# Analysis of the Competition of Ports in the Middle East Container Ports Using HHI

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**Abstract:** The market concentration of selected 24 container port/terminal in the Middle East region was evaluated. Data collected for 6 years (2009-2014), HHI (Herfindahl-Hirschman index technique) was used to analyse the market behaviour and the movement of the market towards monopoly or to lead to PPC (pure and perfect competition). Based on the above, by analyzing the defined market data, it was found to be a promising market and tends to competition. Of course, this serves the interest of the client, which is the efficiency and speed of cargo handling safely and at the lowest cost.

**Key words:** Container, ports, competition, HHI, market, cargo, throughput, terminal.

## 1. Introduction

A huge amount of the world trade which is estimated by 90% is carried by ships. World seaborne trade steadily increased within the last two decades, more than 50,000 vessels are sailing worldwide. In 2014, global containerized trade was estimated to have increased by 5.3 per cent and reached 171 million TEUs [1].

The present outlook and the rising globalization of economies call for more efficiency from all representatives in the transport sector, especially ports, where there is a huge public input in their production procedures [2]. Seaport authorities have increasingly been under pressure to enhance performance by guarantying that services are provided on an internationally competitive basis. The efficiency of ports is an indicator of a country's economic development Developing economies' share of world container port throughput raised marginally to approximately 71.9 per cent. This continues the trend of a gradual increase in improving countries' share of

world container throughput. The increased share of world container throughput for improving countries leads to its increase in South-South trade [3].

The performance of ports and terminals is important because it affects a country's trade competitiveness. There are many determinants to port/terminal performance—labor relations, number and type of cargo handling equipment, quality of backhaul area, port access channel, land-side access and customs efficiency, as well as potential concessions to international-terminal operators.

It is so important to study the Middle Eastern region, as the container terminals in this region are located at a critical geographic position in the international maritime trade route between the East and the West.

The assessment and analysis will be limited to the efficiency and competition level of the container terminal/port in the following ports; Dubai (including Jebel Ali), Khore Fakkan, Salalah, Jeddah, SCCT (Suez Canal Container Terminal), Elsokhna, Damietta, Aqaba, Beirut, Khalifa Bin Salman, Hodeida, Bandar Abbas and Shahid Rajaei.

Other ports will be included in the research that shall be considered as a future logistics hub in the Middle Eastern container market as the assessment of port efficiency shall include maritime transport

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(trans-shipment), ports and hinterland (transit) sides. These ports are Latikia, Haifa, Djibouti, Aaden, Dammam, Jubail, Sohar, Ambarli, Ashdod, Alexandria, and Port Sudan.

The final sample will include 24 container terminals/ports in 14 countries of the Middle Eastern region in the time period from 2009 to 2014.

These ports are central ports, in which goods transported between the far East/Australia and Europe are transshipped and exchanged to ports in the Middle East [4]. These ports play an essential role in the region's economic improvement. One of the causes for the limited region-specific Middle East up to date analysis has been a lack of data gathered from the political problems, security status and shortage of transparency in government sectors. There are many determinants to port/terminal efficiency for example, labor relations, quality of backhaul area, type and number of Cargo handling equipment, port access channel, land-side access, customs Efficiency and so on.

These mentioned operational indicators are generally more helpful to port operators and do not contain non-tangible assessments (for example, users' perceptions, service quality, innovation levels and so on, that port customers may find more beneficial [5].

The aim of this paper is to critically examine the concentration in the defined Middle East container ports and to attempt a forecast for their future, if possible, by examining the market behavior and the movement of the market towards monopoly or pure and perfect competition

## 2. Literature Review

There are a huge number of researches on the efficiency of container terminals, but their concentration has mostly been on advanced and emerging markets. There is shortage of researches on container terminals in developing countries such as those of the Middle Eastern region that are situated in a sensitive geographic location in the international maritime route between the East and the West.

