

Chapter 2

Literature Review

In order to find out critical factors for berth productivity in container terminals, we have collected and analyzed many related literatures. After we have found related papers which help to guide our understanding of concept of productivity, a few papers are selected for reference to define productivity factors.

First on the aspect of research method using model, we can find in many literatures that simulation model have been widely used. There are a few literatures using analytical modeling technique to analyze the factors that affect port productivity in container terminals. Nam Kyu Park et al. try to find the relationship and order of critical factors for berth productivity, which is dependent upon the capability, quantity of quay crane, transfer vehicle, and so on. Furthermore, he tested sensitive analysis to evaluate the extent of berth productivity by changing independent variable. And then he established the regression model to evaluate which factor has had the biggest impact on productivity.

Manuel Acosta et al. aim to analyze the factors that affect port competitiveness in case of the port of Algeciras Bay (PAB). It is essential to understand the perspective of the suppliers of port services, in order to apply the necessary judgment when formulating policies to strengthen the competitive position of a port. The model selected to meet the objective outlined is based on the 'extended diamond' of porter. The universe for the study comprises all the institutions and companies involved in the containerization process in the port of Algeciras Bay. First, within this methodology, two procedures are utilized from the quantitative perspective. A survey has been conducted to obtain responses to two groups of questions, one dealing with situation and the other with perceptions. Second, from a qualitative perspective, several open interviews have been conducted to corroborate the responses obtained to the questionnaire. From the data which are obtained in the survey, model has been estimated that minimizes the sum of the residuals in absolute value, utilizing the L1 regression; the model enables the competitive advantages and disadvantages of the PAB, from the point of view of the port operators, to be determined by an analysis of residuals. This analysis demonstrates that the variables representing greater competitive advantages are associated with

transshipment, and with the maritime accessibility of the port to vessels, whereas those generating greater disadvantages are associated with rail transport which according to those surveyed, has resulted in the diversion of significant volumes of traffic to other Spanish or European ports with better communications, particularly Valencia, Barcelona and Gioia-Tauro, and with the state of competition in container trans-shipment activities. According to their research, we can see among the variables that infrastructure, superstructure, technology and communications systems, internal competition, and cooperation of the institutions and companies are the most contributed to the competitive advantage of the port. Nam-Kyu Park et al. aim at finding out the factors to enhance the productivity of container handling of quay crane, using simulation technique and statistical technique, three levels of decision making in terminal operation, strategy, and tactics and operation are selected for defining parameters of simulation. The result of the simulation and test shows that the significant factors to improve the productivity are the stack height of container, block dispersion and the distance in yard planning for shipment. Decision making in the operation level, however, is of significance in the mixed condition of strategic and tactical level. For this paper, ARENA, 4th version Kelton et al. is used to simulate. The reason for utilizing this simulation package is that it has some strong points for modeling the process such as ship arrival and queuing, container crane and yard tractor service pattern, etc. The scopes of the simulation include only container shipment handling on the yard and vessel. If the simulation starts, the simulated transfer crane works for container handling in the yard and waits until next job. As next job, the waiting yard truck receives the shipment and transports it to container crane. Last, container crane handles the shipment for loading on the vessel. To design the simulation model, the entity and its attributes are to be defined. As the entities for simulation, transfer crane, container crane and yard truck are chosen. Both of the processing distribution of container crane and transfer crane are normal distribution with least square error. The processing time of transfer crane and container crane and the velocity of yard truck will be used for simulation. Finally, the study finds out the main factors to improve problem. The results of the simulation and test shows that significant factors in productivity were the stacking height of container block dispersion and distance in yard planning for loading. As literatures using analytical modeling technique to improve the productivity and efficiency of container terminal, we will review Kim and colleague's researches. Kim et al. tried to solve the total travel time of straddle carrier to improve the productivity of container terminal. The authors tried to solve the routing problem by using integer programming technique. In addition, an efficient optimizing algorithm was also developed for solving routing problem of straddle carrier. Kim et al. suggested a decision container terminal support system to improve the efficient operation of port container terminal to enhance productivity.

