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EXECUTIVE SUMMARY

For more than 30 years, the United States Agency for International Development (USAID) has applied Information and Communication Technology (ICT) to development. Today, the majority of USAID programs worldwide include an ICT component. Most recently, the Internet and related Information Technology (IT) has increased the importance of ICT as a sector in its own right, driving economic growth and transforming social and economic activity faster than the steam engine, railroad, and electricity did in earlier times.[1]

The USAID/Bureau for Europe and Eurasia (E&E) requested SETA Corporation to provide support on the Regional Cross Border Trade Facilitation Pilot Project (Pilot Demonstration). Inner Circle Logistics, Inc., (ICLogistics) was selected as the implementing partner for this project. The project was designed to demonstrate an ICT solution built around net-centric technologies that could support the goals of increased competitiveness and economic prosperity of Small- and Medium-sized Enterprises (SMEs) in South East Europe (SEE). The specific objectives included improving the movement of goods at borders, where delays can exceed 12 hours, and providing SMEs with affordable ICT tools that would help them to participate in global supply chains. The results obtained by the two companies that participated in the Pilot Demonstration [Bulgarian manufacturer Radomir Metal Trade and Engineering, (RMTE) – Bulgaria Ltd., and its Macedonian customer, Mittal Steel Skopje (MSS)] clearly show that the objectives of the Pilot Demonstration were met and further suggest that ICT could be equally as effective in enhancing competitiveness and prosperity as more common methods.

The complete net-centric solution demonstrated was made possible by a collaboration of global ICT partners (Neology, iD-Confirm, Motorola, and TechnoLogica), led by a net-centric solution provider, ICLogistics. The solution set included an integration of leading technologies—Radio Frequency Identification (RFID) tags and scanners, fingerprint biometric authentication, a remote communication Internet access, and a Global Positioning System (GPS)—using cutting edge net-centric processes. This integrated technology solution allowed a Macedonian buyer to purchase steel work rolls from a Bulgarian supplier in a seamless electronic transaction.

The solution set also allowed for the real-time tracking of the truck, driver, and cargo from departing time at the supplier's loading dock to arrival at the buyer's factory. It facilitated the delivery of electronic documentation to Customs and a border crossing procedure whereby required information could be gathered with a simple scan of the RFID tag, resulting in reduced border crossing times. Security was added to the system using biometric authentication so that only an authorized and identified user could gather official information at a border crossing, providing improved security desirable in today's environment.

Among the benefits it offered, the solution recognized advantages in addressing the three critical barriers to regional trade—cost, standards, and border crossing procedures. The combined solution is estimated to produce cost savings of $458,240.00 EUR annually for the two participants of the Pilot Demonstration and their direct suppliers and customers. Owing to the net-centric processes, the demonstrated solution worked across software platforms, languages, and varying company requirements, putting real integration in the grasp of SMEs with limited ICT and financial resources.

[1] http://www.usaid.gov/our_work/economic_growth_and_trade/info_technology/index.html

The solution can also help governments to share information among border agencies or with their counterparts across a border, offering further reductions in border wait times and the promise of regional integration. Minimizing human intervention by using electronic data flows at borders, the solution enhanced security and reduced the potential for corruption, important pre-conditions for regional cooperation.

Finding ways to make companies and countries more competitive in the international trade arena is a gateway to achieving improved economic prosperity. Customarily, processes have been improved in two key areas—the physical infrastructure, such as upgrading road conditions, and the institutional framework, such as harmonization. The Pilot Demonstration establishes how new technologies and net-centric business processes enhance improvements in both key areas, as well as improve the competitive position of businesses through a third area, the improvement of the "technology infrastructure."

The deployment of ICT to strengthen regional competitiveness offers direct benefits and works to support the improvement and maintenance of physical infrastructure and the institutional framework. For instance, ICT solutions can help to preserve the physical infrastructure by better monitoring weight limits of trucks that cross SEE borders, avoiding damage to the roadways due to overweight.

In conclusion, the Pilot Demonstration suggests that there may be a third and equally critical mode of facilitating trade, increasing SMEs competitiveness, and driving countries' economic prosperity that stands side-by-side with building and maintaining the physical infrastructure and improving the institutional framework—the deployment of applicable ICT tools.

SITUATION

In 1946, Bulgaria fell within the Soviet sphere of influence and became a People's Republic. Communist domination ended in 1990, when Bulgaria held its first multiparty election since World War II and began the task of moving toward political democracy and a market economy while combating the traditional development challenges of inflation, unemployment, corruption, and crime. The country joined the North Atlantic Treaty Organization (NATO) in 2004. Today, reforms and democratization keep Bulgaria on a path toward eventual integration into the European Union (EU) in 2007, while neighbors Croatia, Macedonia, Romania, and Turkey also seek accession. Its eventual integration with the EU will depend on its ability to address these development challenges and affect economic reform.

Picture 1: Map of Bulgaria

Bulgaria is located on the Balkan Peninsula of SEE. It is bounded by Romania to the north; Macedonia, Serbia, and Montenegro (Serbia Rep.) to the west; Turkey to the southeast; Greece to the south; and the Black Sea to the east. Its traditional trade has been with the former Union of Soviet Socialist Republics (USSR), although its main western trading partners include Germany, the United Kingdom (UK), Switzerland, Austria, France, and Italy. Because of its history and geography, Bulgaria lies at a crossroads for SEE regional trade, which is an opportunity for Bulgarian businesses and a challenge to regional growth. Organizations such as USAID and the World Bank (WB) have recognized trade facilitation as a primary means to generate the economic growth required to support the region's transitions.

The purpose of the Pilot Demonstration was to illustrate how an ICT solution based on net-centric supply chain infrastructure facilitates trade across regional borders while enhancing productivity and transportation effectiveness among SMEs and their trading partners. This report also illustrates how the data collected using this infrastructure enables private businesses to achieve higher capital efficiency ratios.

The cost effective introduction of net-centric supply chain management solutions … is among the important factors for increasing the competitiveness of small and mid-sized enterprises in Southeast Europe. In the context of Bulgaria's EU accession, net-centric solutions target two further key areas – compliance of Bulgarian SMEs to the EU norms for product traceability and balancing trade facilitation and security across the future external EU borders.

Mrs. Boyka Pavlova, President
Chamber of Commerce and Industry
Pernik Bulgaria

The Pilot Demonstration supports the over-arching goal of increasing regional competitiveness and EU integration. The specific objectives of the Pilot Demonstration were as follows:

- Expediting the process of moving goods across borders in response to current wait times that can be in excess of 12 hours; and
- Enhancing competitiveness of regional SMEs by providing them with affordable technology that helps them participate, collaborate, and trade electronically as participants of international and global supply chains.

BACKGROUND

A net-centric information environment utilizes emerging standards and technologies to optimize assured information sharing among all users. Technology moves from an application-centric to a data-centric paradigm, thereby allowing users access to applications and services through Web services. The information environment is comprised of interoperable computing and communication components, making use of both static and dynamic data. In addition to showing the value of the net-centric environment, the Pilot Demonstration employed RFID tags as a means to automatically identify and capture data and biometric authentication as a security enhancement to the net-centric environment.

The complete net-centric solution demonstrated was made possible by a collaboration of ICT partners, led by ICLogistics:

- ICLogistics is a provider of net-centric global supply chain management solutions that enable trading partners to do business electronically regardless of their level of sophistication or technology platform. ICLogistics provides fully integrated data and document exchange capability and data visibility functions that facilitate real-time business transactions.
- Neology is a vertically integrated provider of RFID-enabled solutions. Its efforts are focused on the advanced security vertical market, especially in the border crossing and vehicle control sectors.
- iD-Confirm is a developer and maker of a next-generation biometric technology that addresses three of today's critical business issues—identity theft, financial fraud, and homeland/personal security.
- Motorola Bulgaria is the Bulgarian division of the *Fortune* 100 global communications leader that provides seamless mobility products and solutions across broadband, embedded systems, and wireless networks.
- TechnoLogica, headquartered in Sofia, Bulgaria, is a group of companies specializing in the field of IT and the provider of a GPS component for the solution.

The Pilot Demonstration was focused in Bulgaria and Macedonia as a test case for SEE. The barriers faced by Bulgarian and Macedonian firms in regional trade—costs, standards, and border crossing procedures—serve as a barometer of what is happening in the region.

Producing cost savings is at the heart of increased competitiveness. As noted by CARANA Corporation in their study on Impact of Transport and Logistics on Bulgaria's Textile and Apparel Competitiveness (May 2005), SEE cannot compete against the Far East in areas such as labor costs. Therefore, savings in other areas like transport and logistics are critical to the viability of industries, such as the apparel industry.

The area of standards is a complex and multi-tiered issue because it relates to ICT, government requirements, and company preferences. Standards issues exist between trading partners who have varying ICT standards (such as Enterprise Resource Planning [ERP] or legacy systems), levels of sophistication (an ICT support department or none at all), and language capabilities. In addition, governments and corporations have varying standard document formats in which they receive information. All of this creates tremendous hurdles, particularly for SMEs who have the most difficulty navigating through the complex maze of standards issues.

Border crossing issues are often cited as some of the more burdensome challenges faced by companies engaged in cross border trade. Border agencies do not typically share information with each other or with their counterparts across the border. Areas for improvement include increased efficiency, reduced delays, and improved security and transparency.

The companies participating in the Pilot Demonstration were Bulgarian manufacturer Radomir Metal Trade and Engineering, (RMTE) – Bulgaria Ltd., and its Macedonian customer, Mittal Steel Skopje (MSS). The live test completed on April 27, 2005, involved a physical shipment of steel work rolls from supplier to buyer.

- RMTE, based in Radomir, Bulgaria, produces steel work rolls for the processing of hot and cold steel slabs, ship shafts, crushers for the cement industry, and similar large industrial metal goods.
- MSS is a division of Mittal Steel, a multinational steel maker with shipments of 42.1 million tons and revenues of over $22 billion USD in 2004, the product of a merger announced in October 2004 between LNM Holdings and Ispat International.

CURRENT BUSINESS PROCESSES

RMTE and MSS have been business partners for approximately 20 years. RMTE sells steel work rolls to MSS on an as-needed basis. In order to evaluate the effectiveness of the Pilot Demonstration, the business processes of RMTE and MSS were benchmarked against the new ICT solution.

Each order received by RMTE is customized and requires a lead time of several weeks. A typical order has a small number of very large items. Due to the scale of products and complexity of production, errors within the order and delivery processes can be costly. MSS functions technologically at a level similar to many SMEs, without a legacy and/or ERP system or other type of comprehensive technology infrastructure. However, they are anticipating implementing an ERP in the future.

Currently RMTE and MSS mainly conduct business transactions though mail, e-mail, and fax (Figure 1). The companies' expectations in participating in the Pilot Demonstration were to improve decision making, to gain efficiencies, and to enhance electronic communication and data exchange to and from clients, suppliers, and Customs.

Under current practices, the typical process can begin with an e-mail or hard copy Request for Quotation (RFQ) from MSS to RMTE. Accompanying drawings are e-mailed to RMTE when possible or mailed by Compact Disc (CD) when the files are too large. MSS also mails hard copies when it solicits bids from local suppliers. An RFQ is not issued for every order, as some goods are under a fixed-priced contract for a period of up to several years. However, MSS estimates that they send about 9,000 RFQs per year. RMTE responds to an MSS RFQ with a mail, fax, or e-mail response.

