

China's investment in African ports: Spatial distribution, entry modes and investor profile

Authors: Z. Yang, Y. He, H. Zhu and T. Notteboom

A modified version of this work had been published:
Research in Transportation Business and Management,
<https://doi.org/10.1016/j.rtbm.2020.100571>

This is a pdf file of an unedited manuscript that, in a modified form, has been accepted for publication or has already been published. For convenience of the visitors of this site, an early version of the manuscript provided. All legal disclaimers that apply to the journal pertain.

Please site this article as: Yang, Z., He, Y., Zhu, H. and Notteboom, T. (2020). China's Investment in African Ports: Spatial Distribution, Entry Modes and Investor Profile, Research in Transportation Business and Management, <https://doi.org/10.1016/j.rtbm.2020.100571>.

This article was uploaded to PortEconomics.eu
On: 02/10/2020

Porteconomics.eu is a non-profit, web-based initiative aiming to advance knowledge exchange on seaport studies. Developed by researchers affiliated to various academic institutions throughout Europe, it provides freely accessible research, education and network-building material on critical issues of port economics, management and policies

China's Investment in African Ports: Spatial Distribution, Entry Modes and Investor Profile

Zhongzhen YANG

Faculty of Maritime and Transportation, Ningbo University, China
yangzhongzhen@nbu.edu.cn

Yunzhu HE

College of Transport Engineering, Dalian Maritime University, China
heyunzhu@dlnu.edu.cn

Hao ZHU

Faculty of Maritime and Transportation, Ningbo University, China
741957631@qq.com

Theo NOTTEBOOM (*corresponding author*)

China Institute of FTZ Supply Chain, Shanghai Maritime University, China
Maritime Institute, Faculty of Law and Criminology, Ghent University, Belgium
Faculty of Business and Economics, University of Antwerp, Belgium
Antwerp Maritime Academy, Belgium
theo.notteboom@gmail.com

This is draft author version. Please cite the paper as follows:

YANG, Z., HE, Y., ZHU, H., NOTTEBOOM, T., 2020, China's Investment in African Ports: Spatial Distribution, Entry Modes and Investor Profile, *Research in Transportation Business and Management*, <https://doi.org/10.1016/j.rtbm.2020.100571>

Abstract

Over the past decades, China's direct investment in Africa expanded significantly and became more diversified. The increased involvement of Chinese interests in Africa has intensified the debate on the benefits, modes and risks linked to these investments. Chinese state-owned companies have directed large amounts of expertise and resources to African ports, not only to deliver benefits to the investing parties, but also to contribute to a more effective and efficient African port industry. This paper presents an analysis of Chinese investments in and operation of African port infrastructure. Next to offering a comprehensive view on the spatial distribution of Chinese investments in African ports, this study elaborates on the specialization of major Chinese state-owned companies in terms of investment modes, and on the reasons behind the observed/expected geographical distribution of specific entry modes across Africa. It is shown that China's port investment in Africa is primarily concentrated on the African east coast. The EPC+F+I mode (Engineering Procurement Construction + Finance + Investment) is the most common arrangement adopted by Chinese enterprises in view of port investment in Africa while also PPP type of arrangements are frequently used. China's enterprises are challenged to choose suitable modes when investing in African ports by taking into account their own attributes, the development status of the host countries and the port characteristics.

Keywords: Belt and Road Initiative; Port investment; African ports; Investment mode; Public-Private Partnership

1. Introduction

The growing investment projects of China in Africa have received a lot of attention in recent years, not the least in the context of the Belt and Road Initiative (BRI). However, China's investment in Africa (mainly direct investment) can be traced back to the 1950s. By the early 1990s, China had invested in 102 projects in Africa for a total investment amount of USD 51.19 million or an average investment intensity of about USD 0.5 million per project (Liu, 2008). China's direct investment in Africa accelerated with the launch of the "going out" strategy in 1998. Driven by this strategy and the "China-Africa Cooperation Forum" ministerial meeting, China's investment in Africa saw great progress in 2000. The Beijing Summit of the China-Africa Cooperation Forum in 2006 opened a new era of China's investment in African countries (Liu, 2008).