Port efficiency can be measured by estimating its technical performance and effectiveness. Talley [6] reported a set of performance indices including annual cargo throughput. It also supposed that ports and terminals target maximum cargo movement, efficiency and productivity. And stated that multiple authors have used productivity, physical activity and relative performance in order to calculate port efficiency. Several researchers have used cargo throughput (activity) to resolve models of port or terminal performance, although consider the performance variable to be mentioned by the volume of containers handled at the terminal and measured by container throughput. Stated that port or terminal efficiency can be calculated by performance of container terminal throughput. Pallis [3] said that performance should be mentioned in terms of effectiveness and efficiency as well as reported that performance is normally related to operational efficiency, physical quantities and efficiency in resource use. Efficiency does not necessarily aim to higher competitiveness and performance, although, Ports must also provide effective customer service.

Local economic performance proximity to industrial and urban centers and location are essential in analyzing container terminal efficiency. Except for transshipment terminals, terminal performance is widely measured by local economic developments because production and consumption centers improve container flows.

Proximity to the European economic core affects terminal performance. Northern European ports within the range of Le Havre and Hamburg serve essential and growing hinterlands. They have efficiently capitalized on economies of scale and compete in southern European hinterland ports (for example, Italy and France). Some Mediterranean ports have stood out as intermediary transshipment hubs that connect other continents with northern European ports [7].

Only three researches have concentrated so far on

the performance of container terminals in the Middle Eastern region, those by Al-Eraqi et al. [4] and Almawsheky et al. [8] so we try to add a new study to the body of the efficiency of container terminals in literature of the Middle Eastern region.

# 3. Descriptive Statistics (Market Throughput)

The data used were mostly obtained from terminals websites and the annual reports of ports authority, as well as from secondary sources such as the CIYs (Containerisation International Yearbooks) Ports and Harbours and Containerisation International

## 3.1 Assessment of Port Competition

The port competition within a region can be assessed using different indicators, such as throughput, market share, market concentration, location, accessibility, port infra and super structure. Port efficiency decreases with competition intensity when measured in a range of 400-800 km (regional level); and the effect from competition is not significant when competition is measured at a local level (less than 300 km) or at a global level (more than 800 km).

## 3.2 Market Share

The market share of each hub ports is calculated as a percentage from the total throughput of the 24 mentioned ports and is presented in Table 1. Dubai is the Market leader in the Middle East with a consistent growth of market share from 25.2% in the year of 2009 to 31.09% in 2014. However, a strong competition still exists between ports outside the gulf. In 2009, Ambarli and Salalah recorded a market share of 7.67% and 7.58% respectively. Meanwhile, Jeddah terminal recorded a decline of their market share from 10.363 % in 2009 to 6.87% in 2014. On the other hand, Suez Canal C. Terminal recorded a market share 7.322% in 2009 with slight growth in 2014 with 7.538% in the second place just after Dubai as shown in Table1/Figure 1.

## 3.3 Market Concentration

The Herfindahl index (H) measures the degree of competition among firms in the market. It is defined as the sum of the squared market shares of (n) individual company. As such, it can range from (1/n) to 1—moving from a large amount of small firms to a single monopolistic organization where H = 1. A decrease in the Herfindahl index generally indicates a decrease in concentration [9].

Table 2 indicates that in 2009 the Herfindahl index was relatively small (0.1051), which means that although Dubai and Jeddah together account for about 35.64% market share, the market was highly competitive in such a period. It might be due to the high degree of competition among the other terminal operators such as Ambarli, Salalah port, Suez Canal Container. terminal with market share around 8-10%.

However, although DP world market share increased to 31.096% in 2014, competition between terminal operators has significantly increased as the Herfindahl index increased to 0.1278 in 2014 (Table 3). The increase in the number of players in the market implies that the market is going towards less concentration and more competition among terminal operators. It may reflect a positive impact on ports customers in terms of port fees and service being provided and terminal handling charges.

