

NANYANG TECHNOLOGICAL UNIVERSITY

SEMESTER 2 EXAMINATION 2014-2015

MT2005 – PORT ECONOMICS

April / May 2015

Time Allowed: 2 ½ hours

INSTRUCTIONS

1. This paper contains **FOUR (4)** questions and comprises **TWO (2)** pages.
 2. Answer **ALL** questions.
 3. This is a Closed-Book Examination.
 4. All questions **DO NOT** carry equal marks.
-

1. What are isoquant and isocost in economics? How does a terminal operator use the two concepts to determine the optimal method of production in cargo handling? Illustrate with a real example from the port industry.
(10 Marks)

2. Singapore is a major transshipment hub. With reference to Michael Porter's Diamond model, discuss the competitive advantages of the port of Singapore relative to its major competitors in terms of six aspects, namely
 - (a) factor conditions
 - (b) demand conditions
 - (c) related and supporting industries
 - (d) firm strategy, structure and rivalry
 - (e) role of the government
 - (f) chance
(30 Marks)

3. Answer the following questions, giving both positive and negative perspectives.

(a) Does a distribution network of a port have a positive impact on its competitiveness?
(15 Marks)

(b) Is the concept of inland port applicable to the Port of Singapore?
(15 Marks)

4. (a) With the expansion program of the Panama Canal likely to be completed by early 2016, describe the possible impacts on the physical characteristics of container vessels passing through this canal.
(10 Marks)

(b) Describe and explain the possible strategies that container ports, especially those on the Atlantic Ocean side, can adopt in order to reap the benefits of the Panama Canal expansion program.
(20 Marks)

END OF PAPER

MT2005 – Port Economics

1. Definition

- **Isoquant**
 - is a curve representing the combinations of factor inputs that yield a given level of output in a **production function**
- **Isocost line**
 - represent the combinations of factor inputs that have the same amount of cost
- **Production function**
 - Is a mathematical expression of a relationship between inputs and outputs, showing units of total product as function of units of inputs
 - 2 kinds of inputs (*labour* and *capital*) that determine the solution, whether it is more labour- or capital-intensive

$$Q = f(K, L, \gamma)$$

where: Q = port output (e.g. tons, TEUs)

K = capital input

L = labour input

γ = a parameter reflecting the current state of technology

- Directly related with **Cost function**

$$C = wL + rK$$

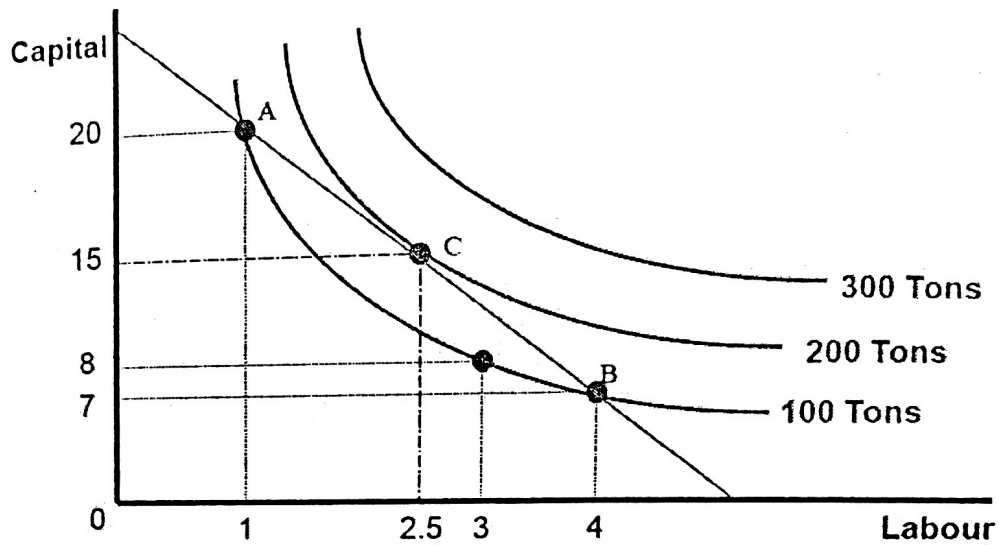
where: C = total cost

w = input price for labour

r = input price for capital

Illustration with real example from port industry

- Taking **PSA** as an example
 - PSA is very capital-intensive terminal operator and focuses a lot on technology
 - PSA constantly innovates through automation and use of intelligent systems
- Draw the graph with Capital and labour as the two axes



- Describe A, B and C, which is along the isocost line
 - A: 20 units of capital and 1 unit of labour
 - B: 7 units of capital and 4 units of labour
 - C: 15 units of capital and 2.5 units of labour