Once MSS selects a supplier, they print a hard copy Purchase Order (PO), sign it, and send it by fax or mail. MSS estimates that they send about 3,000 POs annually to suppliers for non-production materials. RMTE estimates that they receive about 400 POs per year, initially by fax and then by mail. Most orders arrive at RMTE in English and are translated to Bulgarian prior to any action being taken. RMTE provides order status updates only when changes are made or

by customer request. MSS tracks all POs and invoices via Microsoft (MS) Excel, since they lack an ERP system.

When RMTE completes an order and is ready to ship the product to MSS, they create a set of four hard copy Customs documents, and an electronic file on disk. An RMTE representative accompanies the shipment to a local Customs office along with the documentation. Customs reviews the hard copy and electronic documents and saves copies of the electronic files once the shipment is cleared. The Customs officer then stamps the hard copy documents that accompany the shipment to the physical border. Copies of the invoice and packing lists are faxed from RMTE to MSS following local Customs clearance. Obtaining local Customs clearance can take from 30 minutes to 2 hours for RMTE, which receives favorable treatment at the office owing to its large presence in the Radomir community.

> *Inefficient trade procedures and the lack of measures for trade facilitation in particular have a negative impact on the SMEs. The loss that is caused by the hours spent waiting at border crossings, the complicated and unnecessary requirements of documentation and lack of information technology in data processing, is significant for business entities. Investing in trade facilitation will have a significant effect on improvement of the exports.*
>
> Mr. Zoran Jolevski, Vice Chair
> UNECE Committee for Trade,
> Industry and Enterprise Development

There are four stations at the Bulgarian border: Road Tax (where the truck is weighed), Agricultural Inspection, Customs, and Border Police. These four stations are associated with four different government agencies, and each has its own standalone database. Customs agents inspect the documents (hard copy, carried by the driver) and also the cargo if deemed necessary, and then manually enter data into their computers. Zoran Jolevski, Vice Chair, United Nations Economic Commission for Europe (UNECE) Committee for Trade, Industry and Enterprise Development, noted that the United Nations Conference on Trade and Development (UNCTAD) estimates that the average Customs transaction involves 20-30 different entities, 40 documents, and 200 data elements (30 of which are repeated at least 30 times). Manual data entry at the border causes delays. This is true both entering and exiting Bulgaria, while no information is shared across the border to Macedonia.

Macedonia also has four stations, but the processing differs as freight forwarders send data electronically to Customs. Goods arriving into Macedonia usually go from the border to a local Customs office, where the goods are inspected and the paperwork checked. If it is after hours, the goods are stored in a secure holding area until the next morning. If a special dispensation has been granted (e.g., all the paperwork was taken care of ahead of time), the goods can go directly from the border to the delivery destination in Macedonia.

It is important to note that both the Macedonian and the Bulgarian Customs agencies are making great strides in automating and improving their systems, infrastructure, and processes. However, challenges still exist for both the business community and the federal organizations operating at the border.

There is opportunity to improve the supply chain by enhancing the integration, timeliness, and accuracy of information, using a solution that works across multiple software platforms, without limit to the data and document types that it handles. Each agency uses standard forms that can be electronically populated with data from SMEs and/or freight forwarders. The current manual nature of these transactions not only makes them slow and error-prone but also vulnerable to corruption and security breaches. By automating business processes and incorporating Auto ID and Data Capture (AIDC) functions, trading partners and border agencies can reduce time and effort, reduce data entry errors, share information across the border, increase security, improve

decision making, and move goods more quickly, resulting in reduced total landed costs of products.

Step	MSS Macedonia		RMTE Bulgaria		Customs
1	Send RFQ by e-mail or mail	→			
1a	Send RFQ-related drawings by e-mail or mail (CD or hard copy)	→			
2		←	Respond to RFQ by mail, e-mail, or fax		
3	Send PO by fax	→			
4			No acknowledgements or order status are sent prior to goods shipment unless requested		
5			Prepare Customs documents, four hard copies, and disk	→	
6				←	Documents reviewed & hand stamped at local Customs office in Radomir; electronic copy saved to system
7		←	Send shipping documents and invoice by fax to MSS; Hard copies with shipment to border crossing	→	
8				←	Hard copy documents reviewed. Cargo inspected and information re-keyed as needed at Bulgarian border
9				←	Hard copy documents reviewed at Macedonian border
10				←	Hard copy documents reviewed and cargo inspected as needed at local Customs office, Skopje.
11		←	RMTE shipment delivered to MSS along with hard copy invoice		
12	No acknowledgement sent to RMTE that shipment has been received in good condition; hard copy invoice forwarded to MSS finance department for payment				

Figure 1: Current State of Purchase and Delivery Between RMTE and MSS

TECHNOLOGY SOLUTION

The technology solution applied in the Pilot Demonstration illustrated how ICT tools could be used to facilitate both the transactions between buyer and supplier (referred to here as the purchasing process) and the end-to-end delivery of finished goods (referred to here as the delivery process). In order to improve the current situation, the solution had to prove that it could lower costs, work across multiple standards, and improve the border crossing procedures. By achieving these objectives, the solution would address the three major barriers to regional trade—costs, standards, and border crossing—thereby enhancing trade and leading to gains in competitiveness and prosperity.

In preparation of the criteria for the Pilot Demonstration, numerous conversations were held beginning in June 2004 with local companies, chambers of commerce, and industry organizations to craft a demonstration that would appropriately meet local needs. Site visits were also performed with the two participating companies to gain a significant amount of insight. The United Nations standard for electronic documentation (UNeDoc) was used as the document exchange standard, which allows the participants to easily exchange information and benefit the region's movement toward EU integration. After the companies agreed to participate in the Pilot Demonstration, the net-centric solution was developed over an eight-week period using a collection of specific requirements.

In order for the designed solution to have wide applicability to other companies and countries, it had to exchange data electronically in order to effectively integrate the supply chains of RMTE and MSS, while working with any legacy or ERP system. The ICT solution was designed to meet this requirement as well as to handle any type of documentation, standard or customized, and to have Graphical User Interface (GUI) capability in multiple languages, creating a critical element of transparency. The solution also has the ability to handle integration between trading partners with varying ICT infrastructures and levels of sophistication, critical for integrating supply chains from SMEs up to large multinational corporations.

For the RFID component to be a useful part of a trade facilitation solution, it had to function within a range of scenarios, for instance the ability to read RFID tags on objects that were stationary and moving, and for a wide variety of products. For this reason, multiple tag types were used and a variety of readers employed. The data generated by the scans also had to be accessible anytime for it to be relevant. Therefore, the data was housed in a virtual relational database on the Internet that was accessible through Web services reporting.

The Pilot Demonstration was divided into two phases, the purchasing process phase and the delivery process phase. The unique aspects of the solution for each phase are described in this report and detailed technical data is included in the Appendices.

Purchasing Process

The purchasing process encompassed the exchange of electronic documents from RFQ through invoice. The components of the technology solution used for the purchasing process are as follows:

- Client Software – Written in Java, Scarborough Fair^{SM} (SF) Client software is installed on a Personal Computer (PC) and runs at the client site. Utilizing the flexibility of Extensible Markup Language (XML), it allows the user to receive or to transmit data and documents for trade directly with a partner, or to populate a database on SF server—either from manual inputs or from automated data imports. In this phase of the Pilot Demonstration, SF client software was the platform for exchanging the electronic documents between buyer and supplier.
- Server Software - Also written in Java, Scarborough Fair^{SM} Server software is hosted at a Web site and houses the data transmitted by SF client software. All documents and data flow through SF Server creating a virtual relational database where Web services reports and Internet access provide real-time visibility for decision makers. Inventory balances, production schedules, progress reports, and the like can be stored in an online database for viewing via SF Server software.
- Authentication Control - Ringmaster^{SM} provides the authentication and control functions for this system. It also provides the Domain Name System (DNS) lookup and other Web services.
- Virtual Private Network (VPN) - Carnival^{SM} is a Web-based application designed for large corporations that allows them to provide prime customer supply chain data to suppliers, access the Scarborough Fair^{SM} client software of their supplier base, and tie the data elements of their suppliers directly to their own Supply Chain Management (SCM) and ERP systems. In this case, the Carnival^{SM} VPN was used to share a drawing file for the RFQ.

Delivery Process

The delivery process encompassed the AIDC-supported delivery of the cargo shipment from the seller to the buyer, including the crossing of one international border. The components of the technology solution used for the delivery process are as follows:

- RFID Tags – A microchip attached to an antenna that is packaged in such a way that it can be applied to an object. The tag picks up signals from and sends signals to a reader. High dielectric and low dielectric tags were used in the demonstration corresponding to what types of materials were being tagged. Different materials, such as metal and paper, have different RF energy reflecting properties, requiring different tags. RFID tags were applied to the driver's passport, the cargo, and the truck to track their movements and provide electronic data in the delivery process.

Picture 2: Steel RFID tag

- RFID Readers – A device used to communicate with RFID tags. The reader has one or more antennas, which emit radio waves and receive signals back from the tag. Both tray scanners (close proximity document readers) and 4-port, multi-antenna archway scanners (moving and long-range readers) were used. The readers were employed in the demonstration to identify the scanned item, note its location, and provide a time stamp.

- Directional and Circular Antennas – Additional antennas were attached to the fixed reader to provide accurate scans at long range and for objects in motion.
- Biometric ID Device – Part of the family of AIDC products, a biometric device identifies a human from a measurement of a physical feature or repeatable action of the individual. For the Pilot Demonstration, a fingerprint reader was used to secure the transaction information by only allowing a certified user to transmit RFID reads to the virtual relational database. This particular fingerprint reader employs a proprietary algorithm that is capable of creating up to 2 billion codes per registered ID device. Of the 2 billion possibilities, the reader randomly displays one for use.
- RFID Scanner Utility– Circus^{SM} is an RFID scanner utility that allows users to read from and write to RFID tags and to export data to an XML file.
- Database Utility – Part of the SF family of products, Jester^{SM} is a client-side utility designed to run in the background associating multiple data formats to an XML Schema Definition (XSD) and using that XSD to report data to the SF server on a timed interval. For the purposes of the Pilot Demonstration, Jester^{SM} ran a service that connected directly to the XML export files from Circus^{SM} (the RFID database utility) RFID tag reads at 14 separate biometrically authenticated checkpoints, and loaded that data directly onto the secure USAID Regional Cross Border Trade Facilitation Web site and virtual relational database, enabled by a variety of Internet connectivity solutions.
- Internet Canopy – The Canopy system uses an innovative wireless broadband technology employing radio technology to deliver high-speed Internet access where a fixed infrastructure is impractical or unavailable, enabling automated RFID transmissions of vital data from remote, unmanned checkpoints on shipping routes. The connectivity provided by the canopy was also used to link to a vehicle tracked by a GPS Web site during the presentation of the solution at the Regional Cross Border Trade Facilitation Conference.
- GPS – GPS is a radio positioning system that provides location information via satellite, enabling the accurate pinpointing of GPS-equipped vehicles and moving objects. This capability was demonstrated on June 7, 2005, with the live tracking of a vehicle for participants attending the USAID Regional Cross Border Trade Facilitation Conference.

The biometric component was used to secure the information upload that was being read from the RFID tags and to also ensure accountability and the integrity of goods in transit across borders identified as being traditionally prone to corruption. Following the demonstration, the GPS component was integrated into the solution set to provide seamless tracking of a cargo shipment through the delivery process. This addition provides a link from real-time reports containing data about a shipment to a visual map showing the exact location of the moving vehicle carrying this shipment. A visual depiction of the solution set is shown in Figure 2, and a more detailed solution description is included in the context of the Pilot Demonstration.

