AI PORT INITIATIVES

- POSSIBLE MODERNIZATION OF PORT OPERATION AND MANAGEMENT THROUGH CUTTING EDGE ICTs –

by

Kenji Ono[1], Masayuki Tanemura[2]* and Y*asuhiro Akakura[3]

1. INTRODUCTION

This paper highlights and discusses possible application of modern information and communication technology (ICT) such as the internet of things (IoT), big data and artificial intelligence (AI) to the container port operation and management. Particular focus is placed on an importance of creating a port big data based on the daily port operations for fostering an AI as artificial terminal manager. Difficulties of port authorities and business community to invite the AI into daily port management, operation and business due to the long continued operation manner and business practices also need to be addressed.

Port productivity may be one of the key issues for the global container terminal operators, which are competing each other for surviving in the global and regional container trade market. This is more and more accelerated by reflecting recent changes in business environment at ports, which are strongly requested to be more efficient logistics service provider among the global supply chain networks. There is no doubt that the modern world economy fully depends on the global production network and sophisticated supply chain management. Nowadays, materials, parts and components for automotive assembly lines, for example, are gathered across oceans in a regular basis, hence ports, as essential connecting nodes of waterborne and land transportation networks, are one of key players of global production activities.

In this context, commitment to the extremely sophisticated but complicated and fragile supply chain management requires port community more time and cost consciousness, resulting in introduction of recent cutting-edge information and communication technology (ICT) for improving port operation efficiency and productivity. The global port operators are now facing the client's strong requests to provide more quality logistics services with less port charges.

2. APPLICATION OF THE CUTTING-EDGE ICTS TO PORT OPERATION

In 2011, the government of Germany launched a new ICT policy, namely Industry 4.0, which aims at introducing automation and data exchange in manufacturing technologies. It focuses on digitization and interconnection of industries, value chains and business models, which are likely based on the recent development of ICTs including cyber-physical systems, the Internet of things (IoT), cloud computing and cognitive computing. An artificial intelligence (AI) based on deep learning programing, accurate sensor technology and big data is also rapidly attracting a big attention of the world business community. In line with these recent trends, global port community is going to step in the more ICT based and client oriented port operation and management.

An example may be the smart-PORT logistics (SPL) concept initiated by the port of Hamburg, Germany, which includes ICT based traffic management system and real time information on traffic and port infrastructure along with the demand-oriented networking via a central public cloud. While the services

[1] Executive vice president, Kobe-Osaka International Port Corporation, k-ono@hanshinport.co.jp
[2] Senior coordination officer for international affairs, Ports and Harbor Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan
[3] Head, Port Systems Division, National Institute of Land and Infrastructure Management, MLIT

have been just started after several years pilot phase, the SPL may be thought to pave the way of dramatically changing the future port operation scene.

Considering the above mentioned global trend of creating more smart and competitive port management, the government of Japan has just decided to launch, as a part of its recent port policy reforms, a new ICT based port operation concept, namely “AI port initiatives”, for improving port operation productivity and port traffic traceability through employing AI for port terminal operation system configuration. The new terminal system is expected to enable AI independently to operate container yard cranes for minimizing machine movement and energy consumption. AI controlled terminal operation system is also expected to manage container dray traffic at port for realizing quick container check-in and delivery.

3. ADVANTAGES AND CHALLENGES

Introducing AI into container terminal operations is expected to enable port terminal operators to: i) collect, process and store a bulky digitalized data without no terminal staff intervention from daily terminal operations on 24 hours and 365 day per year basis, ii) provide terminal planners with an indicative optimum solution and best practices including best stowage and yard plans for assisting prompt decision making based on the past experiences and real time data, and iii) quickly control and process container cargo traffic by fully automatizing container yard and gate operations.

Major challenges however may include: i) smooth introduction of the newest sensor technologies for efficiently and effectively collecting all terminal operation related data and information as digitalized form, ii) materializing an accurate big data transmission between on-site sensors and the terminal control host computer through IoT channels, iii) developing man-machine interface for assisting operator’s prompt decision making, iv) renovating current terminal operating system by employing AI based architecture, and v) securing appropriate countermeasures against computer virus and hacking. A variety of deep learning software is currently available including many open software. Mobilizing these existing software resources may save the project time and cost, and enable us to invest more human and financial resources for developing AI loaded terminal operation system. Most advanced sensor technology such as image processing techniques also may contribute, as eyes of AI, to the system development.

4. FURTHER ISSUES

The ICT based management and operation system may provide us with an attractive solution to dramatically increase port efficiency and competitiveness, to contribute to the global logistics innovation, and to improve business profitability and working environment at ports. At the same time, however, we must carefully consider and discuss the best course to invite AI into our ports as a good partner. The port community are not always welcome to build a robot port. What needed in a practical viewpoint may be how to create a well-designed human-AI collaborative system for realizing further smart port operation and management under AI support. AI controlled terminal may be a common business interest of the port community and also a common challenge, therefore this agenda must be discussed globally.

5. CONCLUSION

This paper invites an attention of conference attendees to the recently developed cutting-edge ICTs in the context of possible application to the port operation and management. Actually some of global ports have already initiated innovating their port operations and management by mobilizing most recent IC technologies such as AI, IoT and big data, therefore, starting discussion about this emerging agenda and sharing data and information among PIANC member community will surely benefit not only the conference attendees but also the whole global port community as well.