Cargo Control System based on Internet facilities

Eduardo Mario Dias
Escola Politécnica da Universidade de São Paulo
Departamento de Engenharia de Energia e Automação Elétricas

Edison de Oliveira Vianna Jr.
Ministry of Transport
Secretariat of Transport Program Management
Department of Maritime Transport (DPTA)

ABSTRACT

This paper intends to describe the first Brazilian experience on developing a cargo control system with the Internet by using the Internet facilities in order to process documents involving Brazilian ports authorities. We present some hints about port productivity in this last years with the operation under the legal landmark determinate by Law 8630/93. The conclusion of the modernization process of Brazilian ports will be done with the utilization of the developed cargo control tool and when it will be working in almost Brazilians ports.

Key words: Cargo control system, Internet, portuary systems

1. Background

The Port Authority of the state of São Paulo (Companhia Docas do Estado de São Paulo – CODESP) operates Santos, the largest Brazilian port. At the beginning of the last decade, seeking to improve its operational controls, it developed an anti-fraud system for control of scales for weighing merchandise. In so doing, it established a partnership with the Polytechnic School of the University of São Paulo (Escola Politécnica da Universidade de São Paulo) that continues to this day. The work grew to include the development of administrative, financial and operational control systems. Beginning in May 2000, it became the responsible entity for developing a System of Inspection and Control of Tenant Contracts and a System of Cargo Control, which allowed the port authority to control the movement of cargo and embarkations through a system of electronic data interchange (EDI). This system, developed and implemented by CODESP starting in November 2002, involves data related to three documents: Request for Docking and Priority Status (Requisição de Atracação e Prioridade – RAP), Cargo Manifest (Bill of Lading), and unloading and shipping reports.

Therefore, beginning in 2000, CODESP, an entity linked to the federal government, and the Polytechnic School are implementing an electronic data interchange, allowing the Port of Santos to complete its modernization process, with a reduction in contracts with isonomy and justice between tenants and concessionaires, thus increasing the revenue of the port authority and financing its own process of modernization and technological innovation. There have been other noticeable effects, such as the improvement in customs collection, greater control over contraband of illegal merchandise, greater security in loading and unloading operations, and the possibility of adequate planning with a reduction in port operation time.
Meanwhile, in April 2000, the Ministry of Transport, through its Merchant Marine Department (Departamento de Marinha Mercante – DMM) developed a method to control collection of the Cargo Surcharge for the Renovation of the Merchant Marine (Adicional ao Frete para Renovação da Marinha Mercante – AFRMM) and to accompany the entry and exit of merchandise from the ports. The MERCHANT (MERCANTE) SYSTEM, begun in September 2001, was implemented in the ports of the South/Southeast regions of Brazil, culminating in the inauguration of the aforementioned controls in the ports of Recife, Salvador, Cabedelo, and Ilheus, in August of 2003.

The Agreement on Data Interchange and Integration with the System of Foreign Trade of the Secretariat of the Internal Revenue Service (Sistema de Comércio Exterior da Secretaria da Receita Federal – SISCOMEX) was signed in July 2002. At that time, the technical teams from the Ministry of Transport, the National Agency of Maritime Transport (Agência Nacional de Transportes Aquaviários – ANTAQ), and the Secretariat of the Internal Revenue Service of the Treasury Department increased their activities. They sought to integrate the systems, improving their databases and thus rationalizing their actions and streamlining the bureaucracy involved in ship movements, customs clearing for merchandise, payment of federal taxes, and effective controls for the freeing of merchandise in Brazilian foreign trade.

These efforts seek to minimize the risk of waste of public resources and to unify efforts to provide a national solution that allows for the integration of the port community through processes of standard data interchange, which streamline bureaucracy and speed the movement and clearance of ships and merchandise in Brazilian ports. Thus, SISPORTOS is being developed, which will integrate all of the existing systems of control and electronic data interchange, such as SUPERVIA, MERCANTE, SISCOMEX, and others. To this end, a cooperation agreement is being signed with the University of São Paulo, through the Polytechnic School - Department of Electrical Energy and Automation Engineering, with the goal of using the Electronic Data Superhighway (Supervia Eletrônica de Dados – SED) integrated with the Merchant System, and in turn integrated with SISCOMEX. This will allow the Ministry of Transport to provide integration and data interchange for different entities—both public and private—involved in port operations.

2. Methodology

This project’s methodology was to search for primary data in port management, port operators, and the public administration, and secondary data in a very updated bibliography on the port sector. Most notably, it considered the original research conducted by the group of Dutch companies linked to the port of Rotterdam, together with the Ministry of Transport, about the operations and management of movements of dangerous products along the Brazilian coast: “Feasibility Study For Emergency Response Plans and Environmental Protection Instruments for Brazil" (references).

