposes. It is used for long-term strategic planning, short-term tactical analysis, and for managing the daily operational business activities. A key developments requirement for the BI includes:

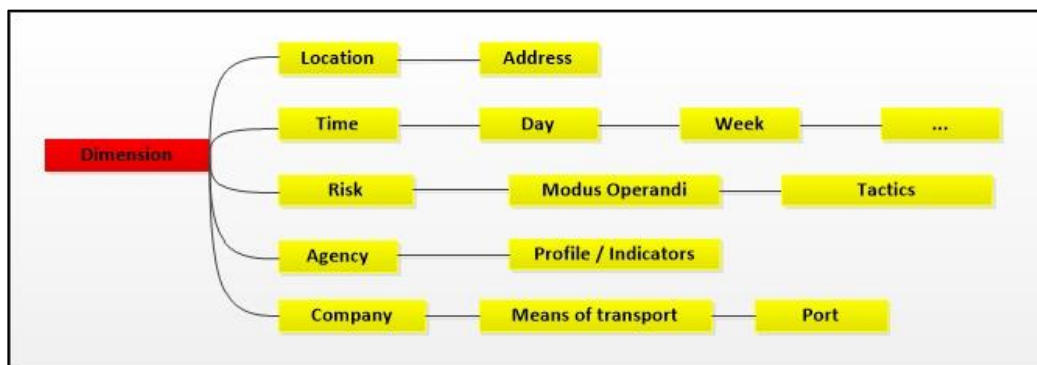
- Tactical and strategic BI is moving closer together. This is because strategic time frames are shrinking to enable TTF to become more responsive to business needs and trader requirements;
- Analytic applications should be used more and more for proactively delivering business intelligence to users, rather than requiring them to discover it for themselves;
- TTF procedures is a key requirement as management implement so-called closed-loop processing to use the results of business intelligence processing to optimize TTF operations. This is particularly true when there is a requirement to support automated decisions, recommendations, and actions;
- Close to real-time (near real-time), or low-latency, business information is becoming an important requirement as traders increasingly make use of business intelligence for managing and driving daily trade operations. The TTF and traders will have a common reporting and analysis services in an accurate and timely manner.

The need to continuously refine business goals and strategies requires a TTFS that can absorb these changes and help TTF to optimize business processes to satisfy business objectives. BI assists here by providing performance metrics, or key performance indicators (KPIs), which businesses can employ to evaluate business performance.

Pattern Analysis using Predictive Analytics and Data Mining

Additionally, it is possible to incorporate knowledge, which has previously been unknown as it is hidden within the masses of data that most agencies have at their disposal. Using data mining techniques and tools, this knowledge can be 'mined' by a TTFS IRM. This method of assisted knowledge discovery complements well the rule-based, transactional and behavioral risk analysis described above. The detected patterns can be used as supporting information in a knowledge engineering process, i.e. to allow human analysts to define causality relationships between entities, events, etc. and then to express appropriate risk rules to match them. Alternatively, the patterns can be (semi-) automatically transcribed in suitable form for immediate inclusion and re-use by the transactional and behavioral knowledge bases (e.g. the result of a rule induction data mining algorithm could be represented as a set of rules that could then be automatically inserted as risk profiles in the transactional risk system).

Figure 9: Organization of Data Warehouse IRM Dimensional structure for Data mining (example)



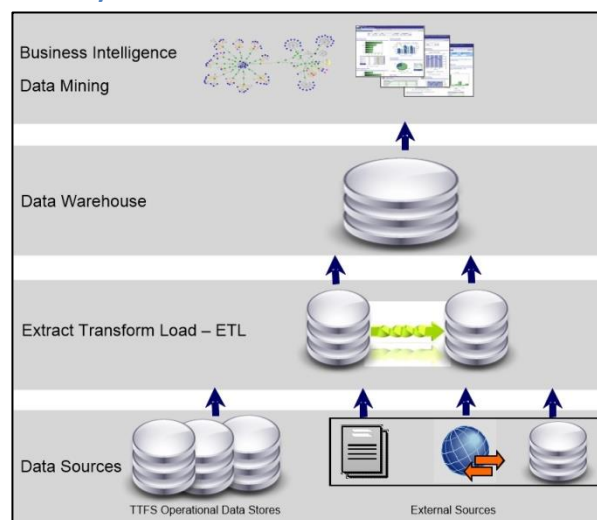
Source: Authors

3.4.5.1 Extract, Transform, Load (ETL)

To meet the TTF requirements and support the change in thinking and measurement, TTFS needs to move towards real time analysis. This implies making TTFS data available, or accessible from the data-warehousing environment. Then TTFS data can be combined, analyzed, and presented in a consistent manner to enable more informed management decision-making. The data warehousing environment is the base for all business intelligence systems. The ETL is a proper tool to achieve these requirements.

