INFORMATION SYSTEM LEVEL IN TURKISH PORTS AND THE DIRECTION OF IMPROVEMENT

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ABSTRACT

Due to the changing business environment in the global scale, the competition between container ports has become very severe in the last few decades. The ports started to invest in their infrastructure and information systems in order to increase their efficiency and to sustain their position as a hub of their region. On the other hand, Turkish ports fell behind in this competition of efficiency, and this situation is affecting the ports as well as the overall economy severely.

This paper aims to offer the direction of information systems in Turkish ports. For this purpose, the current information systems in Turkey’s public and private ports were examined by multiple case study methods, general problems were appointed and the direction of improvement was offered. According to the results, the low level of information technology utilization is not due to any technical incapability, but rather due to administrational deficiency, such as out-of-date business processes, severe bureaucracy and insufficient human resources.

Keywords: Turkish ports, information systems, improvement direction
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1. INTRODUCTION
In the world of globalization, various factors—such as increase in total international trade, the impetus of containerization, and the advent of ultra-large container vessels—enforced the seaports to a fierce competition to invest in port infrastructure in order to decrease service time, thus increase port’s overall efficiency. Recent developments in information technology have deeply affected almost every field of industry and ports are no exception. Since ports are places where various tasks must be carried on in harmony by various bodies, utilization of information technology is inevitable to coordinate and harmonize these activities, ranging from basic tasks like cargo handling to auxiliary tasks such as communication between port-related bodies, in order to increase operational efficiency.

On the other hand the level of information systems in Turkish ports is relatively low and inefficiency is affecting Turkish economy severely (Mersin Chamber of Commerce and Industry, 2003). Due to undeveloped transport infrastructure, international cargo routes between Europe and Asia is being shifted beyond the borders of Turkey (The Undersecretariat of the Prime Ministry for Foreign Trade, 2001). On the other hand, Turkey is holding negotiations with European Union, and – if the negotiations are successful- is expected to be a member of it within the next decade. This will certainly cause an increase in the amount of import and export cargo due to expected foreign investment drawn to the country, because of low land and labor costs compared to European countries. Moreover, the strategic value of Turkish ports, especially Mersin Port, will increase due to reconstruction of Iraq after the war and the port is competing with Tartus and Lazkiye ports of Syria. Therefore, low efficiency of Turkish ports will be a bottleneck for such improvements.

In this research, the level of information systems in Turkish ports was studied by multiple case study method. For this purpose survey studies were carried on Mersin Port (August, 2005), Kumport (August, 2006) and Izmir Port (December, 2006). During the survey, port officials were interviewed about the information systems used in their ports. The principle problems of these ports were seized by literature survey in addition to the results of these surveys. Finally based on the collected information and applications in other ports of the world, a direction of improvement for information systems in Turkish ports was suggested.

2. PUBLIC PORTS
Having a coastline of 8333km, more than 60% of Turkey’s export takes place by maritime transport (Yucel, 1997), which makes the seaports very important for Turkish economy. Major general-purpose ports in Turkey are operated by Turkish State Railways (abb. as TCDD) and Turkish Maritime Organization (abb. as TDI). Among these ports, Izmir, Mersin, Haydarpasa and Iskenderun ports are the ones with greatest cargo throughput, all of which are operated by TCDD.
2.1 Background of Information System Development

TCDD ports started to build container terminals in 1985. Among these, Mersin, Haydarpasa and Izmir Ports were the ones with busiest container traffic. Increased traffic in these ports caused congestion due to Turkish custom regime that is not flexible enough to develop regulations to easy such transport and the lack of sufficient control of the port operations with computerized systems. For this reason, Ports Branch and Data Processing Branch of TCDD prepared “TCDD Port Services Telecommunication Project”, abbreviated as DELIMTEL, in order to supply computer support to container terminals of Mersin, Haydarpasa and Izmir Ports. The analysis tasks were started in August of 1990. It covered a wide range of purposes, including analysing container terminal activities and needs, developing a management information system for a selected pilot port and implementing the system to other ports. The project was estimated to be finished by the second half of 1992.