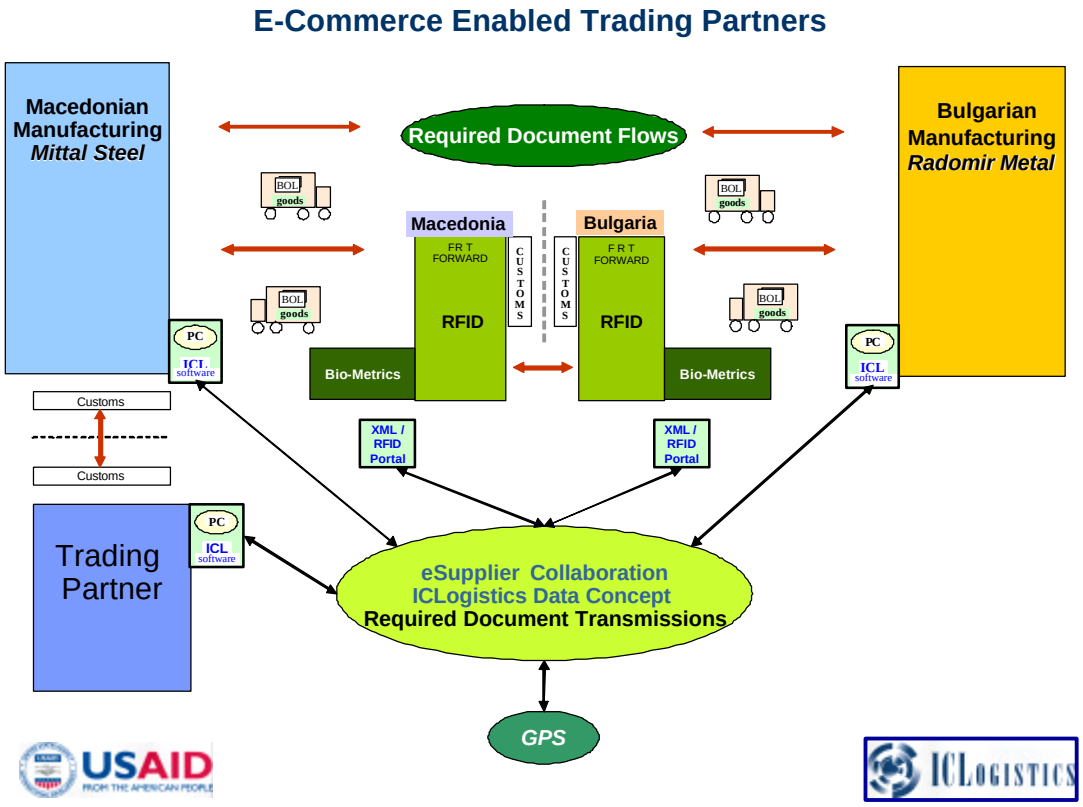


Figure 2: Graphic Representation of the Technology Solution

PILOT DEMONSTRATION

The stakeholders were ready to proceed with the Pilot Demonstration design and implementation once the current challenges, technology solution, and participants were clearly identified. The demonstration's design was driven by the following activities:

- Assist participants with software installation;
- Conduct site training;
- Demonstrate software and RFID capability;
- Collect data;
- Coordinate with members of project; and
- Discuss results and outcomes with Pilot Demonstration participants.

The Pilot Demonstration was divided into two phases. Phase One, the purchasing process, utilized the electronic exchange of product diagrams and files, and documents from RFQ through invoice. Phase Two, the delivery process, tracked the movement of the physical goods using biometric, RFID, and Internet connectivity technologies interfaced to the ICT solution software. This phased approach was necessary due to the long order cycle and production times for the goods supplied by RMTE to MSS. Therefore, the entire purchase process document cycle contains some documents that had been sent weeks or months earlier in the order cycle.

Purchasing Process

The Pilot Demonstration kicked off on April 25, 2005, with the first client software installation and training session at RMTE. Two users were trained at RMTE and two copies of client software installed. The first client software installation was completed by a Pilot Demonstration team member and the second by an RMTE employee. This was done to ensure that the users fully understood the process of installing and registering the software. Time was also provided to the RMTE users to further familiarize themselves with the client software in advance of the electronic document exchange. A local partner provided language support for training and the interface between the team member and participant company staff.

A similar process was undertaken in Macedonia with MSS in preparation for the live document exchange. A Pilot Demonstration team member trained one MSS staff person and installed one copy of the client software. No language support was required at MSS, as the trainee was proficient in English. With the installation and training completed, the participants conducted a live document exchange (the purchasing process phase of the Pilot Demonstration). In addition to the copies of the client software that had been installed on the participating companies' computers, server software was running at the Web sites to support the flow of data and documents between buyer and supplier, and the authentication control was responsible for registering the software and managing user authentication.

The steps identified in the live electronic document exchange mimicked the usual mail, fax, and e-mail steps taken by RMTE and MSS in the course of their normal dealings, beginning with an RFQ and ending with the delivery of an invoice. However, the simple use of the client software as the transmission medium enhanced the amount of information available to the trading partners because of the automatic acknowledgement function. When a document is received, an acknowledgement is automatically generated and sent to the document sender. Information is also stored in the virtual relational database to be used for later reporting and benchmarking purposes. Therefore, the trading partners exchanged more information in a shorter time. Figure 3 summarizes the demonstrated purchasing process.

The purchasing transaction began with MSS uploading its technical drawing into the VPN and then sending a RFQ to RMTE, indicating that the drawing had already been posted for their viewing along with information on how to access it. The CS automatically sent an acknowledgement to MSS from RMTE when the RFQ was received. RMTE downloaded the drawing from the VPN, reviewed the RFQ, and sent a response in the CS using the standard UNeDoc to provide the quotation. When MSS received the quotation, an automatic acknowledgement was sent to RMTE. Based on the quote provided, MSS sent a PO to RMTE and received an automatic acknowledgement of the PO receipt from RMTE. RMTE generated an order status notification to MSS, and MSS automatically acknowledged its receipt. RMTE created the Bulgarian Customs form and UNeDoc ECSI form in the CS and sent these to MSS, which they acknowledged automatically. RMTE created a shipping notification and sent it to MSS in the CS and received an automatic acknowledgement from MSS. And finally, the UNeDoc invoice was created by RMTE and sent to MSS. MSS acknowledged receipt of the invoice, providing RMTE with a level of certainty about its customer relationship that a non-electronic process could not.

Step	MSS Macedonia		RMTE Bulgaria
1	Upload part drawings to VPN		
1a	Send “drawings posted” RFQ in Client Software (CS) to RMTE	→	
2		←	Automatic acknowledgement of RFQ sent in CS; download and review drawings from VPN
3		←	Respond to RFQ electronically in CS using UNeDoc quote
4	Automatic acknowledgement of quote sent in CS	→	
5	Send electronic purchase order in CS	→	
6		←	Automatic acknowledgement of PO sent in CS
7		←	Create order status in CS and send to MSS
8	Automatic acknowledgement of order status sent in CS	→	
9		←	Create Bulgarian Customs form and UNeDoc Export Cargo Shipping Instructions (ECSI) form in CS and send to MSS
10	Automatic acknowledgement of Bulgarian Customs form and UNeDoc ECSI sent in CS	→	
11		←	Create and send shipping notification in CS
12	Automatic acknowledgement of shipping notification sent in CS	→	
13		←	Create UNeDoc invoice in CS and send to MSS
14	Automatic acknowledgement of invoice sent in CS	→	

Figure 3: Simulated Purchase Between RMTE and MSS

The purchasing process phase of the Pilot Demonstration served to meet one of its two key objectives, namely to enhance competitiveness by providing trading partners with ICT that helps them participate, collaborate, and trade electronically as participants of global supply chains. Through this Pilot Demonstration, it was shown how a paper process that has traditionally taken weeks could be performed in hours, providing instant visibility and exceeding the operability of data through use of the net-centric environment.

Delivery Process

On April 26, 2005, a shipment of steel work rolls departed RMTE en route to its customer MSS. The ordering of the steel had been completed months earlier and production of the goods took several weeks. The delivery phase of the Pilot Demonstration showed how the integration of RFID and biometric capability could provide both buyer and supplier better information about the location and status of their shipment, improve the security of that shipment, and speed the movement across an international border.

Picture 3: Truck RFID Tag

The delivery phase began in the truck depot of RMTE. The Pilot Demonstration simulated how an RFID-tagged truck (pictured at right) and driver with an RFID-tagged passport are associated with the delivery. Note that the truck tag and goods tag (see Pictures 2 and 3) used in the Pilot Demonstration are different and correspond to differences in materials and location. Each was scanned at the RMTE truck depot to mark the beginning of the delivery process. The truck then proceeded to be scanned in using the RFID tag in the inbound truck or loading area. A subsequent scan was taken to mark the loading process and to provide a time stamp for each of these events. After the RFID-tagged steel shipment was loaded onto the delivery truck, outbound departure scans were taken for the driver, truck, and cargo, marking the delivery as ready to depart RMTE.

The Pilot Demonstration team followed the vehicle from RMTE to the local Customs office in Radomir. A scan of the RFID tags on the truck, cargo, and driver's passport was taken at the local Customs office to simulate how Customs could upload information to its system rather than using standard paper documents, as well as how buyer and supplier could track the movement of the cargo, truck, and driver. Scans at the Radomir Customs office were taken to mark arrival and departure. Similar scans were taken of the truck, driver's passport, and cargo to mark the arrival at and departure from the Bulgarian border, the arrival at and departure from the Macedonian border, and the arrival at and departure from the local Skopje Customs office. From the Skopje Customs office, the truck, driver's passport, and cargo proceeded to be scanned in at MSS receiving, marking the end of the shipment's journey.

Demonstrated Solution Architecture

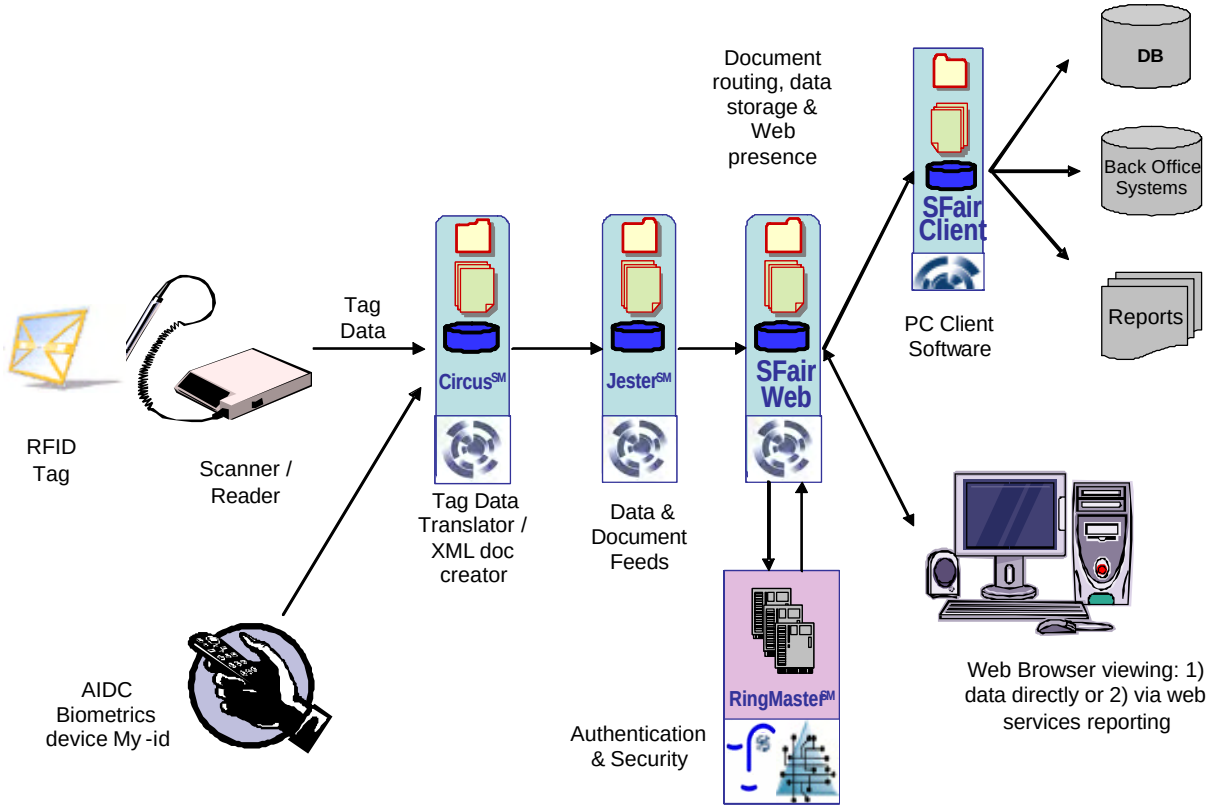


Figure 4: Architecture of Demonstrated Solution

All scans—truck, driver's passport, and cargo—along the journey were taken with a portable tray scanner. Using the Internet connectivity provided by Motorola, the database utility uploaded the data read by the scanner to a virtual relational database on the Internet. The solution architecture is depicted in Figure 4.