Nevertheless, although the ports throughput and market share are influential factors that indicate the competitiveness level of a port, the port location also

**Table 1 Development of container throughput, market share and Herfindahl index of Middle East container markets. 2009-2014 (%).**

| Port | 2009 | | | 2010 | | | 2011 | | | 2012 | | | 2013 | | | 2014 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Throughput (1000) TEU | Market Share (%) | HHI | Throughput (1000) TEU | Market Share (%) | HHI | Throughput (1000) TEU | Market Share (%) | HHI | Throughput (1000) TEU | Market Share (%) | HHI | Throughput (1000) TEU | Market Share (%) | HHI | Throughput (1000) TEU | Market Share (%) | HHI |
| Dubai (Jebel Ali) | 11,124 | 23.111 | 0.053414 | 11,600 | 23.259 | 0.054098 | 13,000 | 26.465 | 0.070041 | 13,270 | 25.960 | 0.067390 | 13,641 | 26.595 | 0.070731 | 15,249 | 29.034 | 0.084298 |
| Khore Fakkan | 2,750 | 5.713 | 0.003264 | 3,023 | 6.061 | 0.003674 | 3,230 | 6.576 | 0.004324 | 3,996 | 7.817 | 0.006111 | 3,800 | 7.409 | 0.005489 | 3,800 | 7.235 | 0.005235 |
| Salalah | 3,340 | 6.939 | 0.004815 | 3,620 | 7.258 | 0.005268 | 3,201 | 6.517 | 0.004247 | 3,482 | 6.812 | 0.004640 | 3,490 | 6.804 | 0.004630 | 3,034 | 5.777 | 0.003337 |
| Jeddah | 4,561 | 9.476 | 0.008980 | 4,738 | 9.500 | 0.009025 | 4,010 | 8.164 | 0.006664 | 3,830 | 7.492 | 0.005614 | 3,091 | 6.026 | 0.003632 | 3,034 | 5.777 | 0.003337 |
| Suez Canal C. Terminal | 3,524 | 7.322 | 0.005360 | 3,646 | 7.311 | 0.005344 | 4,272 | 8.697 | 0.007564 | 3,631 | 7.103 | 0.005046 | 4,100 | 7.994 | 0.006390 | 3,959 | 7.538 | 0.005682 |
| Elsokhna | 403 | 0.837 | 0.000070 | 597 | 1.197 | 0.000143 | 585 | 1.191 | 0.000142 | 452 | 0.884 | 0.000078 | 534 | 1.041 | 0.000108 | 587 | 1.118 | 0.000125 |
| Damietta | 1,213 | 2.520 | 0.000635 | 1,096 | 2.198 | 0.000483 | 1,200 | 2.443 | 0.000597 | 760 | 1.487 | 0.000221 | 1,300 | 2.535 | 0.000642 | 807 | 1.537 | 0.000236 |
| Aqaba | 674 | 1.400 | 0.000196 | 605 | 1.213 | 0.000147 | 338 | 0.688 | 0.000047 | 817 | 1.598 | 0.000255 | 413 | 0.805 | 0.000065 | 403 | 0.767 | 0.000059 |
| Beirut | 995 | 2.067 | 0.000427 | 950 | 1.905 | 0.000363 | 1,034 | 2.105 | 0.000443 | 1,041 | 2.036 | 0.000415 | 1,117 | 2.178 | 0.000474 | 1,210 | 2.304 | 0.000531 |
| Khalifa Bin Salman | 280 | 0.582 | 0.000034 | 368 | 0.738 | 0.000054 | 375 | 0.763 | 0.000058 | 525 | 1.027 | 0.000105 | 595 | 1.160 | 0.000135 | 331 | 0.630 | 0.000040 |