Meanwhile European Union (EU) carried out a project called MEDITEL, in order to develop a computer application program to ease the services the ports that face Mediterranean Sea and to form an information network that enables information transfer about ship and cargo traffic between these ports by implementing the software package called ESCALE which was developed by Port of Marseille Authority. TCDD declared to be involved in this project in 1991 and Haydarpasa Port was offered as the pilot port. According to the agreements, EU would finance the cost for software, and $70,000 of the hardware cost would be compensated by Port of Marseille Authority. On the other hand the modifications to be made on ESCALE package in order to fit the differences in management technique and infrastructure couldn’t be finished on time by the French officials. Instead, the second ESCALE package was offered because of being better for problem handling. But even the second package couldn’t fit the existing system. Negotiations with French officials and EU did not end in any result, and the project was clogged. So, in August of 1995, the technical committee declared to EU officials that developing a new application program for this port would be more suitable.

Meanwhile, another project was being developed by using C programming language under UNIX operating system, in 1995. This program was activated in Izmir Port after testing phase. But because of the problems about real-time operation of this application program with manually offered services, usage of this program was cancelled in 1999.

Finally a technical committee was formed within TCDD in order to compose required technical specifications for effective terminal and port management in the beginning of 2000’s. This project was also canceled in the beginning of 2005 due to the decision of High Council of Privatization Administration that all services except transfer of ownership in all TCDD ports except Haydarpasa Port, would be privatized.1

2.2 Current Situation

In order to seize the current situation of the ports, survey studies were carried out in August 2005 in Mersin Port and December 2006 in Izmir Port, targeting port officials who are responsible for information systems. In 1999, TCDD project group added “fare services”,

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1 Directly obtained from TCDD Headquarters on the basis of Freedom of Information Act Law.
which was missing in the original project, to the application program of DELIMTEL and MEDITEL Projects and finished the new program called “Computerized Tracking of Port Operations Project”. A web-based program called WinPort, programmed using Visual Basic programming language is being used to control port operations. The program includes functional parts for operation tracking, billing, reporting, container and operations lists, and gate operations. The program performs basic database functions to organize operations and reports, but most of the basic operations are still carried out on paper. Even the system has some merits such as receiving service requests from customers through web, essential terminal operation tasks –such as planning– are not supported. Operations in the terminal area are recorded on paper and that inputted to the computer manually. On the other hand, due to bureaucratic problems, official documentation cannot be replaced by computer outputs, thus the effect of the information systems cannot be fully reflected to the speed of the operations.

Based on this survey, the problems of information systems of the public ports can be summarized as follows:

- Planning and tracking of terminal operations are carried on manually.
- Operations are recorded on paper manually and inputted to the system later. Thus the operations within the port cannot be monitored on real-time basis.
- Yard management module is not included to the system. The main reason for this is that the yard itself is not well-organized physically, which makes it impossible to be controlled by a computerized system.
- As a result of lack of yard management, allocation of containers within the yard can consume a lot of time.
- There isn’t a portal site for the ports that inform the users about up-to-date information about the ports.

### 2.3 General Problems

Turkish public ports suffer from severe administrative and structural problems. Administrative problems include:

- Port management couldn’t be converted to an autonomous port authority system, so it suffers severe bureaucratic and regulative inefficiency. Port management must be flexible enough to deal with severe competition in the region, to meet the market demands and to be able to manage the port activities with low cost and high service standards. But such requirements are not likely to be realized by the current public administration (Lokmanoglu, 2003). Free Trade Zone in Mersin Region is a good example that same workers in the same port area are working more efficiently, due to the autonomous management.

- Since these ports are operated by government organs, port revenues are used for supporting other public services such as railroad expenses (Yucel, 1997), thus capital needed for port infrastructure investments is distributed over those services. As a result of this, required projects for infrastructure cannot be finished as predicted.

- Port services are expensive. Turkish ports are indicated as the most expensive ports among the North Europe and Mediterranean ports and this situation is affecting international competitiveness of the ports (Undersecretariat, 2001).
Since most of the tasks are carried out by paper-based manual methods, speed of port and custom services fall behind the commercial activities. (Yucel, 1997)

Information flow and coordination between port-related parties are inefficient.