The ETL engines extract the data from the multiple TTF operational environments (SW, CDPS etc.) cleansed, and transformed before it can be placed in the data warehouse in order to be usable for query processing and analysis (BI). These extract, load, transform (ETL) processes have historically been batch-oriented; the latest database technologies allow to run on a continuous or near-continuous basis. Running multiples of these processes in parallel is another alternative for getting TTFS data into the data warehouse as quickly as possible. Another approach is to extract and load the data, and then perform any required transformations after the data is in the data warehousing environment.

Figure 10: TTFS Reporting and Analysis Infrastructure



Source: Authors

3.4.6 Enterprise Content Management (ECM)

Enterprise content management (ECM) refers to the technologies, strategies, methods and tools used to capture, manage, store, preserve, and deliver content (data and metadata) and documents related to an organization and its processes. ECM tools allow the management of an Enterprise level organization's information. From an external user's view, convenient access to information and communication in timely manner is often as important to their perception of an organization as the quality of the services offered.

3.4.6.1 Current situation

The TTF contributors have considerable gaps in business processes. Information is not available where it is needed within business processes, and electronic business processes are not continuous or they are very slow and in most cases paper-based. The communication layer between the traders and agencies and among agencies is classical archiving system (paper-based handling) in old fashion way, basically an electronic system to manage the business processes, manageable documents workflow doesn't exist. The documents produced within a process is stored locally, on the PC's, in the decentralized, heterogeneous and autonomous environment.

3.4.6.2 ECM Benefits

Closing these gaps and automating the communication layer between traders and agencies organizational interfaces, the process steps and departments and units within the TTF agencies workflow structure will lead to considerable cost savings and operational gains. The functionalities that TTF can benefit from integrated in Enterprise Content Management System:

- To capture, store, and organize information in personalized workspaces, folders, and compound documents from a single point – TF Enterprise Portal, web forms streamline data entry process with timestamp;
- Integrated workflow - flexible and powerful process automation tools for exchange of data, documents, change management, document review, decision making or approvals;
- Automated taxonomy, distribution, exchange and access to documentation;
- Integrated Security and support for Digital Signature;
- Timeframe Alerts (flags) on all levels – by SMS, email, gateway alerts, and integrated notification capabilities inform external and internal users whenever relevant content within the repository is updated;
- Information, decisions distributed to traders and intra-agencies in accurate and timely manner;
- Data entry or document creation should be followed with timely informed decision-making;
- Integrated regulatory compliance - Implementing a secure and scalable document management solution and adopting proven best practices will help to achieve corporate governance and regulatory compliance mandates, legal certainty for traders;
- Information Retrieval - crawl and index most file formats and taxonomy classifications;
- Advanced search functions, including full-text, metadata, XML, and natural language searching, result ranking, summarization, clustering, hit highlighting etc.;
- Version control - Manage the history of even the most complex compound documents, including version control and revision management;
- Audit trails - Comprehensive audit trail functionality records the date and time of an action, who performed it, a description of it, and related document activities such as who worked on it, reserved it, and more;
- Desktop integration - Integrate with familiar Microsoft Office desktop productivity tools. Users can drag and drop files from file system directly into the unified document repository.

4 Organizational implementation requirements

ICT systems are embedded in and managed by an organization that consists of management structures, resources (budget and human resources), processes, and decision-making and governance arrangements. The role of an IT organizational structure is to ensure that IT capabilities are operated successfully and are aligned to the business needs. An IT strategy is a necessary link between the ICT architecture and the business strategy.

4.1 Organizational structure

4.1.1 ICT Organizational Model

There are different organizational models that that can be followed. Today, IT organization in trade facilitation-related public bodies, takes the form of the decentralized or project based structure⁴⁴, in which every department manages its own ICT systems and business needs are disconnected from

⁴⁴ According to Gartner decentralization means “IT is decentralized by business unit, operating group or subsidiary. Each of these entities has its own ICT organization, and ICT budget. There is little or no attempt to coordinate across units or with centralized approach.” Project based means All ICT resources are centralized under a single reporting structure with centralized resource allocation (staffing). The organizational structure is built around resource pools”. (Built-to-Purpose IT Organization,. Research Note published 25 October 2012.) https://wiki.state.ma.us/confluence/download/attachments/466976917/the_builttopurpose_it_organ_238561%5B1%5D.pdf?version=1&modificationDate=1365091095000

the technical services. Such a structure typically consists of three vertical silo functions: i) Business processes; ii) Development / Project Management; and iii) Administration. Such a silo structure ignores services, such as security, disaster management, that are horizontally cutting across ICT systems and organizational boundaries. Decentralized organization also lacks horizontal integration, intra-, and inter-organizational, is focused on the delivery of technology services, and lacks a common IT strategy that caters to all TF ICT needs and expected business oriented outcomes.

Another organizational model is the federated structure. According to Gartner, a hybrid structure is *“a centralized ICT organization supports all infrastructure and enterprise wide services, usually in a shared services environment. Organizational business units maintain their own systems / services development organizations and budgets for business specific services.”*⁴⁵ A federated structure distinguishes and defines between business and technical responsibilities of ICT. Contrary to a centralized⁴⁶ structure that would require the creation of an entire new entity, the federated structure can be constituted of members from ICT departments from relevant agencies. In fact, the federated structure appears to be the best choice for the current TF ICT needs and is followed by countries such as the EU, US, and Canada, and is successful in addressing both the structure of the supportive systems, and the delegation / division of tasks within ICT organization. Budgeting is aligned to and adequate for the business needs and IT Strategy.