Ceres Paragon Terminals claims that they are operating the fastest container terminal in the world. It will be the first marine terminal to integrate the systems provided by Navis with image acquisition portals, weigh-in-motion scales, closed-circuit television for security and gate control, remain-in-truck data entry by

truck drivers, container/yard equipment positioning through satellite Global Positioning Systems (GPS), and advanced crane control systems.

Bin Liu explores China container port throughput correlated to the economic factors such as the GDP, foreign trade volume, fixed assets investment, interest rate and the exchange rate. The correlation analysis is conducted by the means of the double-log linear regression model with the help of the SPSS software based on the past 16 years data accumulated from the indexes. The research shows that China's container port throughput has a positive correlation with foreign trade volume and port fixed assets investment, negative correlation with GDP and interest rate. The result contradicts the international prevailing theory which is widely held among the port authorities.

Yun Cai et al. build a simulation and optimization model for minimizing the total stay time of ships, the paper builds a simulation and optimization model for minimizing the total stay time of ships, which aims at the problem of berth and quay crane scheduling. The simulation and optimization method creates and evaluates berth allocation schemes by genetic algorithms, obtains feasible solutions meeting berth restriction and quay crane scheduling strategy by simulation model, and achieves a good solution including berthing times, berthing positions and the number of quay cranes allocated to ships. The speediness and validity of the method is illustrated by an instance. By this way berth productivity can be enhanced.

Arie Sachish, has implemented in Israeli ports between 1966 and 1990, about cargo handling in ports. Research was undertaken with the goal of developing productivity functions that explain the changes in the productivity in Israeli ports by means of changes in various explanatory factors. A linear programming model is generated for developing productivity functions with an objective function of minimum deviations between calculated and actual productivity. The changes of volume, labour, capital, technology, management, and externalities had a great impact on productivity and on the effect of explanatory factors. The analysis of the relationship between the explanatory factors and actual productivity gives importance to the better understanding of organizational impact on productivity. This understanding can be used as a management tool through which a decision making process may be developed to arrive at decision on steps for raising productivity.

And on comparative analysis, we can find in many literatures that the authors take advantage of comparative analysis to research on port productivity. Peng Chuan-Sheng this paper through collecting china and foreign mega-container terminal statistical data, aims to analyze container terminal productivity. Firstly, the author define the concept of container terminal productivity, which has relationship between the port production output and input, and presents container terminal productivity depends on container terminal establishment, equipment, capacity of workers, work efficiency, and tactics of organization. Moreover, the author presents the indexes of scaling container terminal productivity which are efficiency of length of berth utilizing, efficiency of quay crane utilizing, and efficiency of container yard utilizing. At last, the author compares the indexes of China container terminal productivity with foreign mega-container terminal, and then indicates the developing potential and direction of China container terminal. Yang Chen, the paper in

the context of concerning Asia and Europe with respect to container terminal operations, introduced the advanced production technology and its application. And author summarized some of the trends observed within this field. Because of China modern container terminals which have the limited resources e.g. area and facilities, the authors present that China modern container terminal should take advantage of the high-tech means, for instances, information technology, bigger-facilities, and automatic technology and facilities to enhance the container terminal productivity.

Besides, there are wide ranges of papers devoted to different aspects of productivity in container terminals. Mu Gu the author presents that nowadays because of productivity were not been improved and many carriers departed from the port which result in a sharply fall in throughput, for the propose of enhancing the port productivity and throughput, Singapore port takes several measures: making use of the advantaged geographic location, Singapore port enhances the management. For avoiding phenomenon of containers jam, Singapore port have expanded foundational establishment, added the deep water berth, enhanced the efficiency of loading and unloading, and also reduced turnaround time.