The public ports suffer from insufficient human resources. The managers lack modern business management knowledge and trained operational staff, such as crane operators, is scarce. (Yucel, 1997, Gulenc, 2004)

Other administrational problems cover issues related to insufficient advertising and marketing of the ports, unregistered port land, and insurance policy that does not cover damages given to ships and cargo. (Yucel, 1997, Gulenc, 2004)

Structural problems of the TCDD ports include:

- Physical resources of the ports are insufficient, such as quays and wharves, lengths and drafts, equipments and vehicles that serve the hinterland, stacking and storage places and vehicle parking lots. (Yucel, 1997, Undersecretariat, 2001, Gulenc, 2004)
- Provided that private ports in Turkey do not have railway connection, 95% of the cargo handled in the ports is transferred by trucks, indicating that connection of railway and ports couldn’t be realized for inter-modal combined transport. (Undersecretariat, 2001).
- Other structural problems about railway transport –such as lack of easy access cargo tracking system and container land terminals, etc- are affecting Turkey’s international competitiveness and the cargo route between Europe and Asia is being shifted beyond the borders of Turkey. (Undersecretariat, 2001).
- Old equipments frequently break down. Maintenance and repair of the equipment cannot be handled in an efficient way because of bureaucratic problems. On the other hand, cranes also break down due to overloading (Gulenc, 2004).
- Traffic within the ports is not well-regulated and frequently congests. This is due to insufficient sign tables, lack of control, and uncontrolled and irregular usage of yard area (Gulenc, 2004).

3. PRIVATE PORTS

Obviously, private ports are in a better situation than the public ports in terms of information system, since the managements of private ports are able to move autonomously without tackling bureaucracy and develop their own strategies for port operations. Among them, Kumport is acknowledged as the most high-tech container terminal (Ekonomi) and thus awarded by a “Golden Anchor” for being the most efficient port in Turkey (Deniz Haber, Dunya Dergisi). For this reason the information systems in Kumport was studied as a best-in-class case and a survey study was also carried in August 2006 in order to seize the information systems. The basic characteristics of other private ports are also mentioned briefly throughout this paper.

3.1 Background of Information Systems:

All of the private ports in Turkey deployed package terminal operating systems, whereas Kumport perefered to develop its own operating system. System development process in Kumport, which can be divided into three phases, dates back to 1999. Those days Kumport was a small, general cargo based port whose annual container throughput couldn’t exceed 10,000 TEU’s. In those days port managers decided to sell the port and the main purpose of information system development was to
increase the price. As a part of such a strategy, system development efforts were not based on a systematic research, planning or design, since the port managers did not intend to use the system at all. In the second phase, failing to sell the port, the managers changed the strategy, and decided to run the port in a more efficient way. Due to the improvements in industrial and economic activity in Ambarli Port Complex, container throughput increased drastically, making it impossible to deal without computerized systems. Naturally, the system developed in the first phase couldn’t fit the new requirements of the port, so several modules and functionalities were just added on the demand of the customers, without any distinct prior planning. But ironically, port’s situation and environment were also changing simultaneously and the developments in the system always followed the improvements in the industry and the port itself. New yard management system development efforts started in 2002 and the system was implemented in the middle of 2003. Kumport had its own system coded by a domestic company called Solon. Starting from 2006, Kumport is undergoing a system renewal project, which is supposed to continue for 2 years. Since all the source codes and documentation about the current system is possessed by the developer company, the port management is not able to configure the system when necessary. Especially when there is a failure in the system, the port depends on service of the developer company, which may not be feasible when needed. This time Kumport is developing its own system in order to possess the source codes. For this project, the port management has formed a project team of eight people, who are experienced about the subject. Unlike the previous projects, the new process is planned prior to development. In order to guarantee the success of the system, everything is carried out more scientifically and more professionally, including requirement analyses, design phases, required planning and process re-engineering. Besides, all efforts are documented systematically for future use. By doing so, Kumport will hold the advantage of having an information system that both fits exactly the requirements of the port and enables the port to revise and modify it whenever necessary.