Only authorized users, authenticated by their name and fingerprint, were able to upload RFID-scanned data to the database. When the biometric device recognizes a matching name and fingerprint, in this case a fingerprint reader, a random code is generated from the proprietary algorithm, which has been assigned to each registered user. This biometric code was entered into the RFID scanner utility. For demonstration purposes, the biometric codes were fixed within the RFID scanner utility. Without the correct code, a user could not open the gateway to allow the RFID-scanned information to be uploaded to the database. This type of security is critical for official uses of RFID technology, such as border crossings that have national security considerations. Once scans were uploaded to the database, they were viewable to authorized users via Web services reporting.

Name	Biometric Code	Location	Tag ID	Tag Info	Tag Read Time
RMTE Dispatcher	00000001	RMTE Truck Depot	530F9110	11111111	2005-04-26 13:07:44
Inbound Truck	00000002	RMTE	530F9110	11111111	2005-04-26 15:05:32
Prepare Load	00000003	RMTE	530F9110	11111111	2005-04-26 15:09:48
Outbound Shipping	00000004	RMTE	530F9110	11111111	2005-04-26 15:12:18
Radomir Customs Arrival	00000005	Radomir	530F9110	11111111	2005-04-26 15:18:03
Radomir Customs Departure	00000006	Radomir	530F9110	11111111	2005-04-26 15:24:14
Bulgaria Guard Arrival	00000007	Stanke Lisichkovo	530F9110	11111111	2005-04-26 15:27:36
Bulgaria Guard Departure	00000008	Stanke Lisichkovo	530F9110	11111111	2005-04-26 15:45:33
Macedonia Guard Arrival	00000009	Delchevo	530F9110	11111111	2005-04-26 16:00:47
Macedonia Guard Departure	00000010	Delchevo	530F9110	11111111	2005-04-26 18:11:23
Skopje Customs Arrival	00000011	Skopje	530F9110	11111111	2005-04-26 18:41:19
Skopje Customs Departure	00000012	Skopje	530F9110	11111111	2005-04-26 18:44:12
MSS Receiving	00000013	MSS	530F9110	11111111	2005-04-26 19:53:55

Figure 5: Table of RFID Scans and Corresponding Data

Figure 5 shows the progression of events (from top to bottom) and information (from left to right) that was recorded during the demonstration scans. A user enters his/her user name into the RFID scanner utility and then allows the device to read his/her pre-registered fingerprint. If the user is authenticated, the device generates a biometric code that is used to open the gateway allowing the user to then upload information read from the RFID tag to the virtual relational database, recording its serial number and associated information. The associated information could be a list of goods or a shipment description, but in this case is a numeric string. The process then records the date and time at which the RFID tag was read.

Recognizing that RFID tags can be employed in numerous ways to improve the movement of goods, a second set of tests was conducted to determine the RFID tags' effectiveness while being read in motion. An archway RFID reader was constructed in a fixed location using multiple antennas to ensure data capture. A van was driven past the archway at speeds between 20 and 30 kilometers per hour with 100 percent read accuracy for a total of 10 passes. The fixed reader is shown in Picture 4.

Picture 4: Archway Reader

The delivery phase of the Pilot Demonstration thus showed how the first objective, to move goods across borders with minimal delays, could be achieved. By eliminating the need to manually review and enter information that can be provided by simply reading RFID tags accompanying a shipment, every phase of the delivery process from dispatch to border crossing to receiving can be shortened.

Web Services Reporting

The solution has powerful reporting capabilities based on combining static and dynamic data from the two phases and making this information available via real-time Web services reports. Taken as a unified solution, the purchasing and delivery processes of the Pilot Demonstration used a database with 175 unique data elements, but the potential number of data elements is

unconstrained. The bulk of these data elements came from four standard document types re-created electronically for the Pilot Demonstration:

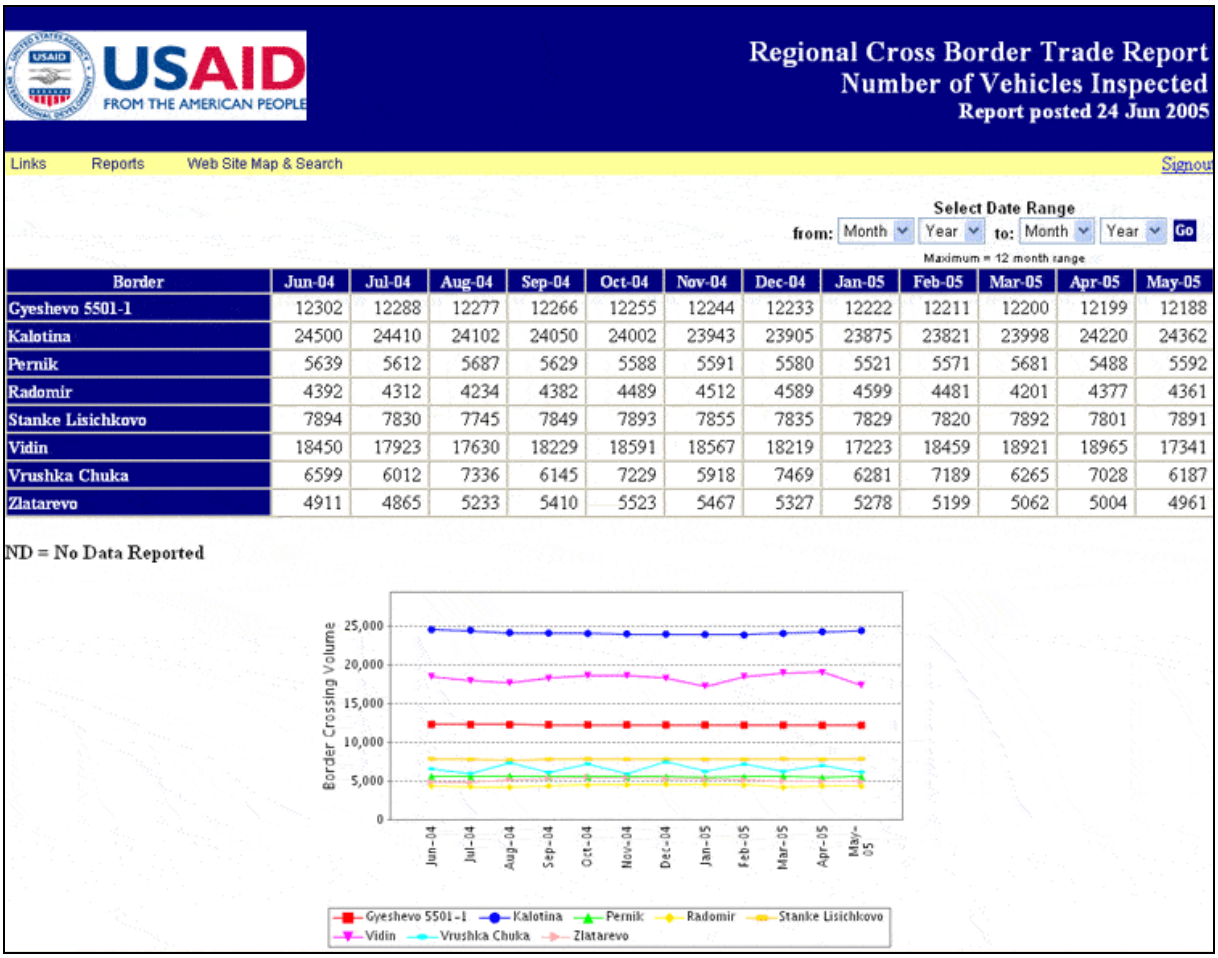
- UNeDoc - Invoice
- UNeDoc - Quotation
- UNeDoc - ECSI
- Bulgarian Customs Declaration Form

These documents, completed by the supplier (RMTE) in this Pilot Demonstration, contain static data (constant data, not time dependent) that was sent not just to the customer (MSS) but also to a secure, virtual relational database on the Web managed by the server software. As described above, dynamic data from the various RFID tag reads and associated biometric codes were also sent to the virtual relational database. All of this static and dynamic data can be linked, or combined, to create useful reports or to provide existing systems with important data for use in the decision making process. In this case, an association was made at the beginning of the delivery process between the RFID tag IDs (for the truck, cargo, and driver) and the above documents related to the shipment. Thus, the data from all the RFID tag reads throughout the delivery process is linked in the database to all of the shipment document data.

For illustrative purposes regarding future opportunities for data availability, the database was populated with additional data elements relating to Customs, partners, border crossing activity, shipments, items, drivers, and vehicles. Several Web services reports were created combining this data with that from the above documents and the RFID tag scans. These reports are representative of what is possible with the technology and Web services reporting. The underlying transactional and transportation data elements can be updated and shared with multiple users who have varying levels of access, creating an unlimited combination of data flows. Documents can also be pre-populated with incoming data flows.

These types of data flows, which are not software platform dependent, can support integrated supply chain and border management across the region. This ICT solution allows for cooperation and information sharing among companies, countries, and inspection agencies. This could lead to further reductions in wait times at the border and better policing of illegal shipments. In much the same way that companies seek to share information to improve the functioning of their supply chains—minimizing costs, reducing delays, and improving information exchange to name a few—the region could integrate its border management information to exact the same types of gains to promote the region's prosperity.

The following reports provide a sample of the Web services reports that were created for this Pilot Demonstration (the data in each is for illustrative purposes only). Each of the reports is viewed from a password-protected Web site using any Web browser and selecting from a menu at the top of the screen. One Pilot Demonstration report is shown as Figure 6: Border Crossing by Vehicle Volume. This report tracks the total number of border crossings for each border location broken down by month. The report displays a rolling, trailing 12-month period with a graphical display of the data shown in the chart.



