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**ICT SOLUTIONS TO FACILITATE TRADE
AT BORDER CROSSINGS AND IN PORTS**

Note by the UNCTAD secretariat

Executive Summary

Information and communication technologies (ICT) have transformed international trade and transport operations. Developing countries must be proactive and ensure appropriate planning for the application of ICT in trade and transport in order to reap the benefits of technological advances, reduce transaction costs and enhance supply capacities. A number of international developments contribute to further raising the profile of ICT and driving the demand for their use and application in trade and transport. Among the main factors that further highlight the need for ICT at ports and border crossings are: the globalization of trade and production processes, the trend towards greater liberalization and privatization in the telecommunications services sector, the increasing importance of supply chain security, as evidenced by the recent adoption of the WCO Framework of Standards to Secure and Facilitate Global Trade (SAFE Framework), and the significant ICT content of trade facilitation measures that may be adopted at the conclusion of current WTO negotiations on trade facilitation. Customs automation is a crucial component of any trade facilitation programme. It needs to form part of a broader process involving, *inter alia* : 1) simplification and standardization of documents and procedures; 2) a review of existing ICT-related legal and regulatory frameworks; 3) extensive capacity-building initiatives; 4) greater cooperation and partnerships with all interested parties.

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I. Introduction

1. Information and communication technologies (ICT) constitute one of the major influencing factors of our societies. Advances in ICT have given an impulse to social and economic developments and have opened new opportunities and perspectives through a wide range of applications, including in trade and transport. International trade and transport have benefited from ICT which contributed to re-shaping the structure and operations of these economic sectors. These techniques allow for safer, secure, smooth and reliable transport and trade through efficient management of information flows, tighter control and enforcement of regulations and increased productivity of equipment and infrastructure.

2. The importance of ICT for transport and trade grew with the advent of globalization and international trade expansion for which the flow of information is key. International trade and transport involve multiple players and numerous and complex transactions which result in a constant need to obtain, analyse and exchange data. The various players issue, transfer and interchange a large number of documents and extensive information as part of contractual arrangements, such as contracts of sale, contracts of carriage, letters of credit, and in relation to Customs.

3. A trade transaction may easily involve 30 parties, 40 documents, 200 data elements, and require re-encoding of 60 to 70 per cent of all data at least once. For example, within a port community where the two main actors, namely, the forwarding and the ship's agents, must communicate and coordinate various information flows, the exchange of information can amount to about 10 per cent of the commercial value of the traded goods. Sources of information that could be involved include the port authority, shippers, banks, insurers, carriers, Customs, etc.

4. As transportation is faster and more efficient than ever, information flows need to keep pace and travel at a faster speed than goods while, at the same time, remaining accurate, reliable and timely. Therefore, storing, retrieving, processing and transmitting information become a difficult task when using traditional paper-based and manual data management systems. Using ICT helps address the problem and facilitates trade and transport through efficient management of information and physical flows. More specifically, electronic techniques allow governments, private operators and traders to save time and money through rationalization and streamlining of procedures and documentation.

5. ICT applications to trade and transport are bound to grow and become even more important with globalization and the emergence of global supply chains and processes. Hence, developing countries must be proactive and ensure appropriate planning for the role of ICT in trade and transport so that they can integrate international trading systems and benefit from technological solutions that are increasingly available and at a more reasonable cost. That being said, for these technologies to be successfully implemented, a complete re-engineering of processes, administrative, regulatory and legal frameworks and infrastructure is usually needed.

6. Against this background, and to reflect further on the increasing role of ICT in the design and implementation of trade and transport facilitation measures, and Customs modernization in particular, the Commission on Enterprise, Business Facilitation and Development, at its tenth session, held in Geneva in February 2006, decided that an expert meeting be held on "ICT solutions to facilitate trade at ports and border crossings". This note aims at providing background information for this expert meeting.

7. The remainder of the document consists of the following parts:
- Part II reviews international developments with implications for the use of ICT in trade and transport;
 - Part III describes the role of ICT in trade and transport facilitation;
 - Part IV examines ICT in Customs and, more specifically, the Automated System for Customs Data (ASYCUDA); and
 - Part V sets out a way forward for the introduction of ICT at ports and border crossings.

II. International developments with implications for the use of ICT in trade and transport

8. A number of international developments contribute to raising the profile of ICT and driving the demand for their use and application in trade and transport. Among the main factors that amplify the need for ICT are: the globalization of trade and production processes, the worldwide trend towards privatization, liberalization and deregulation in the telecommunications industry, the growing importance of ICT for supply chain security as evidenced by the recent adoption of the WCO Framework of Standards to Secure and Facilitate Global Trade (SAFE Framework), and the significant ICT content of trade facilitation measures that may be adopted at the conclusion of the current WTO negotiations on trade facilitation.

Globalized production and trade

9. Domestic supply chains had to adapt to global supply chains by adopting processes such as just in time (JIT), efficient consumer response (ECR), or quick response (QR). These approaches to manufacturing and distribution require rapid turnaround of more frequent smaller deliveries. This in turn calls for transport and Customs clearance processes to be completed within limited timeframes. To adapt to more stringent global supply chains requirements, shippers and transport services are now obliged to make greater use of ICT tools.