Unlike Kumport, the other ports in Turkey preferred to deploy package programs, such as Navis, Cosmos, etc. Unfortunately all pf these programs are developed by foreign companies and are not compatible with the administrational requirements of Turkish government. For example package programs like Navis regulate the movement and allocation of containers, thus container is treated as the unit item and defined by its number and other properties (i.e. 20 ft, 40ft, reefer, dangerous cargo etc.). On the other hand, Turkish Customs Law requires that the port management must keep track of the list of the commodities in a container and their properties. Thus the ports needed some workaround programs to fill such deficits, after all increasing the cost and decreasing the overall efficiency of the system.

3.2 Current System:
When the information system in Kumport is examined, it can be seen that although it is the best case in Turkey, the system still depends on human intervention in its most basic functions (Keceli, 2007). Kumport’s port management system consists of several application programs which are connected to a central database. Although shipping companies can input their requests and cargo information directly through a dedicated line using Solon Acenta program, most of the firms prefer to send their information via e-mail or fax. These requests are manually inputted to the system, and based on these data yard planning is also done by the staff semi-automatically where the system assists the staff to determine the positions of the containers in the yard. If the containers are to be exported, the bayplan which is obtained from the ship captain is also entered the system manually. Since the whole yard area is covered by wireless network, all equipment operators and staff can access the system to
receive job instructions and to report the completion of the job through touchpad screens or hand-held terminals. Touchpad screen are mounted to the every quay crane, yard crane (RTG), stacker, forklift and other transport vehicles within the terminal and hand terminals are used by pointers within the quay area and controllers in front of the gate. At the gate, gate clerk enters the vehicle number into the computer using and if the information about the truck and the cargo appears in the screen, the driver is given a paper slip which a serial number and vehicle plate number (in barcode form), container number, position in the yard, and the details about the shipping company and the container condition (container type, damage, etc.) and on the leave the gate clerk takes back the slip and scans the barcode, and the gate-out process is automatically proceeded by the computer. On the other hand, various bureaucratic requirements related to customs and customs enforcement, which cannot be proceeded by the port management itself, must be fulfilled manually prior to leaving the gate. As the system produces job instructions for every operator within the yard area through these terminals, every operation in the terminal can be traced real-time by the port management. The system also provides several management functions, such as container tracking in the yard, monitoring the current situation of all the tasks in the terminal area, completion rates of loading and unloading tasks, automatic service assessment and billing, and reporting. Every realized service throughout the day is reported to the customers next morning until 10 am via e-mail. The firms are allowed –in fact recommended- to deploy this program in order to track the current situation of their containers on a real-time basis, but only a few of them actually do so.

Starting from 2006, Kumport is holding a project that will continue for about two years to renew the existing information systems and strengthen some weak points of the current system, such as optimization, planning and internet-based customer relationship management (CRM). The port management targets at least two million TEU’s by the year 2010, so the renewal of the information systems will be accompanied by a series of structural improvements. These structural improvements include replacement of quay cranes by SSG cranes, filling the sea for new stacking area, and construction of a viaduct to connect the two custom zones. The yard operations will be based on RTG’s and RMG’s, making the stackers out of concept.

Since other private ports deployed package programs, detailed specifications of their systems are not included in this study.

3.3 Problems:
Although information system usage in private ports is higher than public ports, they are still exposed to several problems. For example none of the private ports in Turkey have railroad connection. (Yucel, 1997). And the port managers are not allowed to access the EDI system of the customs, thus confirmation of customs declarations and actual cargo status must be done manually.

The ports that deployed package programs were faced with the problem that the modules and functions of their system couldn’t fulfill the requirements of governmental offices, such as customs. So they had to supplement their systems with workaround programs, which decrease efficiency and increase cost. In the case of Kumport, the information systems are developed in-house and totally compatible with the legal requirements of Turkish government agencies. But some basic functions such as yard planning, bay planning and
inputting customer requests to the system are not automated and still depends on human intervention. In the near future Kumport is planning to make up for these weak points.

Since ports like Arkas operate for the cargo of its own shipping company, they don’t have any problem on customer relations or information exchange. But for port’s like Kumport experienced severe difficulty to make its customers understand the system and cooperate efficiently. Only big and international agencies accepted to use the system, but small and local agencies refused to use and continued to send their requests via e-mail or fax (Keceli, 2007). Not only the customers but also the workers of the port resisted the system at the beginning, even cutting the wires and vandalizing the equipment. The port management had to deal with these internal and external resistances with enforcement, incentives and education.