Regional Cross Border Trade Report
Number of Vehicles Inspected
Report posted 24 Jun 2005

Links Reports Web Site Map & Search Signout

Select Date Range
from: Month Year to: Month Year Go
Maximum = 12 month range

Border	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05	Apr-05	May-05
Gyeshevo 5501-1	12302	12288	12277	12266	12255	12244	12233	12222	12211	12200	12199	12188
Kalotina	24500	24410	24102	24050	24002	23943	23905	23875	23821	23998	24220	24362
Pernik	5639	5612	5687	5629	5588	5591	5580	5521	5571	5681	5488	5592
Radomir	4392	4312	4234	4382	4489	4512	4589	4599	4481	4201	4377	4361
Stanke Lisichkovo	7894	7830	7745	7849	7893	7855	7835	7829	7820	7892	7801	7891
Vidin	18450	17923	17630	18229	18591	18567	18219	17223	18459	18921	18965	17341
Vrushka Chuka	6599	6012	7336	6145	7229	5918	7469	6281	7189	6265	7028	6187
Zlatarevo	4911	4865	5233	5410	5523	5467	5327	5278	5199	5062	5004	4961

ND = No Data Reported

Figure 6: Border Crossing by Vehicle Volume

On the following page a sample Macedonian T-1 Transit Document is shown in Figure 7. This document is very similar to the actual screen currently viewed by a Macedonian Customs Agent, illustrating the capability to electronically populate current information systems with data supplied directly from the supplier and/or freight forwarder using the client software.

Regional Cross Border Trade Report
T1 Transit Document
Report posted 12 Aug 2005

Links | Reports | Web Site Map & Search | Signout

T1 Transit Document

TIR CARNET	TIR001

Exporter No	568901
Mittal Steel Skopje, 16 Makedonska brigada 18, 1000 Skopje, Macedonia.	

DECLARATION		OFFICE OF DEPARTURE Office Code :CU001 Inland Office
Decl		
Forms	Lists	Registration No & Date
890	89	fgsd/df & 2004-04-04
Items	Tot Pack	Decl. Ref. number
87	990	2004-04-03

Consignee No	798345
Balkan Transport, 22 Octomvri 42, 1000 Skopje, MK	

Declar/Repr. No	ICL
ICLogistics Inc PO BOX 8 Remsen,FFE Unites States Of America - 13438-0008	

ID / Nationality of transport arrival	
GE2345E	CH1
ID / Nationality of transport at border	
GE2345E	CH1
Transport at border	Place Of loading
3	Skopje

Country Of Export	City Of Export
MK	Skopje
	City Of Destination
	Remsen

Marks & numbers of packages	Item No
AF1 Nos. 16/20	1
Number Of Kind	55
Description of goods :	
Steel rolls	
Containers No(s):	
ASDF1234567	

Commodity Code	
840890	
Gr. mass kg	
2000	
Net mass kg	
1800	
Summary decl./Prev. Doc	
Summary	

Additional Information - Documents Produced

Principal No	
Metalworks	
Represented by	R. Paull
Place & Date	

OFFICE OF DEPARTURE
OFf at Inland

Guarantee Type			doc
Reference	AW654	Date	24/02/2000

Office Of destination
CU004

CONTROL BY OFFICE OF DEPARTURE STAMP	
Results	OK
Seal affixed Number	9876
Identity	ID
Time Limit (date)	29/02/2000
Signature	

Place & Date
Skopje & 4/4/2005
Signature / name decl. /rep.
Gegovski

Figure 7: Macedonian T-1 Transit Document

The Border Summary Report, Figure 8, shows a high-level view of border activity. Data is tracked across people, vehicles, and cargo. The rows show the physical border locations while the columns show number of arrivals and departures, total time spent in the border queue, and road taxes collected. This report and format could be particularly useful to a Deputy Minister or high-level agency manager.

USAID FROM THE AMERICAN PEOPLE

Regional Cross Border Trade Report
Border Crossing Report
Report posted 24 Jun 2005

Links Reports Web Site Map & Search Signout

Select Date Range
from: Month Year to: Month Year Go
Maximum = 12 month range

Border Crossings - People

Border Location	Number of Arrivals	Number of Departures	Average Time to Cross hr / min	Total Road Tax Collected
Gyeshevo 5501-1	150	550	2:36	54
Kalotina	550	550	1:12	160
Pernik	55	55	0:29	70
Radomir	25	25	0:17	21
Stanke Lisichkovo	112	111	2:04	90
Vidin	423	423	1:34	129
Vrushka Chuka	19	19	0:14	22
Zlatarevo	52	52	0:58	62
TOTAL	**1386**	**1785**	**1:10**	**608**

Border Crossings - Vehicle

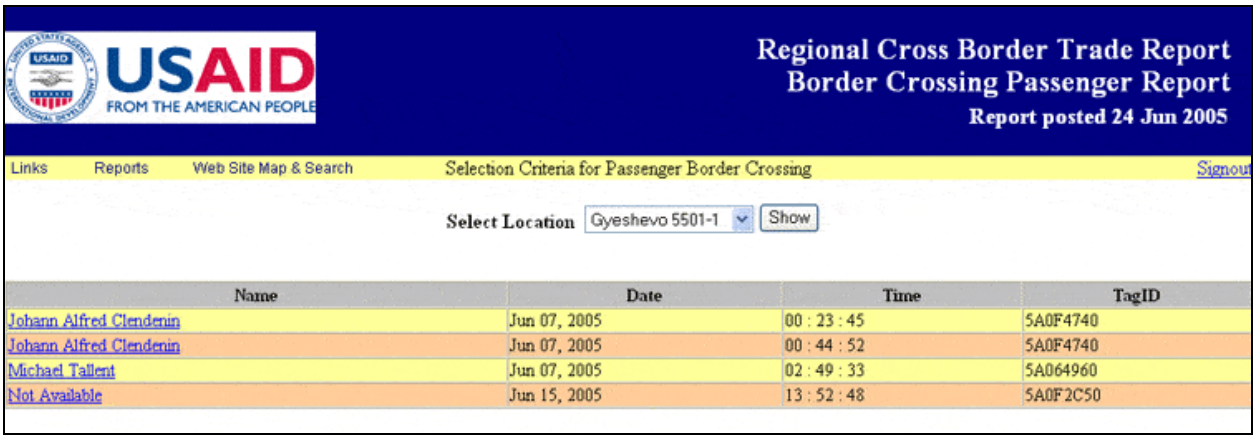
Border Location	Number of Arrivals	Number of Departures	Average Time to Cross hr / min	Total Road Tax Collected
Gyeshevo 5501-1	12044	12044	8:24	88
Kalotina	20031	20031	6:33	177
Pernik	1138	1138	0:49	33
Radomir	630	630	7:12	34
Stanke Lisichkovo	11502	11502	5:21	45
Vidin	18992	18992	2:44	36
Vrushka Chuka	5416	5416	1:23	78
Zlatarevo	4845	4845	2:04	39
TOTAL	**74598**	**74598**	**4:18**	**530**

Border Crossings - Cargo

Border Location	Number of Arrivals	Number of Departures	Average Time to Cross hr / min	No. of Crossings requiring Phyto-Sanitary Inspection	No. of Crossings requiring Veterinary Inspection	Total Freight Charges	Total Road Tax Collected
Gyeshevo 5501-1	12244	12244	10:15	12204	11244	4100	50
Kalotina	23943	23943	14:32	23903	21943	6225	160
Pernik	5591	5591	9:52	5501	5191	1200	70
Radomir	4512	4512	2:39	4502	4112	100	80
Stanke Lisichkovo	7855	7855	11:44	7805	7155	1500	90
Vidin	18567	18567	13:38	18507	11567	3890	145
Vrushka Chuka	5918	5918	12:08	5908	5118	1150	67
Zlatarevo	5467	5467	10:58	5407	5167	1175	68
TOTAL	**84097**	**84097**	**9:48**	**53915**	**49645**	**19340**	**730**

Figure 8: Border Summary Report

Figures 9 and 10 depict reports that contain details of the individuals (passengers) passing through a particular border location. This is accomplished by taking scans at the border of RFID tags located on each person's passport. Figure 9: Border Crossing Passenger Detail 1, shows the name of each person who has passed a given border along with the date and time of the crossing and the RFID tag ID. Clicking on an individual's name in this report pulls up a second, more detailed report shown in Figure 10: Border Crossing Passenger Detail 2.



USAID FROM THE AMERICAN PEOPLE

Regional Cross Border Trade Report
Border Crossing Passenger Report
Report posted 24 Jun 2005

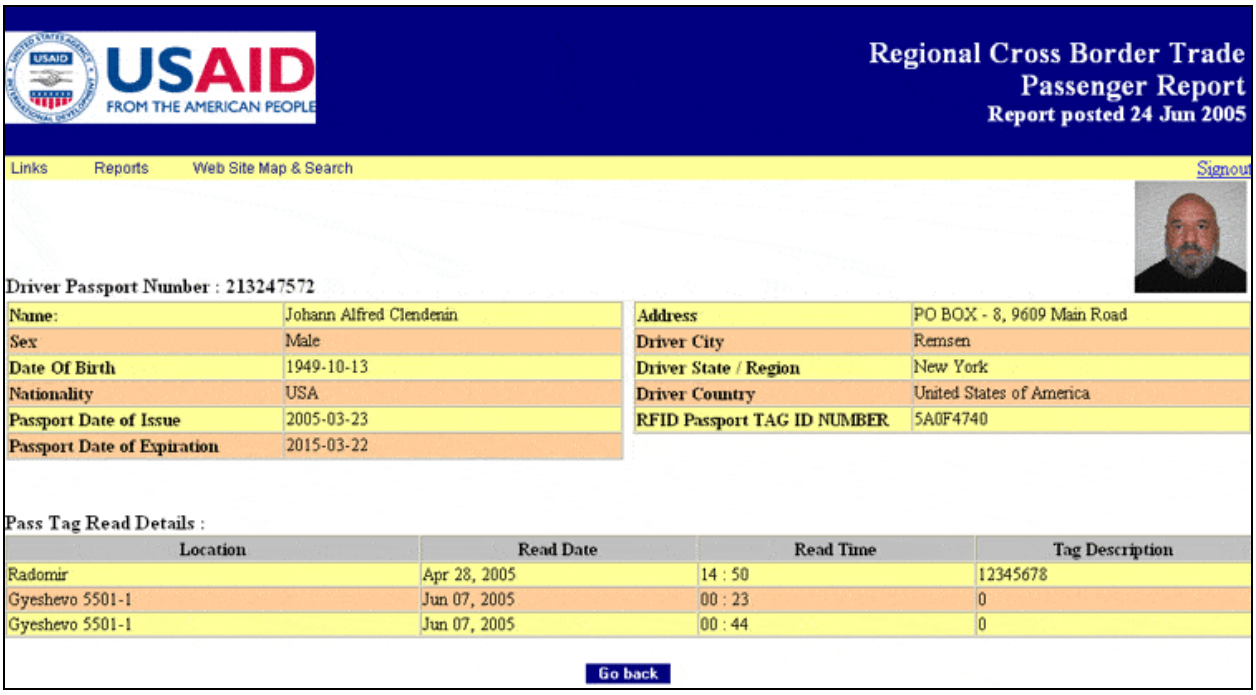
Links Reports Web Site Map & Search Selection Criteria for Passenger Border Crossing Signout

Select Location Gyeshevo 5501-1 Show

Name	Date	Time	TagID
Johann Alfred Clendenin	Jun 07, 2005	00 : 23 : 45	5A0F4740
Johann Alfred Clendenin	Jun 07, 2005	00 : 44 : 52	5A0F4740
Michael Tallent	Jun 07, 2005	02 : 49 : 33	5A064960
Not Available	Jun 15, 2005	13 : 52 : 48	5A0F2C50

Figure 9: Border Crossing Passenger Detail 1

This report provides detailed information about the person in question, such as the information on their passport, as well as a complete history of his/her past border crossings at any location.