| Hodeida | 6,311 | 13.112 | 0.017192 | 6,402 | 12.837 | 0.016478 | 5,446 | 11.087 | 0.012292 | 7,237 | 14.157 | 0.020043 | 6,257 | 12.199 | 0.014882 | 6,578 | 12.525 | 0.015686 |
| Bandar Abbas | 56 | 0.116 | 0.000001 | 68 | 0.136 | 0.000002 | 87 | 0.177 | 0.000003 | 91 | 0.178 | 0.000003 | 105 | 0.205 | 0.000004 | 95 | 0.181 | 0.000003 |
| Shahid Rajaei | 2,206 | 4.583 | 0.002101 | 2,592 | 5.197 | 0.002701 | 2,389 | 4.864 | 0.002365 | 2,258 | 4.417 | 0.001951 | 2,147 | 4.186 | 0.001752 | 1,842 | 3.507 | 0.001230 |
| Latikia | 621 | 1.290 | 0.000166 | 586 | 1.175 | 0.000138 | 524 | 1.067 | 0.000114 | 342 | 0.669 | 0.000045 | 194 | 0.378 | 0.000014 | 254 | 0.484 | 0.000023 |
| Haifa | 1,357 | 2.819 | 0.000795 | 1,372 | 2.751 | 0.000757 | 1,235 | 2.514 | 0.000632 | 1,264 | 2.473 | 0.000611 | 1,357 | 2.646 | 0.000700 | 1,196 | 2.277 | 0.000519 |
| Djibouti | 519 | 1.078 | 0.000116 | 600 | 1.203 | 0.000145 | 634 | 1.291 | 0.000167 | 681 | 1.332 | 0.000177 | 735 | 1.433 | 0.000205 | 773 | 1.472 | 0.000217 |
| Aaden | 62 | 0.129 | 0.000002 | 68 | 0.136 | 0.000002 | 73 | 0.149 | 0.000002 | 95 | 0.186 | 0.000003 | 111 | 0.216 | 0.000005 | 135 | 0.257 | 0.000007 |
| Dammam | 1,659 | 3.447 | 0.001188 | 1,622 | 3.252 | 0.001058 | 1,492 | 3.037 | 0.000923 | 1,333 | 2.608 | 0.000680 | 1,250 | 2.437 | 0.000594 | 1,748 | 3.328 | 0.001108 |
| Jubail | 121 | 0.251 | 0.000006 | 124 | 0.249 | 0.000006 | 167 | 0.340 | 0.000012 | 245 | 0.479 | 0.000023 | 257 | 0.501 | 0.000025 | 278 | 0.529 | 0.000028 |
| Sohar | 145 | 0.301 | 0.000009 | 142 | 0.285 | 0.000008 | 150 | 0.305 | 0.000009 | 198 | 0.387 | 0.000015 | 208 | 0.406 | 0.000016 | 227 | 0.432 | 0.000019 |
| Ambarli | 3,378 | 7.018 | 0.004926 | 3,097 | 6.210 | 0.003856 | 2,686 | 5.468 | 0.002990 | 2,540 | 4.969 | 0.002469 | 3,378 | 6.586 | 0.004337 | 3,488 | 6.641 | 0.004410 |
| Ashdod | 893 | 1.855 | 0.000344 | 1,018 | 2.041 | 0.000417 | 1,039 | 2.115 | 0.000447 | 1,181 | 2.310 | 0.000534 | 1,165 | 2.271 | 0.000516 | 1,250 | 2.380 | 0.000566 |
| Alexandria | 1,508 | 3.133 | 0.000982 | 1,500 | 3.008 | 0.000905 | 1,490 | 3.033 | 0.000920 | 1,350 | 2.641 | 0.000697 | 1,508 | 2.940 | 0.000864 | 1,678 | 3.195 | 0.001021 |
| Port Sudan | 432 | 0.898 | 0.000081 | 439 | 0.880 | 0.000077 | 464 | 0.945 | 0.000089 | 499 | 0.976 | 0.000095 | 538 | 1.049 | 0.000110 | 565 | 1.076 | 0.000116 |
| Total | 48,132 | 100.000 | 0.1051 | 49,873 | 100.000 | 0.1052 | 49,121 | 100.000 | 0.1151 | 51,118 | 100.000 | 0.1172 | 51,291 | 100.000 | 0.1163 | 52,521 | 100.000 | 0.1278 |