10. Today, 80 per cent of developing countries' exports, measured in value, are manufactured goods. This is a reversal of the situation of two decades ago, when only 20 per cent of developing countries' exports of goods were manufactured and 80 per cent of exports were raw materials and agricultural commodities. Developing countries as a group participate far more today in globalized production processes. This trend, however, mostly applies to middle-income developing countries, which are usually more advanced in terms of ICT use. Globally, about one-third of international trade in goods is trade in unfinished goods and components, i.e. trade is just part of a global supply chain. Also, about 30 per cent of international trade is intra-company trade, i.e. the international movement of goods within the same company.¹

11. International trade in manufactured goods is increasingly containerized. Containerized trade has grown by 11 per cent annually since the beginning of the present decade. Containerization enables trade by facilitating multimodal transport and door-to-door

¹ For a discussion of these and related trends see also UNCTAD Transport Newsletter, Geneva, Second Quarter 2005, www.unctad.org/en/docs/sdteftbmisc20053_en.pdf.

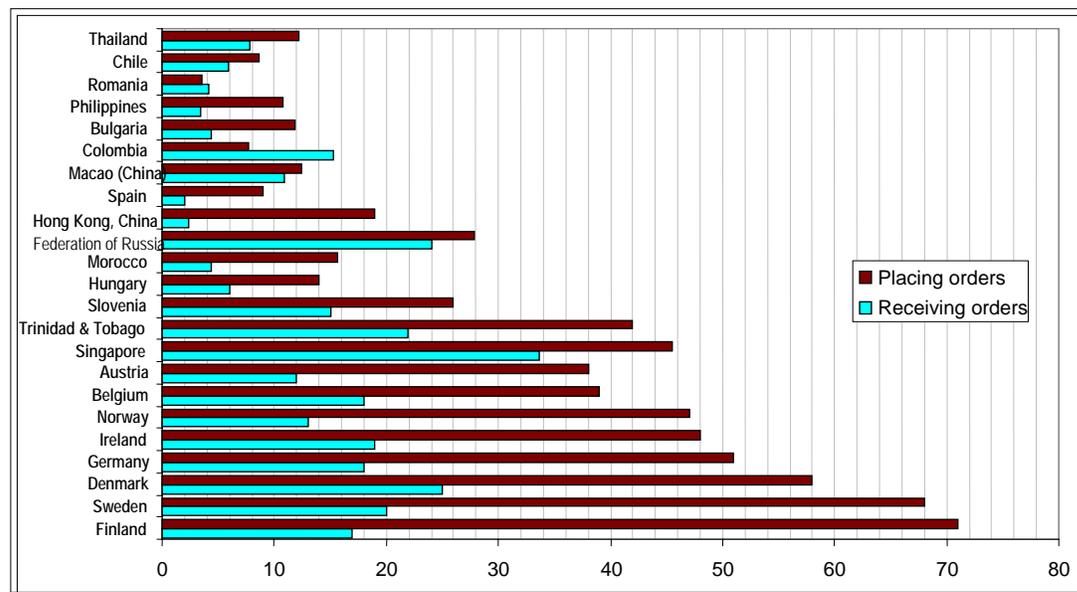
operations and by generating ICT applications such as electronic seals and cargo tracking devices.

12. Ports, airports and other transport infrastructures are increasingly being privatized. For example, only 20 per cent of global container port throughput is nowadays moved by government-operated terminals, down from almost 50 per cent in 1990.² Electronic port community portals are an example of public private-partnerships (PPPs) that combine the interests of the private port operators and users with those of Customs and other public sector entities.

13. Trade as a beneficiary of ICT, is evolving and adopting new patterns such as electronic commerce (e-commerce). The latter connects buyers and sellers through the Internet³ with big differences prevailing between countries (Figure 1). ICT facilitate business-to-business (B2B), business-to-consumer (B2C) and business-to-administration (B2A) transactions. Integrating ICT techniques to these operations allows for rapid issuance, submission, acceptance and processing of electronic documents between all the parties involved.

14. Border crossings, especially for landlocked developing countries (LLDCs) and ports form an integral part of global logistics operations. Government agencies, local traders and transport service providers are increasingly being forced to implement ICT solutions to ensure that national ports and border crossings support efficient supply chain operations. Hence, keeping pace with the ICT-related practice of global supply chains ensures that countries' foreign trade remains competitive.

Figure1: Enterprises placing and receiving orders over the Internet
2004 or latest available year (selected countries and territories), in per cent



Source: Eurostat database 2005; UNCTAD e-business database 2005

² Drewry Shipping Consultants: "Annual Review of Global Container Terminal Operators – 2005", London, November 2005, www.drewry.co.uk.

³ See "Information Economy Report 2005: e-commerce and development." UNCTAD/SDTE/ECB/2005/1 available via www.unctad.org/ecommerce, or also www.gfptt.org/Topics/eCommerce

Liberalization, deregulation and competition in the telecommunications sector

15. Regulatory reforms that have taken place in several countries since the 1990s have changed the landscape of the telecommunications services sector. Originally a State monopoly business, the telecommunications sector has witnessed increased competition and privatization. A key factor in the transformation of this sector was the outcome of Uruguay Round negotiations on basic telecommunications services (e.g. voice telephone, packet-switched data transmissions, circuit-switched data transmissions, telex, telegraphs, facsimile and privately-leased circuits) and the autonomous liberalization undertaken in several countries. This sector is poised to change further as a result of the current WTO negotiations on telecommunications services which, in addition to basic telecommunication services, cover value-added services such as electronic mail, voice mail, online information and database retrieval, electronic data interchange (EDI), and enhanced/value-added facsimile services.