Since port management information systems are not studied as a special subject, hiring specialists who are educated and experienced on the subject is a big issue. It is stated as critical success factor for information system development in Kumport (Keceli, 2007). For other ports, insufficient know-how to develop in-house and lack of trust to “table and chair” local IT firms in Turkey leaded them to deploy package programs. This case incompatibility of foreign package programs arose as another issue, and it was tried to solve by workaround programs. Absence of experienced developers and academic research to lead the port managers and establish cooperation between the members of the whole port community still remains an issue to be solved.

4. DISCUSSION AND DIRECTION OF DEVELOPMENT

4.1 Information Systems
In Keceli et al. (2006), it was shown that information systems can be a solution for most of the administrative and structural problems of Turkish public ports. Mainly contribution of information systems to administrational problems includes decreasing costs, enhancement of business processes, enable real-time information exchange, provide paperless work environment, making the tasks more human independent, and increasing the ports’ competitive force. Besides information systems can decrease the effects of structural insufficiencies by enabling more efficient utilization of existing resources, optimizing work instruction and online control of equipment maintenance and repair to avoid overloads and malfunction, optimizing yard allocation, regulating traffic within the yard, enabling on-line cargo tracking and information exchange between different transport modes. On the basis of these contributions, the minimum level of information systems for Turkish ports should include:

1. Terminal Operating System (TOS) :
   ● planning
   ● yard allocation for containers
   ● job dispatching for equipment and operators
   ● work load optimization
   ● equipment M&R
2. Port Management Information System (PMIS):
   - paperless work environment
   - real-time monitoring and control of operations
   - better marketing through increased competitiveness

3. Port Community System (PCS):
   - real-time information exchange
   - coordination between transport modes (Keceli et al., 2006)

As referred in the previous chapters, the current systems used in Turkish public and private ports have some of these functions, such as job dispatching to cranes and stackers, semi-automatic yard allocation and real-time monitoring; they still suffer from automated planning, automated yard optimization, paperless work environment and real-time information exchange among the members of the port community, especially between different transport modes.

4.2 Regulative and administrational system

In the study of Lee-Partridge (2000), it is stated that the success of information systems in Port of Singapore depended on entrepreneurship of the government. Unfortunately Turkish government is pretty far from being such as “developmental state” and Turkish maritime industry is suffering from severe bureaucratic inefficiencies and multiple-governance (Yucel, 1997, Lokmanoglu 2003 etc.). The port management has legal responsibilities to Customs, Customs Enforcement, Ministry of Finance, Directorate of National Estates, Undersecretariat for Maritime Affairs, and Regional Directorate for Undersecretariat for Maritime Affairs of that city. All these government organs require different conditions to be fulfilled and the multiplicity of regulatory organizations cause time delays and operational inefficiency. Thus there is a lot of literature about necessity of establishing a ministry maritime affairs and unification of all maritime regulation activities under the roof of this ministry (Yucel, 1997, Cubukcu, 1998 etc.). Some of these regulatory bodies and the relations between the port management and them are peculiar to Turkey, so the information systems package programs that are provided by foreign companies –such as Navis, Cosmos, etc.– do not contain modules or functions for such local conditions and legal requirements that exist only in Turkey, as explained above. Thus standardization of information systems for Turkish ports and improvement of administrative system to decrease the level of bureaucracy plays a crucial role for the success of the future information system development projects.

As an example to such bureaucratic problems, the port managements are not allowed to access EDI system of the Customs Office. The agencies submit their customs declarations to the port management and the Customs Office separately, thus duplication of data may cause inconsistencies and increase the rate of error. Among these ports, the management of Kumport is planning to overcome this problem by cooperating with the agencies in order to retrieve custom declaration information from the agencies on an online basis. Such solutions can comfort the port managers to decrease error rates, but for the long term process innovation is necessary.
4.3. Resistance to the system:
When a new system is introduced, it may not be accepted by its users easily even it yields certain benefits. These users may be interior and exterior to the port, but resistance to change is same.