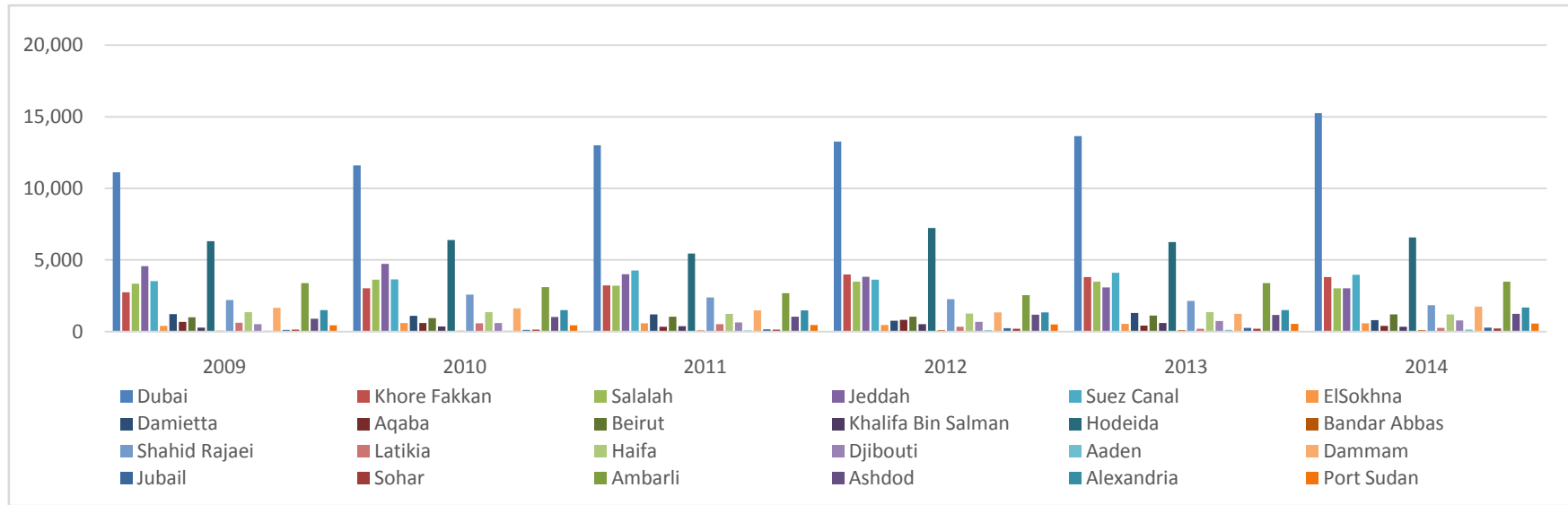Source: Authors derived from various sources.

**Fig. 1 Development of container throughput, market share and Herfindahl index of Middle East container markets, 2009-2014 (%).**
Source: Authors derived from above table.