Seaports play a key role in China's investment spree in Africa. Port terminals are crucial to the growth of the African economy and international trade. At present, 87% of African international trade is with non-African countries and regions (Huang, 2018). The African continent has a long coastline. There are 39 coastal and island countries, and most African ports are in an advantageous geographical position (Cheng and Zhang, 2018), not only to serve coastal nations, but also to reach land-locked countries, such as Mali, Zimbabwe, Uganda, Rwanda and Burundi, through transport corridor infrastructure. Currently, African countries are generally in the early to mid-stage of industrialization (Chen et al., 2014). African coastal ports have become vital infrastructures for the African continent to participate in economic globalization and to function as gateways for international trade with China and the rest of the world.

"China's Statistical Bulletin on Foreign Direct Investment - 2017" shows that China's direct investment in Africa reached USD 4.105 billion in 2017. By the end of 2017, China's direct investment stock in Africa reached USD 43.265 billion. The cumulative investment in African ports amounted to USD 25.549 billion covering 24 seaports in 20 African countries. Figure 1 shows the situation of China's port investment in Africa since 1997.

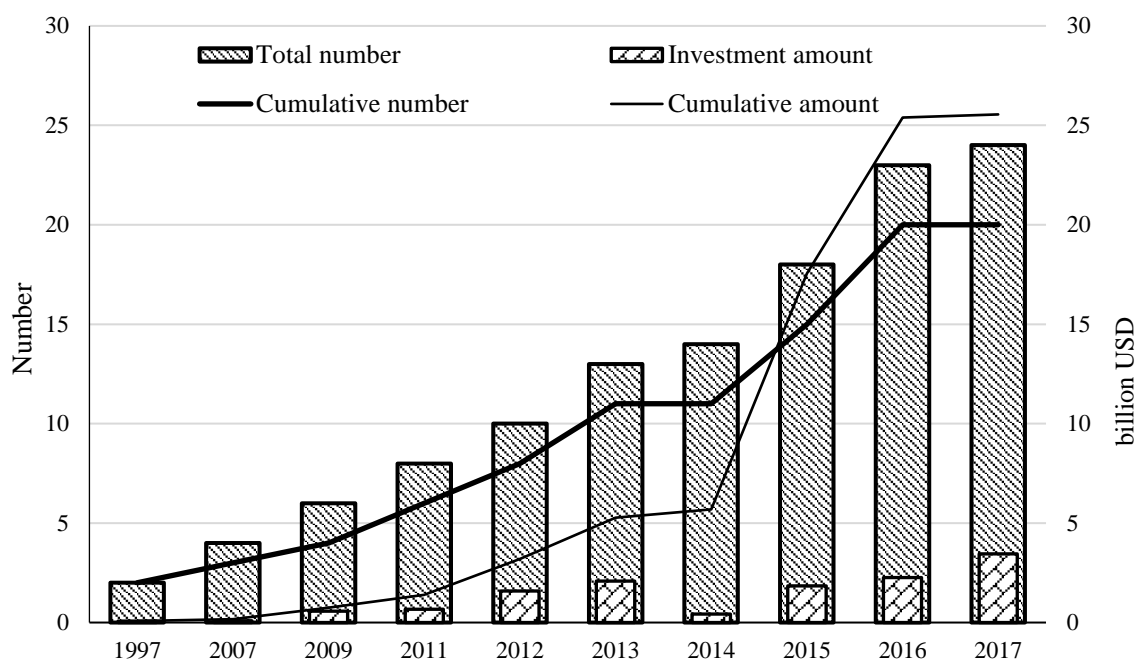


Figure 1 The number of projects and amount of China's investment in African ports
 Source: own compilation based on China's Statistical Bulletin on Foreign Direct Investment