The exact IT organization design depends on the specific context. With regards to the IT needs and architecture described in this paper, the IT organization should have the following responsibilities:

- Organization, planning, development, implementation and maintenance of ICT systems;
- Budgetary planning and management for both operational systems and new developments;
- Planning the development of TTF ICT Enterprise Integration, networks for data transmission and data exchange in National and External Domain;
- Providing support on the users to system and system to system level from both functional and technological aspects;
- Monitoring the functioning and performance of information and technological systems;
- Participation in production, installation, monitoring and documentation of methodologies for ICT policy planning, preparation, use and maintenance of TTF ICT systems;
- Preparing the data for TF analysis and statistics;
- System engineering in the area of installation and maintenance of hardware, operating systems, systems for managing databases and applicative software;
- Analysis of the potential risks to the security of ICT systems;
- Implementing measures for safety and security of the ICT systems;
- Monitoring of current operations and the use of ICT resources and making suggestions for expansion, adjustment and replacement of certain components.

Another essential role of an IT organization is the effective management of people based on careful staff selection, training, motivation and leadership.

4.2 IT Strategy applicable to TF business needs

IT has to deliver outcomes to the operational (business) level and has to respond to existing regulatory, functional and non-functional needs of operational units. To ensure this linkage and outcome performance an IT strategy and a shared Business Process Management are useful.

An IT strategy is a tool to ensure the alignment of business and IT needs and requirements. It lays down how IT is delivering on the business strategy, and how IT is guiding the business strategy, and is an integral part of the business strategy even when formalized in a separate document⁴⁷. A lack of

⁴⁵ source see footnote above

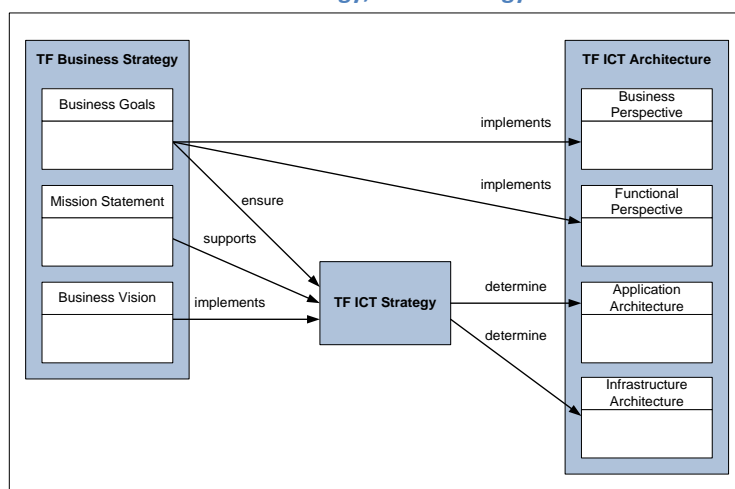
⁴⁶ According to Gartner centralised means « IT is centralized under a single enterprise level. All ICT systems and budgets reside at the enterprise level, instead to have an SOA organization and budget.” source see footnote above

⁴⁷ <http://www.gartner.com/it-glossary/it-strategy>

or poorly drafted business strategy and IT Strategy will increase the Total Cost of Ownership (TCO) of the ICT Systems and can drive the ICT to complexity and “spaghetti infrastructure”.

The diagram below shows how Business Strategy and ICT Infrastructure interact through an IT Strategy, in this case a TF related IT Strategy. The Business strategy formulates the goals, vision and mission statement that are translated into IT business needs and requirements on the functional, application, business and infrastructure level.

Figure 11: Composite Structure –TF Business Strategy, TF IT Strategy and TF ICT Architecture



Source: Authors

Different stakeholders contribute to the development and execution of the IT strategy and the operational and ICT side complement each other, with their respective role being:

- TTF Business owners (public administration and policy makers) provide the operational and functional perspective input to the IT Strategy. Whilst doing so they focus on holistic TF goals, describing desired TF policy changes functions.
- TTF ICT owners will use the business and functional perspectives to develop a reference application perspective and the required supporting technical perspective.

An IT Strategy requires two elements that can be distinguished as follows:

- Business, functional requirements, and technical specifications for Enterprise Integration activities – leading to a common ICT Supportive Architecture;
- Proper Planning – leading to an integrated ICT Plan that includes an implementation of the IT Strategy and a budget plan⁴⁸.