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Regional Cross Border Trade
Passenger Report
Report posted 24 Jun 2005

Links Reports Web Site Map & Search Signout

Driver Passport Number : 213247572

Name:	Johann Alfred Clendenin	Address	PO BOX - 8, 9609 Main Road
Sex	Male	Driver City	Remsen
Date Of Birth	1949-10-13	Driver State / Region	New York
Nationality	USA	Driver Country	United States of America
Passport Date of Issue	2005-03-23	RFID Passport TAG ID NUMBER	5A0F4740
Passport Date of Expiration	2015-03-22		

Pass Tag Read Details :

Location	Read Date	Read Time	Tag Description
Radomir	Apr 28, 2005	14 : 50	12345678
Gyeshevo 5501-1	Jun 07, 2005	00 : 23	0
Gyeshevo 5501-1	Jun 07, 2005	00 : 44	0

Go back

Figure 10: Border Crossing Passenger Detail 2

The Export Cargo Shipping Report in Figure 11 on the following page shows all the information provided by a UNECSI form as completed by the supplier in the Pilot Demonstration.

USAID FROM THE AMERICAN PEOPLE

Regional Cross Border Trade Report
Export Cargo Shipping Report
Report posted 12 Aug 2005

Links Reports Web Site Map & Search Signout

Booking Number	BNO001

Exporter	Radomir Metal Trade and Engineering 2400 Radomir, Bulgaria	Consignee	ICLogistics Inc PO BOX 8 Remsen,FFE Unites States Of America - 13438-0008	Freight Forwarder	Balkan Freight , 78009, 1234 Street, Varna, Bulgaria.

Customs Reference / Status	Exporter's reference	Forwarder's Reference	Country of Origin	Country of Final Destination	Pre-carriage Details	On-carriage Details	Transport Mode	Transport Means	Transport Leg	Place of Loading	Port of Discharge	Please insure for:	No of Containers
UCR001	CONREF1	FRFWD1	IN	USA	PreCar1	OncarT	CAR009	Ship		Varna	Newark	56008	560

Item	Shipping Marks	Commodity Code	Total Gross Weight (KG)	Total Net Weight(Kg)	Total Cube (m3)
IT001	SHM1	200	CCOM1	150	190
ITEM002	SH002	500	CCMO2	550	6800
ITEM004	SH003	789	CC67	900	989

Name of Contact	John
Contact Telephone No.	314-210-0008

Figure 11: Export Cargo Shipping Report

Many other reports are possible. The following (Figure 12) is a complete list of the reports created for this project, including the ones shown above:

Inquiry Reports	Tracking Reports	Border Reports
Item Number	Export Cargo Shipping	Crossing Detail
Invoice	Customs Invoice Level 1	Crossing Passenger Detail
Driver	Customs Invoice Level 2	Crossing Fees Collected
Vehicle	Passport Control	Crossing by Volume
Partner Facilitation		Crossing by Hours
		Crossing by Type
		Police Crossing Activity
		Summary Report
		Macedonian Transit Document

Figure 12: Current Reports

Potential future reports include (but are not limited to) the following (Figure 13):

International Trade Documents	Transport Documents
Acknowledgement	TIR Carnet
Commission	Certificate of Shipment
Credit Note	Bill of Lading
Debit Note	Bill of Loading
Pro Forma Invoice	Dangers Goods Notice
Order	Standard Shipping Notice
Quote	Consignment Document
	Dispatch Notice

Figure 13: Sample of Potential Future Reports

BENEFITS

The Pilot Demonstration was designed to test a net-centric solution that could support the region's goals of increased competitiveness and economic prosperity through enhanced trade, ultimately leading to achieving EU accession. The Pilot Demonstration successfully showed a solution set that could:

- Facilitate movement of goods across borders minimizing delays in response to current wait times that can be in excess of 12 hours; and
- Help enhance competitiveness of regional companies by providing them with ICT tools that allow them to participate, collaborate, and trade electronically as participants of international and global supply chains.

The solution's value is ultimately derived through the seamless integration of data from both Pilot Demonstration phases (RFQ to cargo delivery). For example, at the supplier's loading dock where the initial RFID tag is scanned, the RFID tag information is linked in the database to all of the data from the documents associated with the shipment. Thus, the RFID tag data can be used to recall information from the Customs declaration or UNECSI document completed by the supplier or freight forwarder. Therefore, a multitude of real-time reports are possible. For instance, a scan of the cargo's RFID tag could automatically recall the associated Customs declaration information and make it accessible on the Customs agent's screen, eliminating the need for repeated manual data entry. Just as the document data was sent to a new database in the Pilot Demonstration, this data could be sent directly into the Customs system(s).

Another critical aspect of the solution is that it avoids a "data dump" by routing information only to those who have a need to know. Providing relevant information rather than raw data is the key to improving business process flows. It also allows the system to maintain the confidentiality of certain data elements as deemed appropriate by the data's owner(s).

New users can be added to a supply chain by simply installing the software and having access to an Internet connection, which makes this solution easily scalable, seamlessly and quickly using the existing data elements. Current data and document requirements can be met today and the inevitable changes and future requirements will be met with minimal disruption to the SMEs or government agencies.

The three major and inter-related barriers addressed with the solution are namely costs, standards, and border crossing procedures.

Supply Chain Costs

All manner of inefficiencies negatively impact costs, while better decision making improves the bottom line. Thus, improving business processes can have a profound effect on business profitability, competitiveness, and ability to participate in global supply chains. Many of the Pilot Demonstration benefits that accrued to RMTE and MSS came in the area of both hard and soft costs associated with improved business processes. A cost advantage is achievable by supply chain participants (such as buyers, suppliers, freight forwarders, and regulatory agencies) by using a simple, low-cost, net-centric method to transact business that works across software platforms. The benefits include those described as follows:

- Improves information availability between trading partners, leading to better decision making and improved customer service.
- Decreases “information overload” by routing data only where it is needed.
- Lowers transaction costs through electronic movement of information, and improves the order to production cycle and delivery time.
- Decreases business transactions times versus paper documents that must be distributed by fax and/or mail, leading to more efficient use of time and staff and increased profitability.
- Improves the reliability of information that is exchanged via electronic transfer by minimizing the re-keying of information, leading to fewer errors and more effective production.
- Allows for reduced inventory levels by integrating buyer and supplier, thus decreasing inventory carrying costs and improving asset utilization.

It is worth noting that the benefits are not limited to the documents exchanged in this Pilot Demonstration but can be applied to any documents that might be used in international trade, including but not limited to, documents used by shippers, consignees, material planners, material buyers, police, phyto-sanitary inspectors, veterinary inspectors, and various other government agencies. New users and documents can be added to the system by a simple upload process, making it easily scalable.

At the onset of the Pilot Demonstration process, the team spent time with RMTE and MSS to create a baseline case to determine what savings were created through the use of the solution. Based on this information gathering and the results of the Pilot Demonstration, it was found that processing time savings to MSS and RMTE were about 7,096 hours per year, with an additional savings to their supply chain partners, just for business conducted with RMTE or MSS, of 11,239 hours per year if deployed to all direct suppliers and customers of RMTE and MSS. This translates roughly into a savings of $17,119 EUR per year for MSS and RMTE alone and an additional $23,801 EUR to their supply chains partners. These cost savings are shown in Figure 14.

Demonstrated Solution Annual Cost Savings		
Processing Time Savings		
	To MSS and RMTE	7,096 hours
	To suppliers and customers of MSS and RMTE	11,239 hours
Cost Savings		
	To MSS and RMTE	17,119 EUR
	To suppliers and customers of MSS and RMTE	23,801 EUR
Border Crossing Savings		417,320 EUR
Total Potential Cost Savings		**$458,240 EUR**

Figure 14: Annual Cost Savings Analysis

The ICT deployment process took approximately eight weeks from the gathering of final requirements to its implementation. User training was completed in about two hours at each site, including teaching a user how to install and register the software. Training also provided a knowledge transfer benefit with regard to leading edge business processes. As mentioned, the ICT solution software is designed to have low maintenance and support costs, although this would be determined over the long term.

Standards

As noted earlier, there are several standards issues at work in the context of this Pilot Demonstration. The key to the demonstrated solution is that it accommodates multiple

standards, recognizing that today's regional and international commerce is not standardized by ICT, language, or document requirements. Perhaps the most straightforward issue is that of varying ICT standards. The software and utilities used in the Pilot Demonstration are designed to work in conjunction with any ICT platform. By working in cooperation with existing systems rather than requiring additional investments in new ICT, the demonstrated solution minimizes ICT acquisition and training costs. Because of the solution's flexibility, it also allows users to easily transition to next generation e-Commerce platforms in the future.

The ability of the solution to supply data to multiple users in multiple desired formats provides additional value. When considering standards across the supply chain, a customer may have a preferred format in which it wants to receive invoices from suppliers. Suppliers are often obliged to follow these requirements, but this can create a cost burden that is especially difficult for SMEs to bear. The demonstrated solution allows a user to accommodate multiple format requests, e.g., for each of its trading partners or for Customs, with ease. This same simplicity applies to the manner in which an invoice is viewed, for instance, whether the invoice number appears on the right- or left-hand side.

This same issue of format and view applies at the government-to-government level but becomes further burdened because issues of national sovereignty are also involved. The demonstrated solution eliminates the need to select one particular country's Customs' form to be used in order for Customs agencies to share information. Each country can see and use its own Customs or other border agency form as it has typically done while still allowing for information sharing. When it forwards information to a neighboring Customs service, the recipient will receive the Customs' form in his or her preferred format, language, and layout. This is particularly important across borders where countries do not share a language and where Customs agencies will require customized GUI.

Border Crossing Procedures and Costs

Creating a transportation system for border crossings that can read, record, and share information collected through AIDC devices and other electronic data flows has major advantages in trade facilitation. As the Pilot Demonstration showed, these benefits include:

- Decreasing the time and cost it takes to cross the border by uploading information electronically through AIDC devices.
- Improving the reliability of information that is transferred into the Customs, customer, etc., databases using electronic data transfers.
- Providing tracking capability to determine where a shipment is located and where a problem might exist.
- Improving border security and accountability and reducing corruption by using biometric authentication.

Border crossing times for some SEE countries can be as long as 24 hours, as noted by the WB Trade and Transport Facilitation in Southeast Europe Program (TTFSE). When trucks are stopped at land borders for extended periods, the result is poor asset utilization, which reduces competitiveness. The longer trucks and drivers wait at the border, the fewer deliveries and the higher the costs associated with each delivery. Costs for driver labor, fuel, and unusable inventory can rise significantly if a single trip is lengthened two days by waits coming and going, particularly if the shipment is of perishable items. Employing RFID technology to manage road tax collection, for instance, could minimize similar bottlenecks along the land route beyond the border crossing. Implementing AIDC-enabled, net-centric ICT tools that transfer data

automatically eliminates the need for re-keying data and enables data sharing among border agencies across the border itself.

It is estimated that by eliminating manual data entry, providing data electronically and in advance, and providing for information sharing across agencies and borders, total truck transit time can be reduced by 18 percent. This translates into a conservative supply chain cost savings estimate of approximately $417,000 EUR per year for just the shipments crossing borders on their way to and from RMTE and MSS. This estimate assumes that all shipments arrive via truck. However, many of the shipments are delivered by rail or water or a combination, which are more likely to have substantially higher associated delay costs. For instance, trains go through many of the same processes as trucks, but also have an additional safety inspection for insurance liability. Likewise, ships incur large demurrage costs when they have to wait at ports for trucks or trains that are late due to border delays. This savings estimate also does not take into account the sizable increase in asset utilization that would occur if trucks and trains were not experiencing lengthy delays at the border on every trip.