After the Beijing Summit of the China-Africa Cooperation Forum at the end of 2006, China developed 48 measures to promote China-Africa cooperation. In the same year, China launched "China's Africa Policy". The main contents include: encouraging and supporting China's enterprises to invest in Africa; continuing to provide preferential loans and preferential export buyer credits for Africa; exploring new paths and new ways to promote investment cooperation with African countries; and, strengthening cooperation with Africa in infrastructure construction, such as transportation, communications, water conservancy and electricity (State Council Bulletin, 2006). Since then, China's investment in Africa started to accelerate. In 2007, China's annual investment in Africa reached USD 1.574 billion or a growth of 203% compared to 2006. By the end of 2007, China's cumulative investment stock in Africa had increased to USD 4.5 billion (Huang, 2018). However, in the 2-3 years after the global financial crisis in 2008, the growth rate of China's investment in Africa and in African ports decreased. Affected by the unrest in Libya, China's port investment growth rate in Africa fell to a low point in 2013. Total FDI (Foreign Direct Investment) from all sources inflows in Africa reached USD 57.24 billion in 2013 (+3.7% compared to 2012) and USD 55 billion in 2014 (minus 3%) (Zhang, 2015).

In 2013, Xi Jinping made his first visit to Africa after taking up his post. At the end of the same year, he introduced the BRI, which is committed to the interconnection of the continents of Europe, Asia, Africa and the adjacent oceans. The BRI also supports the development of regional bilateral and multilateral win-win communities of shared interests, of common future and of responsibility through multi-level exchanges and cooperation among relevant countries. The initiative aims at a diversified, independent, balanced and sustainable development in the countries along

the land-based 'belt' and maritime-based 'road' (Chen, 2018). After the introduction of the BRI in 2013, China's investment in the countries along the "Belt and Road" increased especially in African countries. At the China-Africa Summit held in South Africa in 2015, President Xi Jinping announced that China would provide USD 60 billion in aid and loans to Africa. As a result, the year-on-year growth rate of China's port investment in Africa reached 338% in the same year.

However, in 2016 the global FDI fell by 7% mainly because of the economic difficulties faced by the primary commodity exporting countries, a weakened profitability of multinational corporations, as well as the stricter measures adopted by some countries against inversion transactions to fight tax avoidance. Given the global investment environment, total direct investment and construction contracts of China along the Belt and Road decreased by 6.3% in 2016, and the growth rate of China's port investment in Africa also decreased significantly. In 2016, China's non-financial direct investment in Africa amounted to about USD 3.3 billion in the areas of construction, leasing and business services, mining, manufacturing, wholesale and retail (Li, 2017).

In summary, China's direct investment in Africa expanded over the past decades from a small number of host countries to a large number of nations, from small investment amounts to large amounts, from a narrow range to a wide range of fields, and the investment subjects also tend to become more diversified. The increased involvement of Chinese interests in Africa has intensified the debate on the benefits, modes and risks linked to these investments (Chen et al., 2016; Mourao, 2018). Therefore, the question can be raised on how to further improve the quality and efficiency of China's investment in Africa, so that these investments contribute to a balanced African development and support the goal of building a stronger China-Africa community. In this vein, this study analyzes Chinese investments in and operation of African port infrastructure. Starting from a literature review on Chinese involvement in overseas ports (Section 2), this paper concentrates on three key research themes:

1. An examination of the spatial distribution of the investments of Chinese interests in African ports in view of a better understanding of the geographical focus of China's port investment spree in Africa (Section 3);
2. An analysis of the main forms of participation used for investment and operations in African ports (Section 4);
3. An assessment of the use of the forms of participation by the main Chinese companies active in African ports.

The above analysis is followed by a number of recommendations and suggestions on the forms of participation for the involvement of Chinese companies in African ports (i.e. per company and per region). We conclude the paper with a summary of the findings and some thoughts on the future development of investment modes.