The information, when transmitted by digital networks, allows great quantities of data to circulate with quality and precision. Don Tapscott, in the Digital Economy, underscores that the modern enterprise is the real-time enterprise, the one that is constantly adjusting itself to the market and making fast decisions. Goods are received from suppliers and products are sent to consumers just in time, greatly reducing or even eliminating storage time.

Tapscott also asserts that, in the digital world, information is organized and made available immediately as needed. By contrast, using physical and analogical mediums,
accuracy is lower and there is generally a greater volume of paper involved. In addition, errors are more frequent, which can result in high costs and loss of competitiveness. Without a doubt, affirms Tapscott, digital information, through computer networks, is able to knock down massive walls—geographic, economic, and cultural—as a result of advanced technological rationality.

In general, within all companies there is a certain resistance to change. Adopting information technology can be an arduous task; however, once installed, it is generally irreversible and the effort is worthwhile. Thereafter, a natural desire for innovation arises in the race for new competitive strategies garnered through technology.

The Electronic Superhighway allows the corporate pyramid to be gradually substituted by work teams interconnected by networks via the Internet. This model encourages flexibility, innovation, and responsibility among group members.

3. The evolution of productivity

The interface between governmental agencies, national and international transport agents, exporting or importing companies, transport companies of all kinds, and port institutions created by Law 8630/93, constitutes a system of unmistakable complexity, wherein the flow of documents is intense and an integral part of the processes of foreign trade and transport. Indisputably, the institutional model engendered by Law 8630 was a great step forward (Alban, pg. 55).

The modernization process begun by the so-called Port Law (cited above) has not yet been fully concluded, and the constant development of new technologies and frontiers for the improvement of productivity require that ports be constantly in top condition to meet the international requirements for quality, security, and information.

In 1995, when the law spawned a change in the national port paradigm, port operations were managed only by state companies, whereas nowadays they are predominantly private. In order to illustrate the gain in productivity during this period, we can cite the number of Temporary Port Workers (Trabalhadores Portuários Avulsos – TPA), which dropped from 61,797 men in 1995 to 32,869 in 2000, according to data from the Brazilian Navy and from the Labor Management Agencies (Órgãos Gestores de Mão de Obra – OGMO), Figure 1. The workers tend to be somewhat older, as demonstrated by the graph in Figure 2, and this fact suggests training and adaptation to the new operational characteristics.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Quantity</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>33,826</td>
<td>National Federation of Port Operators (Federação Nacional de Operadores Portuários – FENOP)</td>
</tr>
<tr>
<td>2000</td>
<td>32,869</td>
<td>Marinha/INSS</td>
</tr>
<tr>
<td>2002</td>
<td>31,615</td>
<td>FENOP</td>
</tr>
</tbody>
</table>

Figure 1 – Evolution of Temporary Port Workers
4. The System

The model implemented in the ports introduces a management system for electronic documentation, which was named Documentation Center (Centro de Documentação – CDOC). This system is implemented in the Port Authority, in the Santos, Rio de Janeiro, and Sepetiba ports and in the customs of the port of Vitória. It receives and distributes information to the other intervening agencies. The CDOC does not possess a database; rather, its role is that of a “postman”—that is, simply to receive and deliver documentation, validating its content, formatting, and distributing to each agency its due share of documentation, according to law.

5. ELECTRONIC DATA STANDARD

When it was created, SED researched various international models, especially those used in the principal European ports (Rotterdam, Antwerp, Hamburg, and Barcelona), and chose the EDI as the best alternative.

The EDI standard constitutes part of the general concept known as B2B, which, besides e-commerce, also encompasses information management routines. Among the main benefits of the EDI standard are the control of the flow of information, the reduced reaction time for partners, and the optimization of the organization itself.

Once this communication standard has been defined and adopted, small adaptations are necessary to retransmit the data related to the manifest (unloading and shipping), unloading and shipping reports, and control of ship movements.

The SED consists of the automation of receiving and treating data relating to the following documents:

Docking; Cargo manifest; shipping/unloading reports.

With the leasing of the dock areas and the areas behind them, new needs were established, because the contracts establish a series of obligations and rights for both sides. The Port Authority is responsible for the inspection of these contracts and the management of shared areas. The University of São Paulo developed the necessary technology to
optimize the needed resources for the development and execution of these new roles in projects that have been carried out.

This system provides, among other things, mechanisms for control, inspection, and monitoring of the contractual clauses that refer to the contracts of leasing for the area that should be rigorously fulfilled by the tenants. It also allows for the inspection of the flow of shipping and merchandise in the 2 (two) flows (imports and exports) that are the responsibility of the Port Operators.

The Information Management System will receive the data supplied by the SED, storing it in its own database, which will incorporate information to assist in the scheduling of ship docking, operational inspections, and verification of cargo quantities with the billing of port tariffs and the management of leasing contracts.