Another key benefit of electronic transfer of data and documents is the opportunity to improve security and limit "tips" and "gratuities" paid at the border. The TTFSE report, "Reducing the Economic Distance to Market (December 2004)," notes that corruption ranks among the top third of business obstacles in the Balkans. Electronic data flows can help curb the significant cost of corruption to companies. To the extent that processes can be automated and human intervention minimized, there is less opportunity for corruption and an increased capability for third-party transaction verification and follow-up audits. Biometric ID also helps curb corruption. For example, biometric ID can be used to verify that the truck driver at the border is the same person who left the supplier's dock, or it can be used to identify the Customs agent/border official who "passed" a given shipment or vehicle. In addition to decreasing corruption, these security aspects of the solution would also assist in efforts against terrorism and other border security issues.

The Pilot Demonstration was not only a success in meeting the contract requirements, but it also showed its ability to provide a viable solution to the SEE region that would enhance competitiveness and prosperity, saving a potential $458,000 EUR annually, just for business done with RMTE and MSS. In addition, the solution positively impacts both of the TTFSE II development objectives: reducing non-tariff costs to trade and transport, and reducing smuggling and corruption at border crossings. In addition, the solution addresses almost all of the stated program objectives of TTFSE II, including: improved regional transport infrastructure (technology infrastructure); transport facilitation issues in inland waterways and maritime transport (via similar methods demonstrated with trucks and land borders); integrated and transparent border management, at national, bilateral, and regional levels; enhanced security without constraining the flow of goods; full data integration across the supply chain; improved regional coordination and exchange of data; and the establishment of a competitive private sector. The key to the solution's viability is its ability to address the three major barriers to regional trade: costs, standards, and border crossing procedures.

LESSONS LEARNED

In addition to achieving the Pilot Demonstration objectives, the implementation team garnered valuable information that will help guide future work in the area of trade facilitation. These lessons include:

- Within the SEE region, the time and cost associated with border delays and difficulties are beyond what was originally estimated. Additionally, firms may be discouraged from engaging in cross border trade at all, because the perceived obstacles are so great. This election to forgo markets outside of a country leads to an inestimable loss in prosperity.
- Even large companies make limited use of ICT. While the companies that participated in the Pilot Demonstration were larger than typical SMEs, they had little by way of hardware, software, backend systems, and Internet connectivity to support their current work. For instance, RMTE had only a single dial-up Internet connection for the entire company. Companies ready to embrace ICT can leapfrog generations of ICT; however, those that cannot or will not will fall further and further behind.
- Despite the low penetration of ICT among business users, there is no lack of sophistication among those that provide and sell ICT in the region. Capable and proficient local partners were identified suggesting that the infrastructure can support wider deployment of ICT solutions.
- The users trained in the Trade facilitation solution had limited ICT familiarity; yet, they found the software easy to use and they began to recognize the feasibility and benefit of deploying supply chain solutions. Users expressed particular interest in interoperable data utilization and automated data exchange processes. Training in both the technical and tactical solutions for the Pilot Demonstration was completed more quickly than expected suggesting a level of comfort with the provided ICT solutions.
- In congruence with the limited deployment of ICT, there were limited company resources available for troubleshooting and maintenance of ICT solutions. It is an important consideration for the development of all future solutions; maintenance costs often far exceed the cost of installing a solution, and therefore, serve as a check to the deployment of ICT.
- Independent of the ability of the net-centric process to secure and merge static and dynamic data from different locations, users indicated a preference for segmenting and controlling their own data in a physically separate environment from that of other users. The actual location of the data was not as critical as its separation.
- The need for signatures on documents, such as POs and invoices, is a barrier to the full deployment of electronic cross border trade solutions. The practice of requiring and/or legal need to require actual, physical signatures may be more prevalent in SEE than in other parts of the world. Further investigation into electronic signature options and EU practices in this regard will be required.

CONCLUSIONS & RECOMMENDATIONS

The majority of successful development efforts of the last 50 years have been export-led. Thus, finding ways to make companies and countries more competitive in the international trade arena is a major avenue to achieving economic prosperity for an entire generation of inhabitants of SEE. The process of trade has two components, the transactional aspects that occur among buyer, supplier, and regulator, and the physical transport of goods. Trade facilitation can be thought of as anything that leads to the improvement of one or both of these inter-related processes.

According to some studies, the costs related to transport and border procedures in many cases exceed the customs duty that is paid. It is necessary to pay attention to trade facilitation that is behind trade liberalization.

Mr. Zoran Jolevski, Vice Chair UNECE Comm for Trade, Industry and Enterprise Development

The common wisdom has been that key ways to improving these processes have been through the improvement of physical infrastructure, such as improving road conditions, and the institutional framework, such as harmonization. However, the Pilot Demonstration established

how new technologies can assist businesses in improving their abilities to develop and maintain trade. Indeed, the deployment of ICT to improve regional competitiveness not only offers direct benefits but also works to support the improvement and maintenance of physical infrastructure and the institutional framework. For instance, many trucks cross SEE borders overweight, which causes damage to the roadways. ICT solutions can improve the monitoring of weight limits, helping to preserve the physical infrastructure.

This suggests that there may be a third and equally critical mode of facilitating trade, increasing competitiveness, and driving economic prosperity that stands side-by-side with building and maintaining the physical infrastructure and improving the institutional framework—the deployment of applicable ICT tools. This deployment can be thought of as improving the "technology infrastructure" for trade. Based on the lessons learned, it is recommended that deployments of net-centric trade facilitation solutions:

- Make available a turnkey ICT solution that includes hardware, software, peripherals, and Internet connectivity, as needed.
- Consider options that allow users to isolate their data, such as deploying individual servers.
- Integrate an electronic signature component or signature alternative, such as biometric authentication.

Throughout the region there was tremendous interest in the Pilot Demonstration project both during its development and upon its completion. The insights developed in the Pilot Demonstration suggest possible continuing projects in the following areas:

1. Infrastructure pilots to determine the specific requirements of border crossings involving rail, air, and shipping ports.

2. Training and awareness pilots to facilitate understanding and development of net-centric solutions in targeted regional areas and sectors of possible competitive advantage.

3. Regional SME training in contemporary supply chain integration and use of ICT for trade solutions (RFID, GPS, biometrics, and electronic data and document management).

4. Pilots involving the shipment of goods crossing multiple borders and the facilitation of regional in-transit visibility and trade access to EU and US markets.

Specific pilot projects that were suggested during the course of the Pilot Demonstration include, but are not limited to:

1. A continuation of the work that was presented by the Trade Enhancement for the Services Sector (TESS) project on the region's apparel industry, building on the Regional Cross Border Trade Facilitation Pilot Demonstration work and competitiveness and cluster activities. The goal is to help the apparel cluster efficiently import its raw materials through the supply chain and move its finished goods from SEE into Western Europe.

2. A pilot effort with a focus on the benefits that can accrue to governments and that supports the development of an institutional framework and physical infrastructure that will promote competitiveness and prosperity. Possibilities include:

    - Enabling the delivery of electronic documents directly to Customs and other border agencies within a single country. As noted in the Pilot Demonstration, this could have

both a quickening effect on wait times and a profound impact on "gratuities" paid at the border. It could also be the forerunner to the creation of fast lanes for shipments that have been pre-cleared or meet some additional requirements.

- An RFID-enabled demonstration that can provide cargo temperature and weight information to border inspection agencies. This type of solution could lead to more effective agricultural inspections, which could be important for future EU integration, as well as to better ability to preserve the physical infrastructure by reducing the number of overweight trucks that cross borders.
- A net-centric data exchange pilot that could permit a country's border agencies to share information amongst themselves and across the border with their counterparts, transmitting and receiving information in their preferred format. Such an effort would support further regional cooperation, improved movement of goods across borders, and steps toward harmonization. Macedonian Customs has expressed interest in this type of activity.
- A pilot that brings together net-centric tools with a wide array of AIDC devices to track high-value excise tax items coming into the country and transiting through a country.
- A pilot effort that would track the Macedonian Customs Mobile Teams.
- Assisting the Bulgarian Inter-ministerial Committees in Cross Border facilitation. Since all agencies are represented, it would be a direct way to introduce inter-agency data transfer.
- Conducting a joint USAID and US Customs pilot concerning the shipping of containers from the ports of Varna and Borgas. RMTE ships directly to the US from these ports. US Customs is very concerned about obtaining data from point of origin rather than port of departure.

3. Encourage the private sector to expand the scope of the current project to include Romania, Greece, and Turkey. These countries have direct impact on the borders of the countries in this report as well as all trade facilitation issues in the region. Bringing together the different governments as well as businesses in the region can significantly and positively impact SME trade across the region. This private sector led activity could include SMEs from different industries in each of the countries. Expanding the number of SMEs and having SMEs in different verticals will provide additional statistical relevance to the findings.

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APPENDICES
APPENDIX A: NET-CENTRIC TECHNOLOGIES
ICLogistics

Net-Centric Technologies

Net-centric tools integrated into supply chain business processes enhance decision making under uncertainty. Providing data that is visible, timely, accessible, understandable, and trusted throughout the supply chain quickly validates assumptions and accelerates decision making down to the "Last Mile" – the SMEs.

Next Generation Supply Chains & "Last Mile" Integration

A groundbreaking development in making "Last Mile" supply chain data visible and viable is the advent of the "net-centric supply chain." Financially and technically accessible to small business, the Internet provides the opportunity to create a semantic Web community providing more complete data and document access and therefore a better platform for informed decision making in a seamlessly integrated real-time environment.

As soon as data can be gathered and input, that very data can be posted as a Web report, tagged with metadata for quick discovery, or even posted to shared spaces in a "Virtual Relational Database" (vRdB). Further, a net-centric supply chain puts data where it is needed, when it is needed, and in the format in which it is needed in order to accelerate decision making and to increase productivity. Net-centric supply chains have the ability to structure and to obtain data and documents across technical platforms and various organizations. ICLogistics provides the connectivity required to complete the "Last Mile" of information integration in an inexpensive and easy-to-use format.

Net-Centric Software

Net-centric software is a means of facilitating supply chain integration by sharing real-time data and documents between business partners on different software platforms. ICLogistics' net-centric solution systems integrate various legacy systems, software platforms, and infrastructures by interfacing with multiple standards such as flat files, Open DataBase Connectivity (ODBC) Files, spreadsheets, and other data types. The system also makes use of Web service standards (e.g., SOAP [Simple Object Access Protocol], WSDL [Web Services Description Language], UDDI [Universal Description, Discovery and Integration]) to make its data assets visible. In addition, transaction processing modules direct authorized users to appropriate Web site Uniform Resource Locator (URL) locations containing the data elements sought in user specified format and presentation.

As easy to use as most e-mail programs, ICLogistics Scarborough Fair^{SM} (SF) is the flagship software application of the ICLogistics Software Suite. SF is a document and data management application that not only enables Business-to-Business (B2B) document exchange (Invoices, RFQs, POs, and the like) but further adds to the net-centric supply chain enabling Web visibility of virtually any type of logistics process or results metrics data extracted from virtually any data source from a fax machine to an RFID tag.