2. Literature review

In the past decade, an increasing number of researchers have analyzed the internationalization of infrastructure investments by China and other nations in Africa. Such investments tap into the economic development potential of the regions concerned. For example, Lee et al. (2012) studied the economy-wide impacts of port development in South Africa and found that ports are regarded as an economic infrastructure and catalysts for the economies they serve, for example through changes in freight costs. The results support the economic significance of port development, as a means of promoting growth, trade and employment, in South Africa.

In line with the three research themes presented in the previous section, a first research dimension in extant literature relates to the spatiotemporal evolution of direct investment in Africa and its influencing factors. Li et al. (2017) show that Chinese investment in Africa has gradually shifted from resource-based industries (such as geological exploration and development) to manufacturing, leasing, and business service industries, and the subsidiaries invested in Africa have gradually extended upstream and downstream of the industrial chain. The results of the econometric model show that the attributes of the host country and its political and economic proximity to China determine the spatial distribution of China's FDI in Africa. As a latecomer in Africa, Chinese companies, especially non-state-owned enterprises, often choose the countries or regions with less investment and with unstable political conditions to avoid competition with investors from developed countries; since 2009, resource-oriented investments by Chinese enterprises have gradually decreased and investments have shifted to market-oriented sectors. Du et al. (2015) analyzed the spatial distribution of China's direct investment in Africa in the period 2007-2011. The empirical results show that the spatial distribution of China's direct investment in Africa directly relates to the host country's wealth gap, and level of urbanization. Lee et al. (2017) make a link between the spatiotemporal evolution of China's direct investment and the BRI, focusing on its key structural elements, such as transport corridors, city clusters, dry ports, infrastructure, zoning, and area development. The authors study the expected impacts of the BRI on trade and implications on structural changes in transport systems, port networks, and international logistics. Mooney (2016) found that Japan has been seeking to re-establish a leading investment position and influence in Africa. Japan's investments in Africa have so far been focused on the ports of Mombasa in Kenya and Ncala in Mozambique. In order to enhance regional economic activity and intra-Africa trade, Japan is investing heavily in hinterland transport and trade connections and transport corridors in Africa. Japanese-funded transport infrastructure projects are underway over much of the east coast of Sub-Saharan Africa, from Sudan and Eritrea as far as South Africa, as well as in West Africa around Ghana, Togo, and Cote D'Ivoire.

A second research dimension concerns the entry modes used for investments in African ports. Business (2008) analyzed the high levels of investment in African rail, roads and ports by looking at the mixture of public, private and donor funds. Deregulation and liberalization have allowed international port companies to bid for concessions to

operate many of the continent's port terminals, while private-sector operators have also begun to take over some key railway infrastructure. Xie et al. (2017) summarized China's port investment in foreign countries and the corresponding modes, and further analyzed the impacts of the BRI on the port and shipping industry. The authors demonstrate that investments have mainly concentrated in political and economic stable countries in Southeast Asia, South Asia, the Middle East, Africa, and Europe. The modes of overseas investment by Chinese-funded enterprises mainly include joint ventures, mergers and acquisitions, BOT (Build Operate and Transfer), and franchise rights. Port investments in developed areas are mostly based on joint ventures and mergers and acquisitions, while in less developed areas, due to lack of funds, mostly based on the BOT mode.

The third research dimension relates to the use of the entry modes by specific actors. Chen et al. (2019) clarified the attributes and paths of Chinese enterprises entering overseas ports in terms of regional structure, participating entities, and equity changes, and then summarized the main modes by which the enterprises entered overseas ports. The results show that the spatial pattern of Chinese overseas port investment has undergone five stages of development, namely sporadic distribution, nearest layout, global proliferation, local agglomeration, and overall stability. In the sporadic distribution stage (before 2000), Chinese firms' investment and construction in overseas ports was concentrated in North Africa, including only two ports (Nouakchott port and port Sudan). Shortly after 2000, overseas port investment of Chinese firms concentrated on ports in proximity of other ports which already received investments by Chinese firms (i.e. nearest layout phase). Since 2009, China's overseas port investment has grown rapidly and is in the stage of global diffusion. In only four years, 15 new overseas port projects were added. In terms of location pattern, the distribution of overseas port investment of China in this stage shows a clear diffusion, especially in Europe and Africa. Since 2013, China's investment and construction in overseas ports has shown an explosive growth. From the perspective of location patterns, this stage shows local agglomeration compared to the previous global proliferation stage. In this stage, China's overseas port investment is mainly concentrated in hub ports and trunk ports along the "Belt and Road". Since 2017, the spatial distribution of China's overseas port investment has been further optimized, and gradually expanded to South America. Some port projects have entered the operational stage, while others are still in a planning phase.