The policy and regulatory framework of trade facilitation is constantly evolving and IT has to follow these changes and adapt to these requirements. Business Process Management is a tool that allows business processes to be rapidly adapted to changing needs and to be executed in a coherent way. It includes processes documentation, analysis and optimization solutions, state of implementation throughout the architecture, and monitoring and measurement of the Key Performance Indicators (KPI). In particular it contains: i) Accessible services; ii) Access policy; iii) Service contracts; iv) Change management; and v) Data schemes. Business Process Modeling is a part of Business Process management and should be performed by TF business analysts.

⁴⁸ Proper planning answers the following questions: Functional Architecture (what) – linked to BPM; Technical architecture & technology (how); Application of optimisation principle in anticipated developments: where should they be done with the best efficiency and effectiveness, reducing system and data redundancy - (by whom); ICT Strategic Plan implementation strategy - high level planning taking in account budgetary and resources available (when); Effort and budget estimates for each agency (what cost - TCO).

4.2.1 Human resources and Knowledge

IT human capacity and knowledge resources are critical components of organizational requirements, in particular in complex ICT Architectural environment with constantly growing demand for high quality ICT personnel. Successful IT human resources management requires roles and responsibilities that are driven by the business needs and expected outcomes. To best accommodate the HR and knowledge requirements, internal and external IT resources should be mixed where possible and appropriate. A big knowledge gap exists with regards to the capacity for business processes analysis. Business analysis is necessary in the design and implementation phase as well as to monitor performance of a system. This can be based on a common business process management methodology, which is comprehensible for both IT and the operational layers of an organization. In addition it is necessary to train staff as Business Systems Analyst, Business Requirements Analyst, and The Business Process Analyst.

The current reality however looks very different. IT knowledge resources are rather poorly planned and not aligned with business needs, for the following reasons:

- Absence of a defined resource policy and training strategy;
- Poor vendor training support;
- Lack of coordinated training management processes;
- No recognition of business requirements;
- Budget limitations.

As a result, technological objectives and investments are delinked from availability of personnel training and a coherent training needs assessment is lacking. Capabilities of IT staff to intervene, manage and optimize services and systems are therefore limited technically and restricted to specific systems.

A culture of continuous learning, training and professional education and certification—in line with international standards—of IT staff, are key pillars of a firm commitment to the development of professional, efficient, responsible and service oriented IT organization. Retaining qualified IT staff is a challenge for a public sector that cannot compete for budget and legal reasons with salaries paid in the private sector. Administrations worldwide experiment with different options of increasing salaries, implementing a system of career progression, and high quality training/development programs to increase retention.

4.2.2 ICT cost elements

Concerns about IT costs are frequently raised when discussing implementation of trade facilitation. The costs depend on the architecture that is developed and the functionalities. It is therefore not possible to give specific figures for applications, systems or infrastructure components. Some general considerations however help structuring the discussion of costs.

Decisions on investment in ICT infrastructure must consider both the costs and benefits, meaning the costs of infrastructure as well as the operational efficiency gains of improved fast and accurate services. Costs of IT systems also have to be calculated as total cost of ownership (TOC), and a standardized methodology has to be adopted to assess prices. The total Cost of Ownership (TCO) is the sum of all costs including supporting infrastructure to plan, manage and execute ICT projects. This includes:

- Procurement - hardware, SLA, vendor support, life cycle of hardware, warranties, UPS's, increase of processing, storage, network capacities, downtime / failure expenses etc.;
- Development - software, services, licenses, life cycle of the software, migration expenses, integration of software and hardware;
- Operational (additional expenditure or savings with implementation of the services)
 - Personnel - HR resources, additional roles and responsibilities, working hours etc.;

- Training - training on hardware, software, services, upgrade of skills, e-learning cost, training for traders, info portals, preparation of training materials, etc.;
- Logistical support (additional / backup power supply, facilities for new hardware, traveling costs, office space, communications costs etc.)
- Engagement of assets.

Only a realistic costs assessment based on TCO can provide guidance on how to put the right capacity in the right place at the right cost. It may allow predicting the costs (with accuracy +/- 5 to 10 %) for the annual, midterm and strategic level of budgeting. And it also ensures that decisions reach the highest Return on Investment (ROI) possible, over the life cycle of the service.

The TCO data collection methodology should not be applied in an ad-hoc manner, sketching prices and information from various, possibly, non-reliable sources. Accurate TOC estimation and analysis are based on pro-active communication with vendors and survey of the ICT market in both innovative technology and pricing.

4.3 Legal, policy and procedural framework

A complex set of legal rules applies to the use and operations of IT services. The legal framework consists of rules applying to data protection, ICT security, e-documents agency collaboration, including cross-border collaboration and information exchange. Often there is an outdated framework that does not apply to new technologies. This has led to the emergence of national e-commerce or e-transaction or e-signature laws. National legal instruments are however not sufficient. Cross-border paperless trade needs a common legal framework to avoid disruptions along borders. A survey by UNECE on the computerization of the TIR procedure highlighted that cross-border use of electronically signed documents will not become a reality without an internationally recognized certification authority⁴⁹. The ASEAN is a driver of advancing e-commerce in the region, including a harmonized legal framework⁵⁰.