- Point C (15 units of capital and 2.5 units of labour) is the optimal solution as there is higher tons handled with the same cost
 - Production cannot be further increase (to more than 200 tons) if don't increase cost
 - Tangent point between isoquant and isocost is the optimal point

2. Apply Michael Porter's Diamond model to Port of Singapore.

Vital for ports to create and sustain competitive advantage

Determinant	Component	
(a) Factor Conditions	<ul style="list-style-type: none"> Human resources Physical resources Knowledge resources Capital resources Infrastructure <p>→ Basic versus advanced → Generalized versus specialized → Mobile versus immobile</p>	<ul style="list-style-type: none"> <u>Favourable maritime access</u> Natural deep waters and harbour <ul style="list-style-type: none"> Allowing it to service ships with deeper draughts without having to resort to expensive dredging operations Safe and reliable port operations due to non-existence of typhoons and other natural calamities in the region <u>Strategic geographical location</u> <ul style="list-style-type: none"> Located close to some of the world's dynamic economies <ul style="list-style-type: none"> → Between China and India, allowing SG to work as a connection bet the 2 rising powers Singapore's location positions it well for shipments between <u>Asia and Europe</u> and between <u>Asia and the West Coast of the United States</u>. <u>Quality port infrastructure</u> <ul style="list-style-type: none"> Port of SG has well-developed port infrastructure in <ul style="list-style-type: none"> → No. of container berths, cranes and adequate storage facilities → Quality of cranes, quality and effectiveness of port/inter-port information systems → Approach channel → Preparedness of port management → Wide range of port-related and ship-related services <u>Good transportation network to access hinterland</u> <ul style="list-style-type: none"> Road transportation network of Singapore allows easy transportation of goods across whole of Singapore <ul style="list-style-type: none"> → From East to West, North to South, or to the Central area → No difficulties in goods transportation in Singapore
(b) Demand Conditions	<ul style="list-style-type: none"> Demand composition Demand size and growth pattern Demand Internationalisation 	<ul style="list-style-type: none"> Import of many commodities such as machinery and equipment, mineral fuels, chemicals, foodstuffs, consumer goods etc. <u>Transshipment and export</u> is also important <ul style="list-style-type: none"> Demand is largely dependent on other countries especially East and Southeast Asia, and Europe Large demand size <ul style="list-style-type: none"> Singapore is a resource-scarce country, dependent on import, Singapore need to import to satisfy its demand

of Port users such as: Shippers, Shipping Lines, Logistics Companies

- Declining demand (negative growth)

- Relatively good quality of demand for better perceiving, interpreting and responding to users' need

- Demand is relatively standardised in a range
- Port of Singapore can better gauge demand → respond readily to users' needs
- Affirms Port of Singapore's business strategy and reduce uncertainty in decision making

- Presence of internationally lead firms foster high rate of innovation and productivity

- Internationally lead firms deemed internationally as very demanding act as a source of pressure for Port of Singapore to constantly innovate and improve productivity
- Need to constantly upgrade and improve its facilities and services
- Use of technology to build a competitive advantage and provide quality service
- Terminal Operators in Port of Singapore can use knowledge gained internationally to innovate and compete

- Rapid demand growth encourages investment in new products and facilities

- Increase in demand encourages Port of Singapore to constantly invest in new products and facilities so as to meet this surge in demand

- Bunkering

- Singapore is world's top bunkering hubs with many bunker suppliers and bunker tankers operating to provide competitive, efficient and time service to vessels
- Already established international reputation for quality bunkering
- All bunker suppliers and surveyors have to be licensed by MPA, ensuring that there is compliance to quality assurance standards and regulations

- Shipbuilding and repair

- Thriving international centre for shipbuilding, ship repairs and ship conversion and a niche player in construction of customised and specialised vessels
- Have a number of big and small shipyards in Singapore

(c) Relating and Supporting Industries	<ul style="list-style-type: none"> • Supplier Industries • Related Industries

<ul style="list-style-type: none"> • Shipbuilding and repair • Ship chandling • Classification societies • Bunkering • Ship management • Ship broking • Maritime unions • Ship registry • Maritime R&D • Ship financing • Maritime legal services • Dredging • Maritime IT • Maritime defence 	
---	--