As internal users of the system, laborers and employees of the port can refuse to use the system for a couple of reasons. During our survey in Kumport, we found out that the resistance of the employees can reach such a level that they can even attempt to cut the wires and vandalize the equipment. The reasons for the resistance of the employees cover low education level and not being computer oriented, fear for losing their jobs, being unable to predict the benefits of the system to their tasks and prevention of some illegitimate activities of the employees, such as bribing the truck drivers, by the deployment of the new system. On the other hand the response of the customers, which are the external users of the system, may be diverse. The big and international agents may appreciate the system, since they are experienced and realize the benefits of the system to their businesses. But in the case of small and local agents, besides lack of experience and understanding of the convenience brought by the system and resistance to change the way of business they are used to, they may also consider it as an extra workload that is passed from the port to themselves.

In order to solve the resistance to the system, education and training is the basic solution. As applied in Kumport, training programs and enforcement of the port management managed to break the resistance of the workers, and now the employees are so used to the system that they cannot work without it (Keceli, 2007). On the other hand in the case of customers, Kumport couldn’t break the resistance even with enforcement and incentives, since the customers still insist to send their requests via fax or e-mail. For the near future, Kumport is planning to overcome this problem by a web based solution, which is used by Izmir and Mersin ports. Also, the port managers are planning the force the customers to some extent by adding the usage of information systems to their terms of contract with the shipping agencies. Time will show whether this will have a positive effect on customer reaction.

4.4 Research Centers and Academia
An information system for a Turkish port would either be developed within the port itself or it would be outsourced from somewhere else, but it seems that other Turkish ports couldn’t succeed both of them. When they tried to deploy a package program, which is developed by a foreign company, it didn’t match the legal requirements, because most of these are unique to Turkey. In order to fill the gaps between the system and the requirements, other supplementary programs were developed, increasing the cost and decreasing the efficiency. On the other hand, none of these ports had sufficient human resources to develop the system by themselves. Another option was to outsource the system from a domestic IT company. But the port management couldn’t trust “table and chair” IT firms, whether they could provide enough service, since the operations in the port may cease because of a possible failure in the system. Moreover, there is not enough academic research on this subject to guide the industrial organizations.

It is a fact that none of the Turkish ports managed to succeed with the system at the first trial; rather the current systems were developed by the end of a series of failures. Since none of the
related parties, i.e. government, port management, shipping and logistics industrial organizations, IT firms and academic units, do not have adequate expert knowledge and experience on this subject, development and standardization of information systems for Turkish ports must be put into practice as a collective effort of the whole port community.

5. CONCLUSION AND FUTURE RESEARCH
In this paper, results of our survey studies in Mersin, Kumport and Izmir ports were presented in order to seize the current situation of utilization of information systems in Turkey’s major container ports and several directions of improvements were suggested. According to the results, utilization of information systems is rapidly gaining ground in Turkish ports but the levels of the systems are still below the international standards. Moreover, the essence of the problems in front of the information systems in Turkish ports appears to be administrative, rather than technical or economical. For this reason improvement and simplification of regulative system of the state, standardization of information system specifications for Turkish ports and establishing the understanding of the members of the port community is essential for the future development of information systems for Turkish ports.

Among these ports, Kumport clearly represents a best example of successful deployment of information systems, where it is self-developed and totally in accordance with the legal requirements of Turkish government. On the other hand, Kumport’s system still depends on human intervention in some basic functions, such as planning and inputting customer requests. The other private ports preferred to deploy package programs, but faced some problems since those programs are not compatible with local legal requirements. The program used in public ports, i.e. Izmir and Mersin ports have the function of accepting customer request via web, but the system does not run on real-time environment, the tasks are recorded on paper and than inputted to the computer afterwards.

Information system development for Turkish ports is a rich in content field for future research. For example the current situation of all public and private ports should be reviewed and classified, and the factors that caused previous failures should be detected. Thus the similarities between them can be discovered and a base for information systems “standards” can be established. On the other hand government’s policy and the legal requirements imposed on the ports should be reviewed and an improvement plan should be proposed. Finally, a survey research targeting other port community members can be conducted in order to seize their doubts, perceptions and expectations about the information systems, thus these results can be reflected to system design.

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