The investment entities include terminal operators and infrastructure companies. However, COSCO Shipping Ports, the terminal operating company of the COSCO group, has only a small involvement in African ports through its stake in the Suez East container terminal. COSCO's investment strategy is to hold in assets in overseas port terminals for a long time by aiming for a controlling stake. Among the seven overseas terminals acquired by COSCO in recent years, in four of them COSCO has a holding ratio of over 50%. However, as discussed later, African countries prefer to retain their port ownership, which impedes COSCO's investment enthusiasm in Africa. Furthermore, COSCO prefers to invest in bigger ports at strategic locations in the global container shipping network. Few ports in Africa can satisfy this condition. Finally, the main aim of COSCO's Going-Out strategy is to optimize its port presence in Europe's Mediterranean region. Among its seven acquisitions of port terminals in the last five years, except for Khalifa Port, the other six are in the European part of the Mediterranean.

Currently, the goal of Chinese overseas port investment has shifted from equity participation to obtaining a controlling stake. The overseas port entry modes include infrastructure project construction, management right

transfer, the acquisition of equity in terminal concession Special Purpose Vehicles (SPVs), and the transfer of terminal operation rights. Chen et al. (2018) analyze the overseas port investment policy for China's central and local governments in the context of BRI and propose suitable implementation modes for the internationalization strategy of Chinese ports. Guo et al. (2018) summarized the developing status of and foreign investment in African port infrastructure and focused on the development and prospects of Chinese enterprises investing in African ports. They found that currently Chinese companies mainly invest in terminal construction in African port, and gradually expand the port business network in the African region. However, the operating models need to be further strengthened.

3. The Spatial Distribution of China's Investment in African ports

The first part of the presented analysis consists of an examination of the spatial distribution of the investments of Chinese interests in African ports. Geographically, the continent of Africa can be divided into North Africa, East Africa, West Africa, Central Africa and South Africa. Although the western and southern parts of Africa are not part of initial Maritime Silk Road of BRI, the New Maritime Silk Road proposed by Lee et al. (2018) covers all African ports. When studying the utilization of Africa's coastline resources, the coastline can be divided into East Coast, West Coast, South Coast and North Coast. China's port investment is mainly concentrated along the east and west coasts of Africa. West Africa has attracted the largest amount of Chinese port investment (US\$ 6.533 Billion), followed by East Africa (US\$ 3.688 Billion), then North Africa (US\$ 3.559 Billion), and finally South Africa (US\$ 100 million).

Along the east coast of Africa, the port of Bagamoyo (currently shelved) was the biggest planned project, with the port of Djibouti coming in as second. The port of Bagamoyo is located at the narrow strip of eastern Tanzania bordering the western Indian Ocean. It connects with the vast African continent in the north, and is located near the Rufu estuary. The Rufu River is a river in the eastern part of Tanzania. It originates in the Uluguru Mountains and flows eastward to the northeast and finally enters into the Zanzibar Strait of the Indian Ocean north of Bagamoyo. Cargos from the African continent, the Middle East, Europe and Asia can be distributed from the port of Bagamoyo to vast hinterland regions (Wang, 2013), although Mombasa and Dar es Salaam will most likely remain the main gateway ports in the region. The Special Economic Zone of the port of Bagamoyo was announced as a USD 1 billion cooperation project between China and Tanzania following the China-Tanzanian railway project (Wang, 2013). However, at the time of writing, the project was stalled due to the failure of the parties involved to agree terms. China has also withdrawn from the China-Tanzania railway project, which was taken over by Turkish companies. The Bagamoyo port dispute will be discussed in section 5. The strategic position of the port of Djibouti in the global maritime network is also important. The cargo volumes passing the Mande Strait near Djibouti represent about 14% of global trade. Due its location at the southern side of the Red Sea, Djibouti's economic and strategic position from a maritime network perspective is comparable to that of the Suez Canal.