**Table 2 Middle East container market concentration—Herfindahl index (H) in 2009.**

| Port | Throughput 2009 (1000) TEU | Market share 2009 (%) | HHI |
|---|---|---|---|
| Dubai (Jebel Ali) | 11,124 | 23.111 | 0.053414 |
| Khore Fakkan | 2,750 | 5.713 | 0.003264 |
| Salalah | 3,340 | 6.939 | 0.004815 |
| Jeddah | 4,561 | 9.476 | 0.008980 |
| Suez Canal C. Terminal | 3,524 | 7.322 | 0.005360 |
| Elsokhna | 403 | 0.837 | 0.000070 |
| Damietta | 1,213 | 2.520 | 0.000635 |
| Aqaba | 674 | 1.400 | 0.000196 |
| Beirut | 995 | 2.067 | 0.000427 |
| Khalifa Bin Salman | 280 | 0.582 | 0.000034 |
| Hodeida | 6,311 | 13.112 | 0.017192 |
| Bandar Abbas | 56 | 0.116 | 0.000001 |
| Shahid Rajaei | 2,206 | 4.583 | 0.002101 |
| Latikia | 621 | 1.290 | 0.000166 |
| Haifa | 1,357 | 2.819 | 0.000795 |
| Djibouti | 519 | 1.078 | 0.000116 |
| Aaden | 62 | 0.129 | 0.000002 |
| Dammam | 1,659 | 3.447 | 0.001188 |
| Jubail | 121 | 0.251 | 0.000006 |
| Sohar | 145 | 0.301 | 0.000009 |
| Ambarli | 3,378 | 7.018 | 0.004926 |
| Ashdod | 893 | 1.855 | 0.000344 |
| Alexandria | 1,508 | 3.133 | 0.000982 |
| Port Sudan | 432 | 0.898 | 0.000081 |
| Total | 48,132 | 100.000 | 0.1051 |

Source: Authors derived from various sources.

**Table3 Middle East container market concentration—Herfindahl index (H) in 2014.**

| Port | Throughput 2014 (1000) TEU | Market share 2014 (%) | HHI |
|---|---|---|---|
| Dubai (Jebel Ali) | 15,249 | 29.034 | 0.084298 |
| Khore Fakkan | 3,800 | 7.235 | 0.005235 |
| Salalah | 3,034 | 5.777 | 0.003337 |
| Jeddah | 3,034 | 5.777 | 0.003337 |
| Suez Canal C. Terminal | 3,959 | 7.538 | 0.005682 |
| Elsokhna | 587 | 1.118 | 0.000125 |
| Damietta | 807 | 1.537 | 0.000236 |
| Aqaba | 403 | 0.767 | 0.000059 |
| Beirut | 1,210 | 2.304 | 0.000531 |
| Khalifa Bin Salman | 331 | 0.630 | 0.000040 |
| Hodeida | 6,578 | 12.525 | 0.015686 |
| Bandar Abbas | 95 | 0.181 | 0.000003 |
| Shahid Rajaei | 1,842 | 3.507 | 0.001230 |
| Latikia | 254 | 0.484 | 0.000023 |
| Haifa | 1,196 | 2.277 | 0.000519 |
| Djibouti | 773 | 1.472 | 0.000217 |
| Aaden | 135 | 0.257 | 0.000007 |
| Dammam | 1,748 | 3.328 | 0.001108 |
| Jubail | 278 | 0.529 | 0.000028 |

| Sohar | 227 | 0.432 | 0.000019 |
|---|---|---|---|
| Ambarli | 3,488 | 6.641 | 0.004410 |
| Ashdod | 1,250 | 2.380 | 0.000566 |
| Alexandria | 1,678 | 3.195 | 0.001021 |
| Port Sudan | 565 | 1.076 | 0.000116 |
| Total | 52,521 | 100.000 | 0.1278 |

Source: Authors derived from various sources.

has a significant impact on its attractiveness and competitiveness [9].

According to the United States Justice department, this HHI index of 0.1278 indicates there is not much market concentration. The Justice Department considers an HHI score from 1,500 to 2,500 to indicate a moderately concentrated market. A score above 2,500 is a concentrated market (www.investopedia.com/video/play/herfindahlhirschman-index-hhi).

## 4. Discussion

In this section we will focus and analyze the results of the efficiency of one of the most promising container terminals in the Middle Eastern region which is SCCT (Suez Canal Container Terminal)

SCCT has undergone major investments and improvements to become the largest container terminal in Egypt and the second largest terminal in the Mediterranean and Middle East region. SCCT handled 16,500 vessels in the last ten years and serves 16 maritime container lines every week. SCCT also handled 50 per cent of the containerized cargo that moved in and out of Egypt and have handled more than 25 million TEUs from 2004 till 2014 (www.scctportsaid.com).