		<ul style="list-style-type: none"> • Marine equipment and accessories • Marine insurance and reinsurance • Marine salvage and survey 	<ul style="list-style-type: none"> • <u>Ship registry</u> <ul style="list-style-type: none"> - Grow and maintain SG as a quality flag as Singapore Registry of Ships • <u>Ship chandling</u> <ul style="list-style-type: none"> - Jurong Port's Lighter Terminals: Marina South Wharves and Penjuru Terminal - Have a strong network of ship suppliers, chandlers and boat operators, working all around the clock to meet the needs of shipping community • <u>Ship financing</u> <ul style="list-style-type: none"> - Singapore is one of the major financial centres in the region - Presence of major banks in Singapore
<p>(d) Firm Strategy, Structure and Rivalry</p>	<ul style="list-style-type: none"> • Strategy and structure of firms • Goals • Domestic rivalry • New business formation 	<ul style="list-style-type: none"> • New business formation • Inter-port • Intra-port • Domestic • International 	<ul style="list-style-type: none"> • Firms: PSA International and Jurong Port • <u>Firm Strategy (PSA International)</u> <ul style="list-style-type: none"> - Adopted strategy through various alliances and investments in logistics business and port terminal development in around 16 countries - → Ensure that there will be cargo transhipment through port of SG by having greater influence on the supplies lines of transhipment cargo from other ports in the region - Investing in infrastructure, equipment, technology, system processes and human capital to meet customers' changing need (leverage on strengths in innovation and continuous improvement) - → Technology, Infrastructure, Equipment, System processes <ul style="list-style-type: none"> o Portnet o CITOS o Flow-Through Gate o Remote Crane Operations and Control - → Human Capital (leverage on belief in human capital development) <ul style="list-style-type: none"> o Treating people as valuable resources o PSA management, staffs and unions work closely as a motivated, productive and competitive team committed to customer service and adaptable to changing demand <p><i>PSA Institute: training and development for staffs</i></p>

			<ul style="list-style-type: none"> • <u>Firm Strategy (Jurong Port)</u> <ul style="list-style-type: none"> - Leverage Infocomm Technologies <ul style="list-style-type: none"> → GBMS → JP-Online → CTMS - Committed to Safety, Security and the environment <ul style="list-style-type: none"> → Registered as Bizsafe pioneering company → Member of Workplace Safety and Health (WSH) Committee → Complies with ISPS (International Ship and Port Facility Security) Code • <u>Firm Strategy (Focused by both)</u> • <u>Minimal Intra-port Competition</u> <ul style="list-style-type: none"> - Both PSA and Jurong Port have their respective focuses: <ul style="list-style-type: none"> → PSA: focus on Containers, manages <i>Pasir Panjang terminal, Tanjong Pagar Terminal, Brani Terminal and Keppel Terminal</i> → Multi-purpose terminal JP: focus on general cargo, bulk cargo and container - Operate efficiently as one seamless and integrated facility
(e) Role of Government	<ul style="list-style-type: none"> • National • Regional • Local 	<ul style="list-style-type: none"> • Regulation • Subsidy • Macroeconomic policy • Social goods and services • Market failure 	<ul style="list-style-type: none"> • <u>Government role in maintaining favourable business environment:</u> <ul style="list-style-type: none"> - Stable political environment - Efficient civil service and rule of law - Business-friendly practices - Low level of corruption • <u>Singapore's favourable trade policy</u> <ul style="list-style-type: none"> - Free Trade agreements with many countries <ul style="list-style-type: none"> → Network of FTAs has expanded to cover 20 regional and bilateral FTAs with 31 trading partners • <u>MPA's vision of developing Singapore into premier hub port and IMC</u> <ul style="list-style-type: none"> - Able to attract cluster of companies and businesses ranging from ship chartering, brokering to classification societies to come to Singapore <ul style="list-style-type: none"> → Wide range of ship- and port-related services due to IMC position, making Port of Singapore into a One-stop service provider hub

(f) Chance

- **Events beyond ability of form and government to influence**

- Supply shocks
- Acts of pure invention
- Major technological discontinuities
- Financial shocks
- Demand shocks
- Political shocks
- Social upheaval
- Union actions
- Natural disasters

- Demand shock

- **New players emerged and new markets entered**
 - Port of Singapore serve as a link between these countries: Port of Singapore can expect more multinationals from these economies wanting to move into port
 - BRIC Countries: Brazil, Russia, India China
 - 'Next Eleven' (N-11): Bangladesh, Egypt, Indonesia, Iran, Mexico, Nigeria, Pakistan, the Philippines, Turkey, South Korea and Vietnam
- **Increase in production of high value-added products**
 - Continued industrialisation, economic dynamism and growing trade orientation of countries in region provided ample business opportunities for port of SG as transshipment point
 - Port of Singapore in better position to take advantage of this external opportunity because of EOS developed, scope it has enjoyed in containerised cargo operations, high level of efficiency and its excellent infrastructure relative to other ports in the region