Carlos pestana and Nicolas peypoch the paper proposes a framework for benchmarking Italian and Portuguese seaports and the rationalization of their operational activities. The analysis is based on the Luenberger productivity indicator. A key advantage of this method is that it allows for both input contraction and output expansion in determining relative efficiencies of those seaports that perform worse than others. Several interesting and useful managerial insights and implications arise from the study. The general conclusion is that the benchmarking of multi-country seaports of a single country, reflecting different cultural by benchmarking the seaports of a single country, reflecting different cultural traditions and managerial practices. The paper aimed to extend the established literature on seaport productivity by applying the Luenberger indicator to estimate and decompose productivity change. Earlier studies on seaport productivity tend to employ non-parametric techniques and Malmquist productivity indexes. The Luenberger productivity indicator is a difference-based index of directional distance functions whereas the Malmquist index is a ratio-based measure. Luenberger introduces the shortage function-which has the desirable properties of accounting for both input contractions and output improvements-and establishes the duality between the shortage function and the profit function. Thus, the Luenberger indicator can accommodate either an input or output perspective corresponding to cost minimization or profit maximization. In the paper he employs the Luenberger productivity indicator of Chambers to estimate and decompose productivity growth on observation of Italian and Portuguese seaports between 2002 and 2004. A key advantage of this method is that it allows for both input contraction and output expansion in determining relative efficiencies and productivity changes. The general conclusion is that there is productivity growth in the majority of seaports analyzed, which is driven more by improvements in technological change than improvement in technical efficiency. Possible explanation for this feature of the results is that investment is not matched by upgraded managerial practices.

Prabir De presented and defined total factor productivity (TFP) model which is a measure of technological change in industry. His study assesses the total factor productivity (TFP) growth of the Indian port sector. TFP is a measure of technological change in industry. His study shows that ports in India are becoming more capital intensive in the post-liberalization period, and except one, the rest of all Indian ports came out with statistically significant TFP changes in last quarter century. His study also finds that, contrary to popular belief, the economy climate in post-reform period has yet to make any substantial impact on the performance of Indian ports in terms of the most popular measure of performance, TFP. Furthermore, the authors collected data from 1980–1981 to 2002–2003 in India port, following the Perpetual Inventory Accumulation (PIA) method. By researching the results indicate that there are tremendous spurt in international research on the relationship between globalization and productivity. Prabir De, presented port should put both skilled workers and application of higher technology in operation to improve the productivity and keep competitive.

Peng-fei Zhou, the author make an elaborate simulator was proposed about the logistics related to the arrival, berthing and departure of vessels in container terminal for designers and decision-makers to evaluate container terminal size in terms of berths and quay-cranes and its current performance. The simulator mainly includes simulation scenario generator, berth and quay-crane assignment simulation as well as input and output data planning. The simulation implement procedure consisting of several steps: first one should choose terminal size, horizon of simulation and throughput in the horizon, the basic berth number and crane number embody terminal size that is an important evaluation parameter. Generally, the horizon, which can determine the simulation scope, is set as a long period, such as several months, a year and even several years, in order to gain a satisfactory and accordant simulation result. The throughput is determined mainly according to the terminal size and the horizon. The second step is that generate traffic scenario once the algorithm for ship traffic scenario generation is in place, the form and parameters of the distributions used have to be determined. When adequate existing data are available, they are used for distribution fitting. Otherwise, projections of traffic flow, empirical distributions, and simplifying assumptions can compensate for the lack of detailed information. Container arrival distributions of year and month must be determined. And their measure unit is also chosen, which can result in errors of given distribution of each week, vessel arrival distribution of each week, one of each day and one of each time slot, and weather frequency each day by month are input. The third step is that allocate berths and quay-cranes and input terminal performance statistics data, the crane productivity show small differences from the terminals and the gross hourly productivity ranged from 22.82 to 24.61 moves. Apparently, the productivity have been affected by weather conditions. Therefore, the hourly productivity of 25 is used for the simulation. The last step is that observe the statistics data, in the statistics output, terminal key performance measure can be find on the basis of which the terminal is evaluated. If the performance measure cannot satisfy decision-makers or designers, we can return to step 1, and modify the

input file. The simulator can be used to design additional terminal size, evaluate current terminal performance and analyze its operation cost.