4.3.1 Data protection and privacy

Public bodies have a specific responsibility, often codified in laws, when collecting, processing and storing person and company related data and information. Privacy laws, on one hand, protect citizens' data, and on the other hand, set limits within which an ICT system operates. They define access and use of data and data protection requirements. The lack of clear rules for data protection and privacy limits the potential of shared architectures and services. Although many countries⁵¹ have such privacy laws, many of them date back to a time when data was collected manually and stored in paper format only and not widely shared across agencies. If not revised and adopted to the current technologies, it will be difficult to derive clear and uniform technical measures that have to be respected. Ideally privacy laws are clear enough to clearly identify what technical measures can and need to be taken when collecting, using and storing data. Technical measures encompass solutions to control and audit access, to filter critical and sensitive data from non-critical and non-sensitive, encryption of stored and exchanged data, as well as ICT security management and solutions.

4.3.2 e-documents and e-signature

The use of electronic documents is still limited for legal reasons, namely legal uncertainty with regards to signature requirements and equivalence of paper and electronic documents and records.

⁴⁹ UNECE (2014) Informal Ad hoc Expert Group on Conceptual and Technical Aspects of Computerization of the TIR Procedure Twenty-fourth session, 25-26 September 2014 - Informal document GE.1 (2014) No. 7 (http://www.unece.org/fileadmin/DAM/trans/bcf/adhoc/conc_tech/documents/id14-07e.pdf)

⁵⁰ Review of ASEAN e-commerce laws, UNCTAD 2013

⁵¹ An UNCTAD mapping of privacy laws counted 107 countries with a privacy law (UNCTAD Press Release "Global mapping of cyberlaws reveals significant gaps despite progress", 24 March 2015, accessed at <http://unctad.org/en/pages/PressRelease.aspx?OriginalVersionID=238>)

Accounting and auditing rules for long time storage of records also have to be adapted to electronic documents and e-signatures.

Replacing paper transport documents/records, for example, is difficult because of the various legal effects these documents have in contract and property laws. The various functions of transport document (contract of carriage, document of title, receipt of goods) are not easily transferred to an electronic document and require the appropriate legal framework in every country. It is for this reason that dematerialization of transport documents, such as the BoL is often limited to the non-transferable sea waybill.⁵² The legal rules for transport document⁵³ have been drafted for a paper-based environment requiring transport documents to be signed and written documents and not electronic messages. Although the Rotterdam Convention adopted in 2008 regulates e-transport documents it has not yet entered into force. Despite these initiatives there still is legal uncertainty regarding the implementation, in particular with regards to their acceptability in judicial proceedings.

Electronic signatures are needed for paperless or electronic communication and messaging, such as the filing and lodging of a goods declaration to Customs. An electronic signature is the electronic equivalent of a written signature and it can come in various forms, from scanned to a digital representation of characteristics, fingerprint for example, or a signature created by cryptographic means⁵⁴. To be recognized as an equivalent to a paper based original signature, the technology and signature form need to ensure authenticity of the origin, integrity of the content and non – repudiation.

Increasingly, countries adopt legal instruments to set the legal framework for the recognition of e-records/documents and signatures in the form of horizontal e-transaction laws, or of separate provisions within a broader e-commerce laws, or separate regulations on e-signature and recognition of e-documents. For cross-border trade this is however not sufficient. A common legal basis for the recognition of e-signatures and e-records is needed so that documents can flow seamlessly and traders and supply chain partners do not have to regard different standards and technologies for electronic communication.

4.3.3 International Agreements, MoU, and Service Legal Agreements

Cooperation and information sharing amongst agencies at national and cross-border level requires rules and procedures that formalize and govern the collaboration and the information and data exchange. An agreement can take many forms including a Memorandum of Understanding (MoU⁵⁵), or a bilateral agreement.

Cross-border exchange of information needs a formal bilateral agreement and Memorandum of Understanding (MoU) to be signed by the agencies involved in the exchange of information. Rules governing cross-border cooperation and information exchange are defined in bilateral agreements. These can be agreements limited to Customs matters, i.e. mutual administrative assistance agreements, or broader agreements such as Cross-Border Transport Agreements (CBTA) that contain, as in the case of the Greater Mekong States (GMS) CBTA, provisions for advance exchange of information and collaboration with regards to Single Window information exchange. With such bilateral agreements, countries define the rights and obligations and the scope and channels of

⁵² See Mariam Goldby, (2011) *“Legislating to facilitate the use of electronic transferable records: A case study. Reforming the law to facilitate the use of electronic bills of lading in the United Kingdom”*. Paper prepared for the UNCITRAL Colloquium on Electronic Commerce New York 14th to 16th February 2011. In the same paper she points out that there are currently three alternatives for an e-Bo: the Bill of Lading Electronic Registry Organisation (Bolero) system, the Electronic Shipping Solutions (ESS) Databridge system and the Korea Trade Net (KTNET) Registry system.

⁵³ These rules are the Hague Visby Rules and the Hamburg Rules.