16. This worldwide trend towards liberalization, deregulation and competition in telecommunication services markets has led to price falls, higher ICT penetration and new services becoming readily available. For example, liberalization and privatization processes have been reported in Uganda, United Republic of Tanzania, Nigeria, Sudan, South Africa and Kenya, resulting in improvements to telecommunication infrastructures of these countries.

ICT and supply chain security

17. An important element of the emerging transport-related security initiatives is the incorporation of ICT as a means to discharge security-related functions in global supply chains. Therefore, compliance with international security requirements depends heavily on the ability to implement specified ICT solutions. The most recent international development that integrates a requirement for the use of ICT is the WCO Framework of Standards to Secure and Facilitate Global Trade (SAFE Framework). The Framework was adopted in June 2005⁴ and rests on two "pillars", namely Customs-to-Customs Network arrangements and Customs-to-Business partnerships and consists of four core elements, all of which involve the use of ICT. First, the Framework harmonizes the advance electronic cargo information requirements on inbound, outbound and transit shipments. Second, countries adopting the Framework commit themselves to employing a consistent risk management approach in addressing security threats. Third, the Framework requires, at the reasonable request of the receiving nation, based upon a comparable risk targeting methodology, the sending nation's Customs administration will perform an outbound inspection of high-risk containers and cargo, preferably using non-intrusive detection equipment, such as large-scale X-ray machines and radiation detectors. Fourth, the Framework defines certain benefits that Customs will provide to businesses that meet minimal supply chain security standards and best practices.

18. The SAFE Framework is based on modern Customs principles contained in the revised Kyoto Convention,⁵ which entered into force in February 2006; these principles include risk management based on advance electronic information, use of modern technology, and a partnership with industry. The advance electronic transmission of information to Customs in accordance with the SAFE Framework requires the use of computerized Customs systems, both at the export and at import stages, as well as the use of ICT by traders for the electronic

⁴ www.wcoomd.org/ie/En/Press/Cadre%20de%20normes%20GB_Version%20Juin%202005.pdf.

⁵ *International Convention on the Simplification and Harmonization of Customs Procedures (as amended)*, June 1999. For the text and status, see the WCO website (www.wcoomd.org).

submission of data for Customs clearance purposes. As of June 2006, 135 WCO members had expressed their intention to implement the Framework. Many of these members will require capacity-building. To this end, the WCO's Directorate for Capacity-building has recently launched a major capacity-building programme (COLUMBUS programme), under which diagnostic missions are conducted, a needs assessment is carried out and an action plan is developed, with a view to identifying donors that are willing to fund projects to enable Customs administrations to become *SAFE Framework* compliant.⁶

19. Several standards of the General Annex to the Revised Kyoto Convention require Customs to apply ICT for Customs operations, including the use of e-commerce technologies. For this purpose, the WCO has prepared detailed Guidelines for the application of automation for Customs. WCO suggests that the Kyoto ICT Guidelines should be referred to for the development of new, or enhanced existing Customs ICT systems. Customs administrations should further ensure that their respective IT systems are inter-operable and are based on open standards. To this end, the WCO recommends that Customs use the WCO Customs Data Model, which defines a maximum set of data for the accomplishment of export and import formalities. The Data Model also defines the electronic message formats for relevant Cargo and Goods declarations.

20. The Kyoto Convention ICT Guidelines recommends that Customs offer more than one solution for the electronic interchange of information. While EDI uses the international standard UN/EDIFACT is still one of the preferred interchange options, Customs should also look at other options such as XML. Depending on the risks involved, even the use of e-mail and telefax could provide a suitable solution. The ICT Guidelines also recommend the possibility to use the commercial systems of economic operators and to audit them to satisfy Customs' requirements. In particular in the context of the Authorized Supply Chain, the possibility for Customs to have online access to the commercial systems of the parties involved, once any confidentiality or legal issues have been resolved, would provide enhanced access to authentic information and offer the possibility for far-reaching simplified procedures. Another example is Cargo Community Systems in ports or airports, whereby all parties involved in the transport chain have established an electronic system by which they exchange all relevant cargo and transport-related data.

21. According to the WCO *SAFE Framework*, the use of ICT in general and electronic exchange of information over open networks in particular, requires a detailed ICT security strategy. The Kyoto ICT Guidelines propose ways in which a comprehensive ICT security strategy can ensure the availability, integrity and confidentiality of the information and the IT systems and data they handle.

Negotiations on trade facilitation at the WTO

22. International agreements are also exerting pressure for ICT adoption in trade and transport. Since 2004, WTO Members commenced negotiations to clarify and improve Articles V ("Freedom of Transit"), VIII ("Fees and Formalities connected with Importation and Exportation") and X ("Publication and Administration of Trade Regulations").⁷ Many of the proposals made by WTO members during these negotiations are related to trade facilitation measures with a bearing on ICT use at ports and border crossings. Almost any measure that simplifies formalities or increases transparency in one way or another, integrates ICT techniques. Some proposals advocate the adoption of specific ICT functions such as the

⁶ See only the Speech by the Deputy Secretary General of the WCO, at the 11th WCO Asia Pacific Regional Heads of Administration Conference, 4 April 2006, Beijing China. (www.wcoomd.org)

⁷ For background information on these negotiations see www.gfptt.org/topics/wto.

publication of trade regulations on the Internet, the use of electronic documents, procedures automation and electronic single windows.