The above-mentioned information includes:

- Request for docking and undocking;
- Cargo manifest for shipping and unshipping;
- Application for internal transfer (within the same fiscal region);
- Gate In; Gate Out;
- Unloading;

6. Cargo Control System and the Electronic Data Superhighway (Supervia Eletrônica de Dados – SED)

The companies that comprise the port community submit information to the authorities in paper document form, which are collected and typed by the companies’ own employees in the respective information systems. The other official agencies involved in port operations, such as the maritime, police, health, and customs authorities, require similar information as that required by the port authorities. This implies a multiplicity of data—on paper—that are prepared and submitted, in distinct formats, but with similar content, as well as to the OGMOs. The use of information in paper format adds inefficiency to processes due to mistakes in multiple typing and loss of documents. The final result is that the processes are, in large part, slow, expensive, and subject to error.

The user-companies involved use information systems designed to meet the requirements of the international trade systems for cargo. Thus, the requirements for documents to provide data and formats specifically for various Brazilian national authorities are additional costs that reduce productivity.

The adoption of electronic data interchange systems similar to those used in other ports around the world, has always been a goal worth aspiring to for our ports. Nonetheless, this type of solution had restrictions due to the high costs involved in its implementation, which may reach tens of millions of dollars.

In addition, considering the need for multiple submission of the same information to various agencies involved in Santos port, USP (the University of São Paulo) adopted, in its development and implementation, the use of the Internet, which allows for electronic data interchange without the need to adopt specific data-communication infrastructures. SED was the resulting concept, which allowed for a single submission of information that meets the needs of various agencies. It is thus propitious for the direct and secure transfer of data among port user systems, including those of exporters and importers and of the authorities and agencies involved in its operation.

7. Customs

Customs control has as its focus the control of cargo, identifying the depositary and its location as well as its document status.
Since the implementation of Siscomex, Customs has been trying to instate the so-called Sicomex Portuário, which is being prepared by technical staff at the Internal Revenue Service that formed, along with the technical team from USP, the work team for the implementation of SED. Should this project be implemented, from the outset it will integrate the needs of the Port Authority with the other authorities and government agencies that comprise the Program for Harmonization of Government Agents at Ports (Programa de Harmonização dos Agentes Governamentais nos Portos – PROHAGE).

In our methodology developed for the SED project, the management of cargo movements was established, which should be based on prior knowledge of the merchandise that will be moved. This will be possible through the advance receipt of cargo declarations and, from this point on, the monitoring of movements, unloading, and delivery for importation, which will allow for the following comparative analyses:

-Cargo manifest X unloading report – Omissions and additions

   Report that compares the cargo manifest sent by the ship agents and their partners with an unloading report sent by the port operator.

Unloading report X cargo delivery

   Allows for the monitoring of the cargo inventory at the terminals, as well as to establish the closing of responsibility of the operator as a temporary depositary.

- Receipt and cargo delivery by the depositary

   Allows for the monitoring of depositaries’ cargo inventory.

- Request to open container X unloading X bill of lading

   The crossover of this information allows for the effective control of cargo, facilitating inspections, performed before opening containers, and the quantitative analysis of unloading information (furnished by the depositary) with the bill of lading information (furnished by the cargo agent). It should be emphasized that with an increase in consolidated cargo volume, this system allows for measures to control unloading, tracing the unfolding of relations between the Master bills of lading (issued by the ship-owners), the sub-Master bills of lading (issued by the consolidating agents), and the bills of lading Houses (issued by consolidated agents).

   This chain of developments can include up to eight levels. The lack of a computerized control for this verification procedure makes the entire process sluggish and difficult to manage.

   This system includes the following steps for implementation:

       Computerization of the Port Authority, Agencies, Cargo Dispatchers, Customs, and Users; use the Internet as a means of communication in order to transfer data without congestion and at a low cost; creation of a port server that allows for control of registration, storage, and interconnection among all users of computers and computerized systems—on land and at sea; Documentation Center; Creation of a standard format for files for commercial and financial documents based on the EDIFACT standard; utilize digital
certification in the transferal of data to guarantee confidentiality and authorship of documents transmitted and received by the systems. A centralized port information structure should be created for commercial purposes and should offer a broad spectrum of services to all users, in relation to data entry in the ports database, queries, transferal of data and whatever information related to maritime, aerial, and railroad transport is necessary—at both the national and the international level.

8. Benefits of Instating the Electronic Data Superhighway

The implementation of the SED in Santos brought, among others, the following benefits:

- **Optimization of docking cradles**
  The implementation of the RAP module, in April 2001, allowed for improved planning for the use of docking cradles, in addition to eliminating four paper documents that had to be submitted to Codesp: docking request, letter naming the port operator, request for infrastructure, and a list of dangerous merchandise.