- Global financial crisis

3. (a) Presence of distribution network such as rail distribution, road distribution and inland waterway

Distribution network of port have positive impact on competitiveness

- Better linkage to the entire supply chain
 - Can provide an all-rounded services to customers
 - Shippers and logistics integrators can focus on the bundle of logistics services offered by the supply chain and no longer just choose the port per se
 - Increasing competitiveness

Distribution network of port don't have positive impact on competitiveness

- It might pose a challenge to the port as they have to compete with these other modes of distribution network
 - Fierce competition might arise between these modes
 - Distribution network is no longer a point of leverage for the port
 - Taking the case of US, cargoes can travel by road instead of via sea when moving from East to West

(b)

Why concept of Inland Port is applicable to Singapore

- Able to capture volume from nearby country e.g. Malaysia
 - For example, from Johor as it is closer to Singapore's customs
- Reduce air emission in central area
 - Tanjong Pagar Terminal is at the central area, can reduce air emission there

Why concept of Inland Port is not applicable to Singapore

- Singapore is a land-scarce country, there is already easy transportation of cargo to seaport directly
 - No need to separately capture cargoes from shippers
 - Unable to speed up cargo flow between vessel and land transportation network
- Unlikely to capture cargoes from neighbouring country such as Malaysia
 - Port of Tanjung Pelepas (PTP) is of too close proximity to Singapore seaport, let alone inland port, there is no reason to divert cargoes to Singapore
- Port of Singapore is strategically planned to be where it is located by MPA (Port planner)
 - Having inland port is a waste of resources
- Singapore is a transshipment hub
 - Singapore port has to be by the quay and not inland
- Singapore is already of close proximity to the various stakeholders involved

4. (a) Expansion of Panama Canal allows transit of larger ships with greater volumes.

Possible impacts on physical characteristics of container vessels

- LOA (Length Overall)
 - Overall length of the vessel, from bow to stern
 - LOA of container vessels passing through the canal will increase

- Beam
 - Width of the vessel
 - Indicates the number of containers that can be stacked across the width of the vessel
 - Beam of container vessels passing through the canal will increase

- Water draft
 - Depth of the container vessel below waterline when full loaded
 - Indirectly indicates the number of containers that can be stacked in the hold
 - Water draft of container vessels passing through the canal will increase

- Air draft
 - Height above waterline
 - Indirectly indicates the number of tiers stacked on top of the hatch cover
 - Air draft of container vessels passing through the canal will increase as more containers can be stacked on larger vessels

(b) Possible strategies container ports can adopt to reap the benefits of Panama Canal Expansion

- Quay crane (QC) deployment
 - Container ports can ensure that they have efficient deployment of quay crane
For e.g. there may be occasion that QCs are vacant due to berthing of longer LOA vessels, as vessel with LOA cannot be served
 - By having efficient deployment, container ports can capture volume from both large and smaller vessels that passed through the panama canal

- Quay crane specifications
 - Outreach: Maximum distance the QC spreader can move to handle the furthest containers on deck
 - Lifting height: Distance of QC spreader to move from quay level to the top-most position
 - Container ports can ensure its QCs are able to handle vessels with larger beam and air draft
 - Increased outreach and lifting height for the QC specifications to handle more containers on larger ships

- Berthing arrangement
 - Container ports can ensure that their berths are able to cater to the needs of vessels with larger LOA and beam
 - As vessels with longer LOA have different clearance requirements from vessels with shorter LOA, possible that vessels with longer LOA

have berthing constraints at port → Ports have to ensure that their berths fulfil the clearance requirement for longer LOA vessels

- QCs within the same terminal operator have different outreach → container ports have to ensure that there is suitable berthing arrangement so that vessels with larger beam can be handled by QC with appropriate outreach

- Dredging

- Container ports can conduct dredging operations to increase the water draft
 - Able to cater to vessels with larger water draft

- Joint Venture

- Container port can enter into joint venture agreement with shipping line to jointly manage and operate a dedicated container terminal for that shipping line
 - With larger container vessels passing through the canal, both the shipping line and port have their respective needs
 - Shipping lines: Want to ensure that their containers can be handled efficiently
 - Container ports: Want to increase the number of throughput
- Such joint venture enable the needs of both parties to be fulfil. Dedicated berth enable shipping lines have to enjoy efficient cargo handling whereas there is a steady flow of cargo throughput for the container ports

- Possible Port cooperation

- Container ports in the Atlantic Ocean side can cooperate so as to capture the container volume in the region

W.N.