Chien-Chang Chou, the objective of this paper is to analyze the container throughputs of major ports in Far Eastern region. These major ports include Kaohsiung port, Hong Kong port, Shanghai port, Pusan port, Kobe port and Singapore port. The findings lead to answer questions whether Taiwan province needs some new port policies, and how Kaohsiung port improves its competition as well. The import and export containers in China are increasing rapidly based on her strong economic growth in recent years. The container throughput of Hong Kong port, Shanghai port and Pusan port grew rapidly in recent years based on the large import and export container volume in South China and North China. For this reason, the market share of Hong Kong, Shanghai port increased obviously over the past 20 years. And Pusan port also kept almost the same market share. Thus the author suggests the Taiwan province shall improve the direct-transportation operation and port policies between Taiwan and mainland China. By the way, there will be more China's containers to go through Kaohsiung port for transshipment, just like Hong Kong port and Pusan port. On the other hand, although Kaohsiung port successively maintained the world's third largest container port before 2000, unfortunately, its market share in Far Eastern region decreased over past 20 years. For this reason, Taiwan province should try to reduce the transshipment cost of Kaohsiung port and attract more transshipment containers from Southeast countries. By the way, Kaohsiung port could improve its competition by maintaining higher container throughput, higher frequency of liners and lower transshipment cost.

"Critical Success Factors in Developing a Port and Hinterland as a Transshipment Hub", the author suggest that the developing a port should do these ways: (1) To develop a transshipment hub, geography a significant factor; (2) First class infrastructure; (3) Competitive pricing; (4) Create a business friendly environment that exercise; (5) Flexibility and seamless management; (6) Attracting global players as tenants and partners; (7) A conducive operating environment. Project Overview is that Establish a Malaysian world-class transshipment port in South East Asia; Compete with the best in the world i.e. PSA of Singapore; Stop Malaysian cargo leakage to neighboring ports; Drive the development of South West Johor economy. In the aspect of Facilitation services, the port should do in this ways: (1) One-stop logistics solution for customers; (2) Simplify business set-up procedures; (3) Liaison between customers and government agencies.

Branislav Dragovic, In terms of terminal productivity, different capacity performance measures, such as berth length utilization rate (TEU/berth meter), total terminal area utilization rate (TEU/ha of total terminal area), quay crane (QC) utilization rate (TEU/QC), QC productivity (TEU/QC-hour) and average number of QCs per berth, may be used to find the optimal capacity and throughput on the terminal in port. His paper aims to make a descriptive analysis of the terminal performances interaction between ports under the framework of interaction between terminals productivity measures. Findings from this study will provide associated performance with an interesting insight into a geographical cover for the world leading port ranges. Thus, this paper develops and describes simulation

Table 2.1 Summary of Berth productivity factors

Authors	Productivity factors
Manuel Acosta	Infrastructure, superstructure, technology and communications systems
Chuan-Sheng Peng	Information technology, bigger-facilities, and automatic technology and facilities
Yang Chen	High-tech
Nam-Kyu Park	Height of container, block dispersion and distance in yard planning for loading
Kim et al.	Improve the efficient operation of port container terminal
Mu Gu	Enhanced the efficiency of loading and unloading
Carlos pestana	Technological system
Prabir De	Skilled workers, application of higher technology
Arie Sachish	Labour, capital, technology, management
Yun Cai	Berth and quay crane scheduling
Song and Cullinane	Dwell time, working time
Cullinane et al.	Service quality
Peng-fei Zhou	Berth and quay-crane assignment
Chien-Chang Chou	Yard tractor, automatic
CCDoTT	Terminal area, storage area, berth, man-hours

methodology to study the container port capacity performance. The study is based on data published on the web site of Containerization International; data were downloaded in 2005 and 2006. For each port and terminal data are referred to the waterside operation of berths and QCs are the more important determinants of productivity. We present the effect on above mentioned container terminals capacity performance with numerical results and computational experiments which are reported to evaluate the efficiency of Major European and Asian Ports (MECP and MACP).

According to CCDoTT, The productivity of container terminal can be measured with terminal's important each part, which is terminal area, storage area, berth and man-hours, etc. and selection of output has to reflects limiting component and define the fact. It emphasizes continuously monitoring of productivity with comparing with another terminal when maximum practical capacity is calculated (Table 2.1).

Critical Factors for Berth Productivity in Container
Terminal

Lu, B.; Wang, S.

2017, XIII, 63 p. 5 illus., 4 illus. in color., Hardcover

ISBN: 978-981-10-2430-6