23. As regards internet publication of trade-related regulations, submissions made at the WTO include the proposal to establish “mechanisms ensuring the publication and availability of information on customs procedures to all Members in readily and promptly accessible official media, including, where possible, in electronic form.”⁸ It is suggested that information “should be made available by the publishing Member for access by any interested parties through electronic means at no cost or at a charge commensurate with the cost of services rendered”, and “Each Member should notify the other Members through the Secretariat the means to access the information published electronically.”⁹ The Internet publication is interpreted as “an available method for Members to meet current publication obligations under Article X of GATT 1994”.¹⁰

24. Another set of proposals relates to electronic documents and the electronic submission of data. It is suggested that “in order to reach a set of common forms and electronic documents, the harmonization of import documents and the data required for release of goods using existing international standards under, among others, the WTO Customs Valuation Agreement, the HS Convention, the UN Layout Key Guidelines and the WCO Kyoto Convention, is essential”.¹¹ Also, “The data set developed within the WCO data model, UN EDIFACT (UN Electronic Data Interchange for Administration, Commerce and Transport) and the UN Layout Key could be identified as basic reference points/standards”.¹² One submission proposes that “in cases where Goods declarations and other supporting documents are lodged electronically and authenticated by electronic signatures or electronic procedures, no other original of these documents shall be requested.”¹³ “Electronic systems should be introduced to replace paper-based procedures across customs and ultimately all other agencies involved in import and export administration.”¹⁴

25. Concerning automation, one proposal suggests that the “Automation of Customs and other agency import/export procedures, with the possibility of electronic submission of Customs and other declarations, and automated payment of duties and other fees and charges”. Another submission states that “If or when automatization is put in place, in cases where physical documentation are required under manual procedures, the Customs should normally accept copies and not only accept/request originals of documents, except in clearly defined circumstances”.¹⁵

26. A further ICT-related topic of proposals is the electronic single window. “The use by Members of an electronic 'single window' for submitting, once only and to a single authority, all documentation and data relating to import/export procedures is highly important for the smooth running of trade”.¹⁶ “A single window does not necessarily imply the implementation and use of high-tech information and communication technology (ICT), although facilitation can be enhanced if relevant ICT technologies are identified and adopted”.¹⁷

⁸ TN/TF/W/30.

⁹ TN/TF/W/32.

¹⁰ TN/TF/W/89.

¹¹ TN/TF/W/45.

¹² TN/TF/W/46.

¹³ TN/TF/W/92.

¹⁴ TN/TF/W/45.

¹⁵ TN/TF/W/36.

¹⁶ TN/TF/W/70.

¹⁷ TN/TF/W/100.

27. In the context of transit trade, it is mentioned that “as a general rule, identification of these goods is ensured by sealing. In addition to this classic function of seals, electronic seals have been developed to provide for the detection and tracking of trucks.”¹⁸

III. Role of ICT in Trade and Transport Facilitation

28. Trade and transport circles are increasingly aware that productivity and quality of transport and logistic services is affected not only by the speed of physical operations but also by the length of administrative and documentary processes. Efficiency gains, resulting from containerization, new and sophisticated equipment and modern managerial techniques, could be undermined by inefficient, slow and cumbersome administrative processes and procedures. Consequently, there is an increasing awareness that the physical movement of goods and the associated flow of information and documentary processes need to be enhanced through ICT.

29. Trade and transport facilitation is concerned with simplifying, harmonizing and standardizing international trade and transport procedures to achieve efficient trading network, and automating these procedures and their underlying operational activities. Clearly, integrating ICT to trade and transport is a necessary action towards reliability, accuracy, cost reduction and speedy flow of information and goods. Nevertheless, there remains a major challenge inherent to the "virtual" nature of ICT and which impedes efforts seeking to develop ICT alternatives to traditional transport and trade documentation. One such difficulty relates to the ability of electronic documents to effectively replicate the relevant functions of the documents in a secure electronic environment, while ensuring that the use of electronic records or data messages enjoys the same legal recognition as the use of paper documents.¹⁹ An example of such difficulties relates to the ability to replicate the "document of title" function unique to bills of lading in an electronic environment. Under existing national and international laws, legal rights attach to the physical possession of the paper document and existing legal regimes do not adequately ensure that the same legal rights may attach to electronic alternatives.

30. In the absence of a uniform enabling legal framework, several contractual approaches (e.g. Bolero Program, the SeaDocs Registry and the @GlobalTrade Secure Payment and Trade Management System), supported by voluntary rules binding on the parties, have been developed to emulate the document of title aspect of the bill of lading in an electronic environment. However, no viable electronic alternative to the negotiable bill of lading has yet been developed for widespread commercial use.²⁰ As the successful transition to an electronic environment is more difficult for negotiable transport documents, it is generally accepted that negotiable transport documents should only be used in cases where a negotiable document of title is required, i.e. where sale of goods in transit is envisaged or where independent documentary security is needed. This, however, is not always the case in current commercial practice.²¹

¹⁸ TN/TF/W/39.

¹⁹ For a detailed overview over some of the main difficulties in this respect, see UNCTAD Report *Electronic Commerce and International Transport Services*, [TD/B/COM.3/EM.12/2](#). See also UNCTAD report *The Use of Transport Documents in International Trade*, [UNCTAD/SDTE/TLB/2003/3](#), at paras. 35–42 and refer to [www.unctad.org/ttl/legal](#).

²⁰ For further information, see documents cited in footnote 16 above.