At the center of the objective to achieve Net-Centricity is the unobstructed flow of data. SF handles myriad data types and sources through the creation of document types written in XML. XML is a Web-based language similar to Hypertext Markup Language (HTML) and the primary technology enabling semantic Web search capabilities. Data, drawn from any source (manually or automatically) and inputted into an ICLogistics XML Schema Definition (XSD) document type located in SF, may be posted to a secure Web site with virtually limitless access points from a wireless Personal Data Assistant (PDA)

device to a laptop computer for on-the-go accessibility. XSD's are used to customize the transmitted data and documents into the appropriate formats and distinct Web URL's for access by the customers of the data and documents. It is easy to change the look and feel of reports to fit operational requirements by customizing the XSD's. In simpler terms, any data can be extracted from a user's database, formatted into the appropriate records and fields, and then posted to the Web in distinct locations so that the right information is supplied to the correct parties through connection to a site that contains data already in the format that is required. In addition, foreign languages can be accommodated to enable utilization across international economies. Data stored in the vRdB on the Web can then be pulled into ERP or other legacy decision support systems. This Web-based data concept is depicted in Diagram 1.

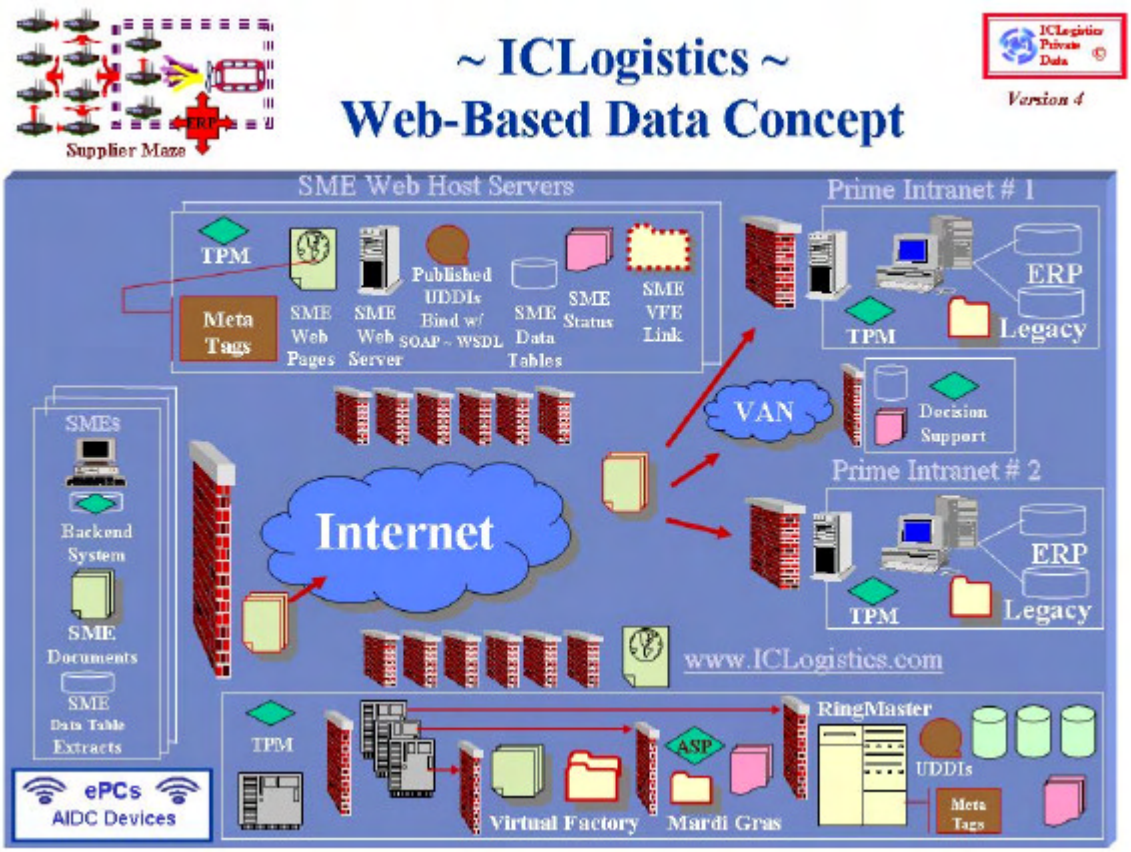

Diagram 1: ICLogistics Web-Based Data Concept

Net-centric software products uniquely address the internal and external connectivity and collaboration problems for businesses, with low-cost flexible solutions that do not require massive infrastructure changes or costly custom integrations but can significantly impact a company's productivity.

ICLogistics is found on the Web at http://www.iclogistics.com/ .

APPENDIX B: BIOMETRIC SOLUTIONS
iD-Confirm™

Biometrics Technology

Biometrics technologies are automated methods of identifying or verifying a person based on a physiological or behavioral characteristic (e.g., a fingerprint or voice). Each user is enrolled by the biometrics system and a copy of the enrollment data is stored in a secured database. When users present themselves for authentication, a new scan/sample is taken and compared with the one(s) stored in the secured database. If the new sample matches, verification is confirmed. (The issue of a secured database is a significant, if not primary, stumbling block to the wider usage of biometrics. Individuals are simply not willing to have their biometric information stored somewhere outside their control. iD-Confirm's™ technology and initial biometric devices store the user's biometric information on a device within the user's control. This eliminates the concern about an individual's biometric information being identified and used by someone else.)

In other words, biometric authentication requires comparing a pre-registered biometric sample against a newly captured biometric sample. This is a three-step process (Capture, Process, Enroll) followed by a Verification or ID process.

iD-Confirm™ is found on the Web at http://www.id-confirm.com/ .

APPENDIX C:
FIXED WIRELESS BROADBAND SOLUTION
Motorola

The Motorola Canopy™ fixed wireless broadband solution allows community service providers to deliver always-on, high-speed Internet access to municipalities and enterprises, home offices, schools, hospitals. and multi-family homes as well as single family residences in rural areas and underserved markets. The new Motorola Canopy system will support delivery options for areas where cable modem and Digital Subscriber Line (DSL) services are not available or deployment is not affordable or possible. By operating in the unlicensed spectrum, Canopy allows community service providers to bypass infrastructure investments and spectrum licenses, significantly reducing the provider's start-up costs and the number of subscribers required to reach profitability.

Configuration

The Canopy system uses Point-to-Point and Point-to-MultiPoint networks that can span distances ranging from 2 to 10 miles in a multipoint configuration, up to as many as 35 miles in a Point-to-Point configuration. The Canopy components are small, unobtrusive, easy to install, and can serve a wide range of network purposes. A Canopy system can be deployed as a stand-alone system, or the Canopy elements can be used to extend the reach of wired Internet Protocol (IP) distribution systems such as cable and DSL. Canopy elements also can serve as a redundant IP backhaul for enterprises and service providers.

The Canopy system is comprised of three major components:

Access Point (AP) Subscriber Module (SM)
The AP modules can be mounted on utility poles or water towers to distribute service to the surrounding community. Current AP implementation operates with a Radio Frequency (RF) signaling rate of 10 Megabits per second (Mbps) per sector over a nominal communication range of two miles. Each transceiver operates with a 60-degree directional antenna to provide coverage to one sector. Each AP has approximately a two-mile reach, although the range can be extended up to ten miles with the Canopy reflector kit.

SM
The small SM is attached to a home or building and does not require any configuration by the subscriber. Once the SM is initiated, it scans the channels and automatically registers with an authenticated AP. The plug-and-play SM installation requires only Category 5 cable with Direct Current (DC) power supplied through that cable. SMs may be located either indoors or outdoors.

Backhaul Unit (BU)
A wireless BU can be used to provide bulk connectivity from a remote network to the access point site. The BU is a point-to-point option for carrying traffic to and from APs or other communication hubs when no fiber or cable connection is available. Each BU communicates with another single BU utilizing a directional antenna. In each BU link one device is configured as the RF timing master. This provision allows the BU to be synchronized to its attached AP to minimize interference.

Set Up & Deployment

There is no need to integrate Canopy products with existing systems, eliminating potential network access complications. Canopy technology is compatible with multiple Internet applications. Network users do not need to install any special software. Individual units are connected via an Ethernet interface to the customer's computer or home network. A Canopy system can be configured to allow over-the-air software upgrades to provide new features for the AP modules, backhaul modules, and subscriber modules.

Reliability

Motorola's Canopy system uses network management tools and detects system outages to minimize downtime and operating costs. It is a distributed self-organizing system where functions such as frequency, time-slot allocation among cells, address translation, and connectivity mapping are all implemented via algorithms in the individual radio/logic units, eliminating the need for expensive central management systems.

Speed and Cost Efficiency

With per-user measurable speeds of more than 6 Mbps, the Canopy system is faster than any other system, including a wired T1. Its smart network design and small-sized components make deployment and operation of a large wireless network fast, easy, and cost effective.

Security and Authentication

Sophisticated base-band processing and directional antennas enable the Canopy technology to virtually eliminate interference from other systems operating on the same frequency bands. To maintain privacy and security, the system comes equipped with an advanced over-the-air Data Encryption System (DES) providing cryptographically encoded communications. A 128-bit authentication allows only authorized subscribers to gain service onto the Canopy network.

Motorola is found on the Web at http://www.motorola.com/.

APPENDIX D: RFID SOLUTIONS
Neology

RFID Technology

RFID is an automatic data collection technology that uses radio frequency waves to transfer data between a scanner and a tagged item to identify, categorize, locate, track, etc. RFID is fast, reliable, and does not require line of sight or contact between the scanner and the tagged item.

A typical RFID system consists of a reader, antenna, RFID tag, and computer or data processing equipment. The reader sends an RF signal to the tag requesting ID information. The tag responds with the information, which the reader forwards to the computer. The link between the reader and the computer can be wireless.

An RFID tag is an integrated circuit connected to an antenna that responds to an interrogating RF signal with simple identifying information, or with more complex signals depending on the size of the integrated circuit's memory. Tags can be attached to almost anything: vehicles; ID cards; high value items; people, livestock, pets; shipping containers, pallets, boxes; etc. Tags can be active or passive, and read-only or read-write.

Scanners communicate with tags via radio waves. They can be mounted in doorways, toll booths, forklifts, or can even be handheld. If the tags and scanner have read/write capability, then the scanner can also update tagged information. Neology's high performance read-write system has been successfully implemented in high speed (160 kilometer per hour [kph]) read applications as well as low speed applications that require writing data to the tag.

Neology is found on the Web at http://www.neology-rfid.com/ .

APPENDIX E: GPS/GIS SOLUTIONS
TechnoLogica

GPS/GIS Technology

The GPS is a satellite-based navigation system. It provides location information that enables the accurate pinpointing of GPS-equipped vehicles and other moving objects.

GPS consists of three components:

- A network of 24 orbiting satellites sending radio signals.
- A control segment consisting of a system of tracking stations located around the world.
- User receivers.

Satellites and their ground stations send radio signals to GPS receivers. The GPS receiver measures distance using the travel time of the radio signals, then uses trilateration (the same method as triangulation, except trilateration uses only distances for locating) to determine the user's exact location. Four satellites are required for the receiver to calculate latitude, longitude, and altitude. The receiver also synchronizes its clock with the GPS time standard. Thus, the receiver can compute position, velocity, and time. GPS receivers are used for determining exact locations as well as for navigation, tracking movement, precise timing, and many other uses.

Designed originally for military purposes, GPS is controlled by the US Department of Defense. There are no subscription fees or set-up charges to use GPS. Since GPS receivers are passive, there is no limit to the number of users. GPS works anywhere in the world, in all weather conditions, 24 hours a day.

GIS use the information from GPS receivers and link the location to various other types of information to provide a wide variety of useful data and applications. GIS views and analyzes data from a geographic perspective, layering relevant information to give users a better understanding of the interrelationships. For example, incoming GPS coordinates can be projected to a map's coordinate system. GIS is most often thought of as a set of intelligent maps showing various features of the earth's surface. However, GIS is also a geographic database of the world and a set of analytical tools.

TechnoLogica is found on the Web at http://www.technologica.com/.