- **Implementation of the Operational Inspection System**
  The Operational Inspection System (Sistema de Fiscalização Operacional) is based on information proceeding from docking, cargo manifest, and report to carry out the inspection procedures, allowing the teams to carry out their work in the best possible manner and considering the security and proper performance of port operations.

- **Control of dangerous cargo.**
  It is now obtained directly from the RAP and the cargo manifest, without the need to classify merchandise.

- **Increased speed in the process of closing and billing ships.**
  Now that information is sent electronically by port users, the billing management can carry out the billing of ships in a more efficient and precise manner, since the system now handles all the compilation of information and tariff pre-classification, allowing for improved analysis of data to be billed.

- **Increase in the company’s revenue.**
  In the first three months after the implementation, a tendency toward increase in the company’s revenue was observed, in addition to an increase in cargo movement.

- **Reduction in the quantity of billing disputes.**
  There was a real reduction of 25% in the quantity of disputes about bills issued by Codesp, due to the verification of volumes moved through electronic data.

- **Management information.**
  The implementation of the system has allowed for the monitoring in real time of cargo movements and of shipping, generating valuable information for decision-making.

The recent developments in the area of maritime transport, with the adoption of the International Ship and Port Facility Security (ISPS) Code, established by the International Maritime Organization (IMO) conference in December 2002, seeks to establish security procedures to be implemented by January 2005. This is an opportunity for the implementation of control system for national security, thus establishing a national model for port control.

The Brazilian port system, responsible for more than 95% of our foreign trade, currently handles about 500 million tons per year, a rate that will significantly increase in a short period of time due to the increasingly intense pressures that the global economy has been exerting on the balance of our foreign accounts.
In light of the volume that international trade of goods via maritime routes has reached, it is estimated that about 7% of the global cost of foreign trade operations, or about US$420 billion/year, are caused by bureaucratic procedures involving documents or the production of documents called “shipping doc”; and that these same procedures, in most cases, are directly responsible for the retention of merchandise for days, weeks, or even years at a port or terminal. Besides causing an imponderable increase in costs, these procedures can even render large business transactions unviable.

In the case of Brazil, we can cite a considerable number of container ships that operate in our ports and experience delays, generally due to procedural problems involving documents. The daily cost of one of these ships varies from US$20,000.00 to US$70,000.00, while, depending on the content, the value of its cargo may reach US$100,000,000.00.

In this context, as has been happening all over the world, the priority given to the implementation of integrated systems of electronic data sharing gains special importance. In the world’s largest and most modern ports, these systems have become powerful instruments to transform the status of ports from “Operational Barrier” to “Platform for Logistical Intersection of Markets and Agent of Economic Development and Foreign Trade.”

As such, ports, in line with Law 8630/93, are no longer just locations where cargo movements, storage, and transfer are carried out; they are an important component of the restructuring of the transport matrix, seeking to increase competitiveness of enterprises and their level of exportation.

9. Conclusions

While on the one hand, Brazil’s trade balance must not be restricted by the management and inspection capacities of the Internal Revenue Service and the Port Authorities, on the other hand, these cannot disavow their role as regulators and controllers of the flow of merchandise entering and leaving the country.

With the accelerating increase in cargo movements in Brazilian ports, the process of cargo control carried out by customs and port authorities require computerized systems that render the process automated, lending them the necessary reliability and transparency.

The system of cargo control that will be used must be capable of interacting in a dynamic way with the various intervening elements in the port process. Thus, they act as a platform for the integration of various links that form the chain of importation and exportation.

In this manner, information furnished by one link in the chain will be complemented by the next, rather than furnished anew. This process should occur through the EDI—electronic data interchange.

The new realities at ports will depend on the trade relationship with the rest of the world, on agreements and the form of communication among agents involved in the operations of merchandise movements, and on the requirements of consuming markets.

The systems of cargo control and electronic data interchange should meet the new global tendencies in foreign trade and security, attributing traceability to merchandise so that the sources of fraud, falsifications, and violations can be identified.
The importance of traceability can be illustrated by the recent Bioterrorism Act (BTA – 2002), published by the United States government in June 2002, which required that all food processing operations for foodstuffs to be exported to the United States—including storage—be registered. In the case of Brazil, there is the recent law prohibiting the planting and transport of transgenic soy in the state of Paraná.

This objective can be reached by the application of the methodology developed by SED, providing the cargo control system with the necessary information and integrating the Merchant Systems and Siscomex, as related in Figure 6 below:

Figure 6 – Integration Model SED – Merchant – Siscomex.

BIBLIOGRAPHY

[2] DPTA - Departamento de Programas de Transportes Aquaviários - Pesquisa junto aos OGMs de Transportes - Setembro de 2003 – Brasília
[10] Tapscott; Don - The Digital Economy