²¹ See the results of a wide-ranging UNCTAD survey on the issue, *The Use of Transport Documents in International Trade*, [UNCTAD/SDTE/TLB/2003/3](#), and refer to [www.unctad.org/ttl/legal](#).

31. In this regard, it is worth noting that a variety of international conventions have been adopted to provide a basis for global alignment of laws and regulations.²² Adopted in 1996, the UNCITRAL Model Law on Electronic Commerce,²³ along with other legislation²⁴ has been implemented by a number of States to remove legal barriers, such as requirements for "writing" "original" or "signatures", recognizing the evidentiary effect of data messages, and permitting incorporation by reference of the terms and conditions of the contract of carriage. In 2001, the UNCITRAL Model Law on Electronic Signatures was adopted;²⁵ more recently, in 2005, the United Nations Convention on the Use of Electronic Communications in International Contracts, was adopted by the General Assembly²⁶ to provide a more comprehensive legal framework for contracting in an electronic environment.²⁷ For its part, the UNECE developed UNeDocs,²⁸ a set of electronic documents used in the pilot phases in the United Kingdom and for which plans are being considered for implementation in other countries. These will allow the creation of trade documents in PDF format on the basis of the XML files, and vice versa and aims to replace the paper-based environment with electronic records, including electronic signatures and payment operations.

32. Digital signatures, or public key infrastructure (PKI) arrangements, are also an attempt to ensure a secure electronic exchange of information. An integrated Customs control chain includes the possibility that traders can submit in advance both their import and export declarations to Customs administrations. Mutual recognition of digital certificates allows the economic operator to sign all electronic messages to those Customs administrations having accepted to recognize this certificate. This cross-border recognition of digital certificates can help increase security and, at the same time, provide significant facilitation and simplification for the trade operator.

33. Despite the difficulties preventing a full conversion to an electronic environment, ICT applications in trade and transport are numerous. While not an exhaustive list, the following will review a sample of main ICT uses in these fields.

ICT in Transport

Information interchange and management

34. EDI is used in the transport sector to manage the flow of goods and information involved in a trade transaction using structured data. Computers that receive the tagged data elements are able to interpret the information and thus initiate appropriate administrative or other transactions automatically. It is used to transmit documents such as purchase orders booking instructions, bills of lading and manifests, container loading plans and Customs declarations. It is also used to transfer funds and transmit information to track and trace cargo and containers. A number of companies provide EDI solutions, which can be implemented by installing the software.

35. The international standard for EDI is UNEDIFACT, developed and maintained by the United Nations. Although EDIFACT is recognized as "the" international standard, there are

²² For a list of international conventions relevant for trade facilitation, see <http://www.gfptt.org/Entities/ild.aspx>.

²³ The text of the *UNCITRAL Model Law on Electronic Commerce*, as well as information on its implementation by States is available at <http://www.uncitral.org>.

²⁴ See, for example, European Commission *Directive on Electronic Signatures* 1999/93/EC of 13 December 1999.

²⁵ For the text of the *UNCITRAL Model Law on Electronic Signatures*, see at <http://www.uncitral.org>.

²⁶ For further information, see <http://www.uncitral.org>.

²⁷ For further information, see <http://www.uncitral.org>.

²⁸ <http://www.unece.org/etrades/unedocs>.

many other national and industry data standards. New standards are being developed such as the Extensible Markup Language (XML).²⁹ XML together with Internet is said to have drastically helped reduce start up and transaction costs as compared to traditional EDI systems. Based on XML and web technology, a variety of standards emerged on a more general or sectoral basis aiming at ensuring automated recognition of supported business transactions, negotiation, contracting and processing, creating online dispute resolution mechanisms, signing and encrypting contents transmitted using the Web, and more general issues such as Internet governance.

36. EDI has also been at the source of cargo community systems (CCS), which were developed over three decades ago in ports and airports to facilitate transit operations on the multimodal platforms. These systems allow for automatization and the simplification of information exchange between a number of trade and transport stakeholders. Specific to ports, port community systems (PCS), a computerized system within the port environment linking all the players of the transport chain rely heavily on ICT. They encompass all of the companies using the port and make information about goods in the port accessible to all while ensuring information flow is maintained around the port. For example, users can automatically book berth space and confirm times of arrival/departure, book bunkering, maintenance, and repairs and submit the variety of certificates and visas needed for specific goods, vessel, crew and passengers. Examples of port community systems include PORTNET in Singapore, INTIS in Rotterdam, ADEMAR in Le Havre, PROTIS in Marseille, HIT in Hong Kong, EDI in Kobe, SEGHA in Antwerp and DAKOSY in Hamburg.

37. There are differences in how port community systems are implemented. For example, in Rotterdam the system is introduced by the port authority which, then, instigates port users and operators to use the system; German ports, on the other hand, followed a more decentralized approach ensuring that these systems are implemented by the terminal operators or outside entities.

38. Initiatives are being developed for information flow between port community systems, such as EurotransPortnet in Europe involving the port of Antwerp, Le Havre, Rotterdam, Hamburg, Bremen/Bremerhaven and Felixstowe. The intent is to provide port users a single point of access to the computer systems of all six ports. Another example is the EUROMAR port community system network connecting the Mediterranean ports of Marseille, Genoa and Valencia.