With containerized traffic in the Middle East region, Egypt anticipated to grow by double digit numbers. SCCT will lose its competitive edge if infrastructure to enhance navigational capacity is not improved.

The terminal's advantageous location is just one reason for its established reputation as a crucial transshipment hub for the Middle Eastern region and gateway port for local cargoes in Egypt. Complementing its beneficial location with a

consistent adherence to international standards and a high level of efficiency, the terminal has continued to enjoy positive growth. It is also facing challenges as it waits for the Egyptian government to approve the expansion of navigational access into East Port Said: "With 3.4 million TEUs in 2014, which is based on 2251 vessels handled". SCCT have recorded a nine per cent growth in the volumes handled and a four per cent drop in the number of ships serviced.

Based on the above discussion we estimate that SCCT would have been able to double its volume growth figures.

## 5. Conclusions

This study is an attempt to provide a satisfactory understanding of the market share and competition of selected container terminals in the Middle Eastern region and to add to the body of literature available in such study in this region. The HHI was used to analyze 24 container terminals from 12 countries in the region. The HHI efficiency score gives the terminal management a warning signal that the lower their HHI score, the greater likelihood a container terminal has of failure. HHI is thus very useful for identifying the least efficient terminals, which require the closest attention.

Numerous conclusions can be drawn from this study as follows. Among the 24 terminals in the region only 5 terminals (Dubai included Jebel Ali, Suez Canal C. terminal, Ambarli Salalah and Jeddah) are growing constantly; the rest of the terminals are inefficient. Aden terminal shows the lowest level of Market share with a score of 0.201.

We recommend that any future plans for ongoing extension or improvements in ports/terminal should begin with correct demand forecast and information

sharing between port authorities, carriers and shippers.

It is also important that the container terminals authority should conduct yearly comprehensive efficiency evaluations. This will not only support the management of the terminal in responding to the stress of international competition, but also act as a basis for decision-making with respect to continuing development in operational efficiency [9].

Finally, the inefficiency of container terminals in the Middle Eastern region may also be the result of issues including the Arab Spring revolutions in some countries in the region such as Yemen, Syria and Egypt, which affected the economy, investments, security, shipping lines and internal policy and consequently the efficiency of container terminals in the region. Countries in the Middle Eastern region have different political and social structures, including monarchy and republican forms of government that might affect the efficiency of container terminals in the region. Thus, we suggest that further studies examine the effect of government type and political instable factors on the efficiency of container terminals within the context of Middle Eastern region.

On the other hand, when interpreting this study results, some caution should be taken. The findings are based on only a few observations from each country involved in the study; thus the derived efficiency scores may not express the complete detail of the terminal in each country. Bearing in mind that some container terminals were not included in the sample due lacking of data availability. These missing terminals are likely to exert either a positive or a negative influence on the efficiency estimates of those that remain in the sample.

It is also noteworthy that several factors were not given consideration in this study due to the difficulty of obtaining data; these factors also have implications for the operational efficiency of terminals and include factors such as labor, operational time, berth occupancy and handling speeds of cranes. Terminal management, with regard to its terminal operations should strive for complete and detailed data. It would

be appropriate to consider some factors that may influence the container terminals efficiency, such as hinterland, GDP, type of ownership and so on.

Despite these limitations, this study has contributed to the literature by revealing the efficiency of Middle Eastern container terminals, as there has previously been very limited study in this region. From this point of view, the derivation of the efficiency estimates for the Middle Eastern container terminals evaluated in this study simply constitutes a beginning, rather than an end in itself.

A challenge for academics and researchers is to attempt to involve the respective authorities in obtaining comprehensive and reliable data that will lead to deeper information on the industry. Further research should address these issues within the context of Middle Eastern container terminals.

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