⁵⁴ See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/356786/bis-14-1072-electronic-signatures-guide.pdf

⁵⁵ MoU are signed between at least two parties, i.e. government entities or entities of different countries, to formalize a common action and cooperation. Depending on the elements and language used in the MoU they can be legally binding documents or not.

information exchange⁵⁶. MoU may be signed at agency level to provide further details regarding the data set, data and message standards and technologies and IT applications.

MoU are also used on the national level to define responsibilities, the scope and type of collaboration amongst two administrative units. Collaborative ICT systems that rely on different agencies contributing information or processing requests and enquiries need to have a robust agreement in place defining the rules and scope of cooperation. An agreement can take many forms including a MoU.

One example of the scope and content of a MoU for a Trade Information Portal has been described by the World Bank. The MoU would define the roles of the different agencies, including defining a lead agency, ascertain rights and obligations of the lead agencies with regards to contract with IT service providers, and maintenance of the website, define obligations of agencies to communicate and submit specific information to the lead agency, and contain provisions for conflict resolution. More specifically, it will also define the scope of the information to be shared and communicated, as some data and information may be considered sensitive and agencies therefore will not agree to share it in the absence of clear legal rules⁵⁷.

Service level agreements (SLA) have a different purpose. They are documents signed between a service provider and its clients to specify the services that should be delivered. The partners define performance criteria with regards to availability and uptime, response time and other benchmarks in such a SLA. SLAs are frequently used in a Single Window environment to agree to the services and quality standards between the service users and the SW providers—the service users are other commercial or public entities that use the SW architecture to deliver a service to its end-users. SW SLA define commitments in two directions: service provider in terms of uptime and availability of the services and applications, and the service users in terms of their performance commitment such as processing time and volume etc.

5 Conclusion and recommendations

Governments worldwide are increasing their efforts to implement trade and transport facilitation reforms. They do this by taking reference from existing international Agreements and best practices. The underlying rationale is to make trading across borders less costly, faster and reliable, as well as to increase efficiency of government processing in terms of managing higher trade volumes with fewer resources while increasing security. Legal, policy and organizational changes are necessary to implement trade and transport facilitation measures.

ICT plays an important role in making these changes happen. It allows new channels of communication and information exchange that supports Internet publication, paperless trade, and agency cooperation at the process and information level; it improves internal processing at the agency level, statistics and performance management; it enables a faster, integrated and intelligent risk management.

The mapping of the TF ICT needs in chapter 1 highlights the numerous trade facilitation areas where IT can be used to allow agencies to better respond to operational and legal trade and transport facilitation requirements. To respond to these requirements, a new way of thinking in how best to harness the potential of ICT to support trade and transport facilitation is necessary.

Since the 80's, large ICT systems have been developed to support Customs processing. For too long, ICT systems remained technology silos, resulting in complexity, low satisfaction, poor communication, and problems such as experiencing low flexibility, long lead times for implementation of new technological trends and high implementation, deployment and

⁵⁶ See the WCO (iii) MODEL BILATERAL AGREEMENT ON MUTUAL ADMINISTRATIVE ASSISTANCE IN CUSTOMS MATTERS

⁵⁷ World Bank Developing a Trade Information Portal, page 6.

maintenance costs. In recent years, technology trends have made enhancements of these systems possible and create potentials for new applications, services, and ICT architecture design. It is possible to process faster, and have more complex algorithms, costs for infrastructure have gone down because of virtualization and cheaper hardware components such as storage, changed networking.

Some of the recent ICT developments attempt to capture this potential: they cater for electronic processing and facilitate B2G2B communication, namely Single Windows for Trade. But these systems remain isolated, architecture and technology is outdated and not able to cope with increasing volumes of trade, and do not allow for shared services, flexibility, scalability and integration. The full potential of ICT for process or organization re-structuring and design is not yet used. Deepening and integration are the two necessary directions to improve the ICT support for trade and transport facilitation. This means extending IT to more business processes and areas at the agency level followed by development of integrated applications at the general level.

Putting in place an integration tool that is meant to integrate any sub system and constitutes the interconnectivity and interoperability layer between traders and other TTF sub-systems is the direction to go for. Such a tool, as described in this document as TTFS, is a complex paperless system, that provides event-driven integration⁵⁸ in an orderly manner. It therefore supports information and process integration for enhanced agency cooperation, integrated risk management, and simplified B2G2B communication. Such an integration tool will improve and simplify the interconnectivity and interoperability and does not require a change in the current national domain TTF architecture.

The TTFS will enable modernization through the workflow management, process automation and service orientation. It also enables single entry point for information exchanges with traders, with other governmental agencies (system to system), banks, insurance companies etc. Additionally, such a TTFS will facilitate trade with a bi-directional communication layer and automated procedures through an integrated TTF Enterprise Portal.