Cargo and vehicle tracking systems

39. Cargo and vehicle tracking systems improve accountability, enable enhanced risk management assessment and minimize opportunities for loss. These systems ensure that goods reach their destination in their intended condition which is appealing both to governments and to private companies striving to improve the integrity and efficiency of international supply chains. This ability to trace goods, containers and means of transport including, ships from the point of origin to their destination is increasingly associated with information transfer using communication tools such as global positioning systems (GPS), radio frequency identification devices (RFID) or bar code scanning.

40. The use of satellite positioning systems to monitor the situation or location of equipment in the terminal is gaining ground. Terminals which already have these systems include: HHLA Hamburg, the Dubai Port Authority, the Port of Kotka (Finland), Patrick in

²⁹ <http://www.w3.org/XML/> . See also <http://www.ebxml.org> and <http://www.unece.org/cefact> for information on the UN set of standards ebXML.

Australia and BLG Bremerhaven. Another equipment tracking technology is the RFID device which is comprised of low-cost tags that assist in the tracking of goods and vehicles. These devices are placed on individual items and can either be active, i.e. constantly emit a radio frequency signal, or are passive and only emit a signal when queried by an outside source. In order to track goods, readers (either hand-held or fixed devices) can track and record the numbers from the RFID devices affixed to each product or container. These readers, however, entail additional costs which would be borne by the shipper or passed along to the consumer/end user.

41. In addition to tracking and tracing functions, ICT are used for access control. An example of such techniques is the Cargo Card implemented in the port of Rotterdam. The driver identity card system which also reads the driver's handprint as a secondary check speeds up admission of trucks into the terminal and ensures that the container has been scrutinized. Automatic imaging systems in terminal gate operations, is another example which takes less than one minute to complete. Trucks passing through the terminal gates trigger sensors, which automatically activate digital cameras that photograph the container, the chassis number, the truck licence number and the driver's face. These technologies which are of greater relevance to supply chain security initiatives speed up the inspection and control process and, ultimately contribute to rapid transit time of goods and smooth movement of trade.

Terminal operations management

42. ICT used for terminal management purposes are of particular interest to ports. Terminal management systems is a broad heading for a number of functionalities, including harbour master function of managing and supporting vessel traffic, stowing and unloading vessels, optimizing the use of equipment and means of transport, planning the utilization of vessels, container yards and depot. While several companies have taken the decision to develop their own software, off-the-shelf terminal management packages are provided by companies such as NAVIS and COSMOS. These systems make it possible to, among other things, plan for optimum container positions and movements in the yard and vessel and rail loading schemes.

ICT in Customs

43. Several Customs functions can readily benefit from ICT, including Customs data validation, cargo inventory control, goods declaration processing, electronic notification of release, revenue accounting and Customs enforcement. As part of Customs reform, automation stimulates Customs modernization and fosters the use of ICT by other governmental departments and private sector stakeholders involved in Customs operations. Customs automation results in increased transparency in the assessment of duties and taxes, reduction in Customs clearance times and predictability, which all lead to direct and indirect savings for both government and traders. Automation is also an opportunity for reviewing and aligning Customs procedures to international standards, conventions and other instruments, e.g. the revised Kyoto Convention of the WCO.³⁰

44. An interesting and popular ICT application in a Customs setting relates to the Electronic Single Window Initiative. A Single Window is a facility that allows parties involved in international trade and transport to lodge standardized information and documents with a single entry point to fulfil all import, export and transit-related regulatory

³⁰ For more information see the UNCTAD Technical Note # 3, "The use of Customs Automation Systems", available via <http://r0.unctad.org/ttl/technical-notes.htm>; and also the GFP topic "Customs Issues", published under <http://www.gfptt.org/entities/TopicProfile.aspx?name=customs>.

requirements. Hence, the primary objective is the single submission of data to rationalize existing approach and requirements, especially the re-use of existing data wherever possible. However, the 'Electronic' single window concept is emerging as a prominent trend in the context of this initiative given the ability of ICT to efficiently respond to the requirements of 'one-stop' shopping approach and its synergies with the growing number of Government online strategies. Examples of electronic single windows initiatives include DAKOSY in Germany, PORTNET in Finland, GAINDE2000 in Senegal, the single window system administered by AGEXPRONT in Guatemala and TradeNet in Mauritius.

45. ICT use at border crossings could prove a useful tool against challenges posed by landlocked nature of certain countries and associated obstacles such as inadequate transport infrastructure, insufficient integration and harmonization of trade and transport procedures between LLDCs on the one hand, and transit countries on the other. ICT can play an important role in accelerating and simplifying these processes, which can potentially help landlocked countries integrate global trade networks. As a result, improving the communication infrastructure and promoting ICT applications related to transit transport has the potential of reducing transport costs and improving the access of LLDCs to transport services and global trade. Achieving transport connectivity by way of ICT paves the way to trade competitiveness. This virtuous circle could be illustrated by the case of container shipping whereby countries with access to the highest supply of liner shipping services are also among the countries with the highest Internet use per capita. In fact, the success of the world's busiest container ports of Hong Kong (China) and Singapore as transshipment and logistics centres could, among other factors, be explained by their successful installation of ICT-based port community information systems.