China's largest investment along the west coast of Africa is found at the port of Abidjan, followed by the port of

Conakry. West Africa is rich in bauxite, petroleum, diamonds, gold, iron ore and other minerals, and is also the world's key producer of coffee, cocoa, cotton and rubber. Chinese actors have invested in four West African ports, i.e. Abidjan, Lagos, Tema and Conakry. While China is absent from the main oil exporting ports in West Africa, the country has not been absent from oil investment in West Africa, particularly in Nigeria¹. For a long time, China has mainly obtained Africa's resources and energy through trade cooperation, and its oil concerned investment in Africa started late. Till now West Africa has been more inclined to cooperate with European and American companies. European and American oil companies have already occupied a dominant position in oil production in Africa, while China has only a few oil and resource projects in West Africa. At present, the port of Conakry is one of the largest ports in West Africa and the gateway port for landlocked countries in the region. China has invested US\$3 700 million in Conakry. The project has expanded China's influence in West Africa and provided convenient and reliable transport guarantees for China's mining projects in Africa in the area of iron ore and bauxite.

3. Modes of China's Investment in African ports

The second research dimension of the paper consists of an analysis of the main entry modes used for investment and operations in African ports. The required data to perform this part of the analysis could not be obtained easily from published statistical material. Therefore, the data collection process was mainly based on information available online and provided by Chinese and African companies and government entities involved in African ports.

The data collection process resulted in a list of projects in African ports with involvement of four different Chinese companies, i.e. China Merchants Holdings (International) (CMHI), China State Construction (CSC), China Harbour (CHEC) and China Road and Bridge (CRBC), see Table 1.

Table 1. Summary of the collected data on China's investments in African ports

¹ In 2009, Sinopec spent US\$7.24 billion to acquire the Swiss company Addax, whose main assets are located in Nigeria. China and Nigeria have established the Lekki Free Trade Zone, which provides a platform for Chinese companies to invest in energy in Nigeria. In July 2010, China State Construction Engineering Corporation signed an agreement with the State Oil Company of Nigeria to invest US\$ 8 billion to build an oil refinery in the Lekki Free Trade Zone. In the same year, China National Offshore Oil Corporation spent nearly US\$3 billion to acquire 45% equities in Nigeria's offshore oil block OML130. In November 2012, Sinopec reached a preliminary agreement with Total of France on the purchase of its equities in Nigeria's onshore oil block. The transaction price is expected to reach US\$ 2.4 billion. In September 2010, the China Development Bank and the Ghanaian government signed the "First Phase of US\$ 3 billion General Cooperative Financing Framework Agreement". Based on the Agreement, the two parties would cooperate in the fields of oil and gas, energy, infrastructure, agriculture, and so on. During the same period, Chinese energy companies such as China National Offshore Oil Corporation were also actively seeking cooperation with the Ghana National Petroleum Corporation (GNPC) through the China-Africa Development Fund to explore and develop Ghana's offshore oil and gas fields.