The description of the current trade and transport facilitation needs and how the increased technological potential could be leveraged to enhance IT efficiency and outcomes, leads to the following four recommendations:

- 1) The linkage between regulatory and operational (business) and IT design and systems needs to be strengthened. A weak capacity to translate regulatory and operational (business) needs into clear IT design increases costs of IT development and leads to ICT systems and applications that cannot fully deliver on expected TF outcomes. Without a comprehensive mapping of the business needs across organizational boundaries, IT cannot be leveraged for a fundamental re-design of organizations and processes. Such changes are however necessary to achieve agency cooperation, integrated risk management, and simplified e-procedures. Public administrations have to get more involved in defining their operational needs and the functional and non-functional requirements. This means investing into training of staff on a long term basis.
- 2) At the organizational level IT systems need to be coupled with a shared strategy, common BPM framework, cooperation on shared data, and project management methodology.
- 3) Although an integrated trade facilitation IT framework may be a futuristic vision this framework can be implemented in incremental steps. Meeting the organizational and architectural requirements may look like a far stretch for many countries facing legacy systems, expensive network connections, lack of adequate funding and knowledge and human resources. Having the vision of this framework in mind helps to adopt the necessary steps at the architecture, organizational and legal levels. The trend in the proliferation of different portals, systems and IT applications can only be stopped with a vision for an integrated framework.

⁵⁸ This means that the data will be received, processed and delivered to the sub systems.

4) There is a need to push mobility further to avoid disruption along the chain of physically moving the goods across borders, inside ports, and clearance facilities. Paperless developments have focused on digitalization of customs and licenses and certificates. Outside this business process, paper documents are still required to get the goods out of the warehouses, out of the ports and to move them along the routes through the checkpoints. Paperless procedures have to be extended to include such formalities outside the main offices.

5) A regional approach to promoting a more effective use of ICT for trade and transport facilitation can benefit from enhanced regional cooperation and standard-setting. This entails developing a common legal framework for the recognition of e-signatures and e-documents in UNESCAP Member States, a regional data model and messages standards, increased cooperation for data exchange related to licenses and certificates to secure the authenticity of license and certifications by system to system exchange of data, and increased cooperation and sharing of risk information and intelligence.

6 Annex

This section provides a brief overview of the state of preparedness of Nepal, Kyrgyzstan, Mongolia and Myanmar towards the implementation of a National Single Window for paperless trade. The information presented below was gathered by national consultants who interviewed customs officials and related trade sector practitioners guided by a questionnaire⁵⁹.

Figure: Summary of the state of ICT readiness

| | ICT Areas | Nepal | Kyrgyzstan | Mongolia | Myanmar |
|----|--|--------------------|--------------------|----------|---------|
| 1 | Operational National Single Window (NSW) System | No | No | No | No |
| 2 | Existing plans for implementation of NSW | Yes | Yes | Yes | NA |
| 3 | Target date for NSW implementation | 2017 | 2018 | NA | NA |
| 4 | Availability of Customs Organizational Structure | Yes | Yes | Yes | Yes |
| 5 | Availability of Customs Electronic Declaration System | Yes | Yes | No | No |
| 6 | Availability of Customs Clearance System | Yes | Yes | No | No |
| 7 | Electronic Registration System of Actors | Yes | Yes | No | No |
| 7 | Availability of leased line connection (optical fiber) | Yes | Yes | Yes | NA |
| 8 | Availability of Wi-Fi connectivity | Yes | Yes | Yes | NA |
| 10 | Participating Government Agencies (PGA) front-end application | Mostly Paper-based | Mostly Paper-based | Manual | Manual |
| 11 | Existing laws and regulations pertaining to paperless transactions | Yes | Yes | No | NA |

⁵⁹ Mr. Purushottam Ojha (Nepal), Mr. Urmat Takirov (Kyrgyzstan), Ms. Tsevelsaikhan Sharbandi (Mongolia) and Ms. Ei Ei Tun (Myanmar) and Mr. Dennis Pantastico (as lead consultant)

1. Nepal

Nepal's customs operations are highly automated and use the UN Automated System for Customs Data (ASYCUDA++) modules for trader's declaration and internal risk management. It has resulted in fast clearance, with 40 percent passing through the green lane.

ASYCUDA++ is being implemented in 19 customs offices out of the 30 customs offices. Electronic customs declarations are being used for import and export by air and land. In addition, the Customs Act allows pre-arrival submission, which is important in trade and transport facilitation. Documents required to process pre-arrival processing are commercial invoice, Bill of Lading, packing list, letter of credit, and certificate of origin. However, all these documents are submitted manually and Single Administrative Document (SAD) is lodged only after the arrival of goods. Electronic declaration for transit, bonded movement of goods, warehousing, and temporary admission are targeted to be implemented by 2017.

A high level National Trade and Transport Facilitation Committee (NTTFC) has been established in order to work as the platform for trade facilitation with a public-private partnership to advise the government on trade and transport related issues. The Committee has formed a separate sub-committee to oversee and facilitate the implementation of Nepal National Single Window.

The on-going implementation towards Nepal's Single Window is supposed to help traders reduce the cost of and speed up the transaction processing by enabling them work in an ICT-led environment. Presently traders need to visit different organizations with similar documents for export and import clearances, thus the Single Window will allow for one time entry of necessary data elements of various documents from their offices for a faster transaction.