Benefits of Customs automation

46. There exists ample experience with Customs automation of differing levels in a wide range of countries. According to this experience, Customs automation usually entails most, if not all, of the following benefits:

- Increased collection of duty and taxes due to uniform application of the law, automated calculation of duties and taxes and built-in security;
- Enhanced revenue collection and administration controls;
- Improved and timely foreign trade statistics as trade data are an automatic by-product of the system;
- Better economic governance due to more transparency and automated procedures;
- Faster release of cargo from Customs clearance;
- Simpler procedures and documents based on international standards
- Reduced physical examination of goods;
- Separated payment of duties and taxes from physical clearance of goods (under a deferred payment scheme, e.g. payment by week or month);
- Faster electronic Customs declarations through the use of Direct Trader Input (DTI) or other online connections;
- Reduced Customs audit of documents and records after release of the goods;
- Readiness for introduction of e-commerce and e-governance; and
- Capacity-building of staff and management in Customs and in the private sector (e.g. through training courses on simplified procedures and documents based on international norms, UN recommendations and WCO standards).

47. Some countries have reported substantial reductions in release times, e.g. from 5 days to 2 hours in Zambia and 4 days to 3 hours in Yemen. The Chilean Customs administration was able to reduce the processing time of an import declaration from an average 10.8 hours when it used a paper-based system to 2.2 hours using EDIFACT. Similarly, Customs controls based on risk management reduced the need for physical inspection to 5–12 per cent, resulting in direct cost savings for the private sector of more than \$1 million per month.

Costs of Customs automation

48. The cost implications for implementing and operating a Customs automated system vary from country to country according to the initial situation of the Customs administration (such as existing computers systems and reform programmes), and the level of locally available professional skills to support the modernization process. Implementation costs are mainly influenced by:

- The number of international advisers and experts needed to install the basic computer hardware infrastructure and customize the key software elements;
- Training needs for Customs staff and management, taking into account the possible turnaround of staff attracted by higher salaries outside Customs after becoming ICT specialists;
- Procurement of computer equipment and access to telecommunication infrastructures;
- Refurbishing of buildings at Customs headquarters and at each of the regional offices and border posts where automation components will be installed.

49. Experience shows that technical assistance for implementing UNCTAD's Customs automated system (ASYCUDA) may cost between half a million dollars and several million dollars and takes about two years. Delays can occur due to revision of legislation, building new offices or procurement of hardware.

50. Upgrading and replacing computer equipment is a reality that cannot be avoided. Customs administration should therefore, ensure at the early stages of the process that the required funds will be available at the appropriate time. Some countries have created saving accounts through the collection of a computer fee of each transaction, reflecting the actual costs of system upgrade and replacement. This is a workable method, unless funds can be obtained from other sources.

Implementing Customs automation systems

51. Successful implementation of the Customs automation systems can be achieved subject to meeting a number of preconditions, namely:

- Developing international conventions, standards and other instruments, and corresponding implementation at the national level, including a national Customs tariff based on the Harmonized System and a declaration based on the United Nations Layout Key and the Single Administrative Document (SAD);
- Using international standards for the electronic data exchange;
- Reviewing and amending Customs law and other related legal instruments to ensure compatibility with the new procedures, notably electronic filing of clearance data and introduction of the SAD;
- Political will and government and Customs management support for reform and modernization;

- A transparent and collaborative approach by project management to generate support from staff and external users, including brokers and agents, and cooperation between public and private sectors;
- ICT systems must be in place for countries to provide electronic connectivity; and
- The creation of an ICT division with the appropriate technical staff will justify an organizational body responsible for operating and supporting all Customs ICT systems.

IV. ICT in Customs: Automated System for Customs Data (ASYCUDA)

52. An automated customs data management system such as UNCTAD's ASYCUDA can handle most, if not all, Customs-related transactions from simplifying and harmonizing procedures and formalities and aligning trade documents to risk management, transit operations and expedited clearance of goods, in addition to collecting timely and accurate data for fiscal and trade policy objectives.

Objectives and components of the programme

53. The programme has two objectives, namely:

- modernize Customs through computerized automation of most border formalities in order to accelerate the clearance of goods, and
- strengthen Customs management and control by providing governments with accurate and timely statistics on customs operations and foreign trade for fiscal revenue and trade policy purposes.

54. ASYCUDA's risk management system capitalizes on over 25 years of experience in computerization and implementation of customs operations worldwide. ASYCUDA covers the whole declaration-processing path, including cargo and transit. It uses sophisticated tools ranging from the regular examination procedures and the allocation of declared goods to a control "channel" (green for release of goods without examination, yellow for a documentary check prior to goods release, red for physical examination of the goods prior to release, or blue indicating that goods will be released after being submitted to a post-clearance audit control by customs) to the use of multimedia, scanned images and wireless devices, which provide Customs officials with immediate remote access to the intelligence and control databases. Customs controls can now be undertaken in situations where this was not possible before – for example, to stop cargo in transit and verify that the paper documents presented correspond to what has been declared at departure, or to perform on-the-spot checks of a container's contents and the status of the goods (cleared, transit, etc.). The system permits periodic assessment of the risk-management process in order to measure the effectiveness of selectivity criteria and to change, extend or eliminate risk-management parameters as needed.

55. The transit module of ASYCUDA includes forgery-proof electronic documents, electronic signature and registration of all transactions. No data re-entry is required by carriers at ports or border crossings. The system allows the processing of transit documents such as the TIR Carnet as well as the full integration of transit procedures into the Customs clearance process with transit documents being generated from waybills and export declarations. A process is under way to fully computerize the TIR procedure through an interface between national Customs transit systems.

56. The programme is prepared by UNCTAD Customs and IT experts in close collaboration with national customs authorities and government agency officials. ASYCUDA's implementation is frequently imbedded in a larger development and capacity-building project, e.g. a project financed by the World Bank or bilateral donor projects

financed by the European Union. Such a project could involve constructing or renovating customs facilities and telecoms equipment in line with UNCTAD specifications for the efficient installation and operation of ASYCUDA. In some cases, ASYCUDA is implemented entirely by national authorities and experts, in line with UNCTAD guidelines, but without its support during the roll-out phase of the programme and the extensive training component normally supervised by UNCTAD experts.

Versions of ASYCUDA

57. ASYCUDA is a modular Customs management software programme. UNCTAD developed and implemented the first version of ASYCUDA in three West African countries between 1981 and 1984 to modernize Customs procedures and compile foreign trade statistics at relatively low cost. ASYCUDA has since undergone through three major upgrades, taking advantage of innovation in computer hardware, operating systems, programming language and software technology, in order to meet the challenges of the growing volume and complexity of international trade. Today, it represents UNCTAD's largest technical assistance and capacity-building programme.

58. The latest version, ASYCUDAWorld, first introduced in 2004, is compatible with major database management and operating systems. The use of XML permits the exchange of documents between Customs administrations and traders on a national basis, and Customs administrations, internationally, via the Internet. An interesting feature of this version for situations with unreliable telecommunications is the fact that no permanent connection to a national server is required.

59. ASYCUDA's modularity, like that of most other Customs management software on the market, means that new or advanced programmes (modules) can be added on at any time to suit the needs of a given country. Such add-on modules can cover Customs functions, such as risk management, transit operations or new security standards depending on national priorities. Further technical features of ASYCUDA include the multi-language/alphabet enabling translation into various languages; built-in security features such as user authentication and asymmetric encryption; updates of reference data without programming; and various communication options via the Internet, Intranet or independent telecoms infrastructure.

Geographical distribution

60. The African continent has the largest ASYCUDA membership with installations in 31 countries. In Latin America and the Caribbean 23 countries operate the system, followed by Asia and the Pacific with 17 countries, and Central and Eastern Europe — the fastest growing area — with 11 countries. Customs declarations processed annually with ASYCUDA range from 3.8 million in Africa to some 5 million in Central and Eastern Europe. The most recent installations include Afghanistan, the Islamic Republic of Iran, Jordan and Moldova. ASYCUDA maintains regional support centres in Kuala Lumpur, Malaysia, for ASEAN, Fiji for the Pacific Island States, Ouagadougou, Burkina Faso, for West Africa; Lusaka, Zambia, for COMESA; and Caracas, Venezuela, for Latin America and the Caribbean.

V. The way forward: introducing ICT at ports and border crossings

61. The use of ICT is poised to grow faster in the future and will continue to greatly affect trade and transport. Developing countries need to adopt appropriate policies conducive to the effective implementation of ICT in the fields of transport and Customs in support of trade. This involves promoting the strategic use of ICT, taking account of rapid developments in this area and incorporating this consideration into the planning and the design of services

infrastructure in support of trade, including transport and Customs. Applying ICT solutions to Customs is a particularly crucial component of any trade facilitation programme. Experience with the ASYCUDA programme shows that Customs automation leads to enhanced revenue collection and administration controls, faster release of cargo from Customs clearance and reduced physical examination of goods. Customs automation needs to be embedded in a process of simplifying and standardizing documents and procedures, review of the legal regime and extensive capacity-building programmes.

62. A prerequisite of effective policy actions for ICT introduction in trade and transport is a complete institutional re-engineering and organizational transformation. Examples of such reforms include a thorough review of prevailing legal and regulatory frameworks and existing formalities and procedures, which will often lead to a process of simplification and standardization. The legal regime may need to be modified, especially as regards the use of electronic documents. In this regard, aligned trade documents based on internationally accepted standards and best practices are basic instruments for efficient information exchange in international trade and consequently for the efficiency and security of the trade transaction itself. Standard aligned paper documents are also a pre-requisite to implement electronic trade documents. They are based on the United Nations Layout Key for Trade Documents (UNLK)³¹ and the United Nations Trade Data Elements Directory, that define, among others, the layout of trade documents, presentation of data, semantics of trade data and applicable international codes for currencies and modes of transport.

63. Introducing ICT tools requires an important information infrastructure and adequately trained human resource. Therefore, extensive capacity-building programmes resting on sustainable financial arrangements are of essence. Such programmes are particularly important in view of the need for regular equipment and software upgrades and the importance of keeping abreast of the latest ICT-related developments and technologies.

64. Since ICT, trade and transport are of a global nature, ensuring that adopted information systems are open and mutually compatible is important. Therefore, emerging ICT applications need to be consistent with prevailing technology used internationally and, more importantly, countries should cooperate to achieve greater integration and harmonization of approaches adopted in relation to ICT solutions.

65. To sum up, developing countries should capitalize on the opportunities offered by ICT tools to further facilitate their international trade and transport operations through the adoption of a set of policy actions that would involve, *inter alia*:

- A capacity-building component encompassing adequate training and institutional reform for the use of ICT;
- An IT infrastructure development programme, including necessary equipment and financial support for the sustainable expansion of ICT systems;
- A regulatory reform enabling the use of electronic means and document and allowing the legal recognition and enforceability of such instruments; and
- A cooperative framework where countries can build on prevailing synergies and coordinate with relevant international organizations, including UNCTAD.

³¹ http://www.unece.org/etrades/unedocs/e_forms/rec01_guidelines.pdf