2. Kyrgyzstan

Substantial efforts have been made by Kyrgyzstan to advance trade facilitation. A noticeable example is the National Single Window system being developed in the country, through a series of legislative acts since 2007. The Government of Kyrgyzstan and relevant Ministries have demonstrated keen interest to make further progress in trade facilitation measures.

Since the establishment of the SW Center for foreign trade operations under the Ministry of Economic Affairs in 2009, the Government's efforts for an integrated SW System are on-going. In January 2011, the Asian Development Bank funded an automated cargo clearance system for the UAIS, and pilot testing began February 1, 2012 using live data. The next core stages for SW implementation will include data migration from the pilot project, integration of government agencies' business processes, and a fully featured website.

In 2011, Crown Agents began to develop, supply, deliver, install, test and commission a Foreign Trade Single Window Information System (SWIS) for the government of Kyrgyzstan. It built a SWIS that allowed the receipt and delivery of the required licensing documents for foreign trade in one place, in accordance with the legislation of Kyrgyzstan. The system, which is used by authorized government officials in relevant departments and by foreign traders, ensures automation of the business processes required to process foreign trade.

The introduction of the FTSW was a means of addressing the organisational and institutional issues that constrain trade development and the integration of Kyrgyzstan into the world. The government

recognised the high cost imposed by inappropriate regulation impacted upon company and national competitiveness, and that inefficient administration was leading to increased transaction costs.

As of 2013, several customs procedures have been streamlined and the number of required documents reduced. The interaction between customs authorities and the SW system currently incorporates nine out of eleven state agencies, including four private certification bodies. Although the electronic system for customs document submission has been fully implemented at 50% of the country's customs posts, the southern half of Kyrgyzstan remains largely neglected in terms of automation.⁶⁰ As for 2015, seven agencies' e-documents (from SWIS) are utilized by UAIS of Customs Service.

In the long-term for Kyrgyzstan, the Single Window system is expected to provide:

- Quicker processing of trade-related documentation and payments;
- Reduced transaction costs for both public and private sectors;
- Improved public service delivery, transparency and integrity;
- Greater commercial predictability for the private sector;
- A central repository of trade statistics and data for use by both the public and private sectors;
- Improvement in the standing of Kyrgyzstan in certain internationally recognised country performance indices (e.g. the World Bank's annual Doing Business Report).

3. Mongolia

There are ongoing efforts by the Mongolian National Trade and Transport Facilitation Committee towards the implementation of a National Single Window. However, a full-fledged Mongolia National Single Window must overcome a number of technological and technical barriers, especially ICT, as well as knowledge gaps of State employees, lack of equipment and the absence of a single integrated business registration system for enterprises. In general, there is:

- No high speed connection between approval agencies and businesses
- The security of servers used by organizations is inadequate, unreliable, has insufficient capacity, and is highly exposed to foreign influence
- There are no official authorities using certified IT programs
- The capacity of computers, technical equipment and other related equipment are relevantly low
- Not all customs border ports are connected to the network.
- The internet speed is low as 158kb/s. This speed is sufficient only to support cameras on the borders, but is not enough for an entire network operation
- There is a vast difference between internal IT structure among the SEW participating agencies which creates an obstacle to operating adequately
- Absence of a single integrated registration system for citizens and business entities
- GASI, the state inspection agency lacks complex methodology recommendations and resolutions on software programmes

Further, in order to determine the bottlenecks in transportation from Ulaanbaatar to border ports, research was carried out across Mongolia, which identified some trade facilitation related barriers. Lack of customs facilities, health inspection agencies' operation and equipment, lack of systems for loading, unloading and transshipment, add time and expense to the transport of goods. Bottlenecks could be addressed by adopting some of the measures mentioned above as well as coordinating the

⁶⁰ CAREC Report on Single Window, USAID Trade Project June 2014

monitoring and inspection agencies, and improving the information flow between approvals agencies by adopting an electronic information system.

4. Myanmar

Presently, Myanmar's international trade sector is considerably under-developed for a country of its size, population, and potential. As World Bank studies indicate, Myanmar is ranked low in various indicators such as Trading across Borders or Logistics Performance Index. World Bank's "Doing Business" survey of 2015 indicates that among the ASEAN countries, Myanmar ranks last in terms of high export costs and duration in exporting goods.

The Myanmar Trade Portal (MTP) is set to be launched in 2015, which will also perform the function of a National Trade Repository. The MTP will be in the form of a web portal that will contain all the information required by traders (importers, exporters, freight forwarders, transport operators) to discharge the regulatory obligations required by all the Myanmar government agencies involved in the control of imports, exports and transit movements.

The Portal will also have facilities to be kept up to date on a timely basis with news, announcements, publications and notices that may be of interest to the trading public. The MTP will also fulfill the requirement for compliance with Article 13 of ATIGA which requires the information above to be published transparently for future integration with the ASEAN Trade Repository (ATR).