Enterprise	Country	Year	Project	Amount	Type
China Merchants Holdings (International) <u>CMHI</u>	Nigeria	2011	equity project of Tin Can Island pier container co., LTD.	\$154 million	Acquisition
	Togo	2012	Lome container terminal project	€150 million	Acquisition
	Djibouti	2012	Acquired 23.5% of the issued share capital of Port de Djibouti S.A. (PDSA)	€1.44billion	Acquisition
China State Construction <u>CSC</u>	Algeria	2016	building Cherchell port	\$3.3 billion	BOT
	Djibouti	2014	building Doraleh port	\$421.7 million	EPC
China Harbour <u>CHEC</u>	Cameroon	2011	construction of Kribi deep water port	\$497 million	BOT
	Ivory Coast	2013	expansion of Abidjan port	\$933 million	EPC+F+I
	Madagascar	2015	Tamatave deep water port	\$1 billion	EPC+F+I
	Ghana	2016	expansion of Tema port	\$476 million	EPC
	Guinea	2016	Conakry port upgrade	\$770 million	EPC+F+I
	Mozambique	2016	to explore the construction of Maputo port	\$1 billion	BOT
	Tanzania	2017	to undertake the expansion of Dar es Salaam port	\$154 million	EPC
	Sudan	1997	contracting projects of Sudan port	\$77 million	EPC+F+I
	Egypt	2009	Port Said container terminal	\$219 million	EPC
	Sao Tome and Principe	2015	building deep-water port	\$800 million	PPP
China Road and Bridge <u>CRBC</u>	Mauritania	2009	expansion of Nouakchott port	¥290 million	EPC+F+I
	Equatorial Guinea	2009	reconstruction and expansion of Bata port	€315 million	EPC+F+I
	Kenya	2013	3 berths at lamu port	\$484 million	PPP
	Gabon	2013	Gentil port manji deep water port project	\$663 million	EPC+F+I
	Republic of Congo	2016	building pointe noire new port	\$2.3 billion	PPP

The last column of Table 1 reveals that different business and investment modes are used for China's port investment in Africa. Currently, the most common business modes used in a port investment context are EPC (Engineering Procurement Construction) (3 projects); EPC+F+I (Engineering Procurement Construction + Finance + Invest) (7), BOT (Build, Operate, Transfer) (3); other PPP arrangements (Public Private Partnership) (4), and acquisition (3).

Under the *EPC arrangement*, a contractor is obliged to deliver a complete facility to a developer who need only turn a key to start operating the facility. The facility needs to be delivered by a guaranteed date for a guaranteed price and it must perform to the specified level. The contractor is responsible for all project activities from the design phase all the way through the construction phase, including engineering, procurement, construction, commissioning and handover activities of the project, leaving the owner with no responsibilities except for turning the key at project delivery. EPC contracts do not necessarily represent long-term investments in African ports: they are construction contracts that are paid for by the port authority or an African government. Their attraction is that they provide working capital during the construction period - depending on whether the contract includes milestone payments once each phase of the construction work is completed - transfer time and cost over-run risks to the Chinese contractor, and in many cases are awarded in conjunction with longer-term loan financing from Chinese banks. Joint ventures are means of accessing resources held by other organizations. Correct partner selection may facilitate innovations in construction technology, reduce the project's cost and time, and increase the performance of EPC projects. The EPC+F+I mode is a variation of EPC which also includes finance and investment modalities to be secured by the

contractor. Considerable academic work has focused on risk identification and qualitative and quantitative assessment of EPC type of projects (Salah and Moselhi, 2016).

Public-private partnership (PPP) in broad terms is a long-term contract between the government and the private sector in providing a specific public service (PPPIRC, 2014). Such partnership requires the risks, responsibilities and return to be shared between the public and private sector. Table 2 shows the characteristics of the main types of PPPs. Several studies discuss the application of PPP schemes in road, rail, airport, seaport and dry port projects (The World Bank, 2003; Turpin, 2013; Farrell and Vanelander, 2015; Nguyen and Notteboom, 2017). The use of PPP arrangements is widespread in the seaport industry. Macario (2014) examined the current state of knowledge on the use of PPPs in the development of the worldwide port network, while Aerts et al. (2014) used a multi-actor analysis to explore the critical success factors (CSFs) for sound implementation of PPPs in the port context, and to determine the diverging opinions of stakeholders with regard to the importance of these CSFs. The latter study points to eight key CSFs in port PPPs: the concreteness and preciseness of the PPP contract, the ability to appropriately allocate and share risk, the technical feasibility of the project, the commitment made by partners, the attractiveness of the financial package, a clear definition of responsibilities, the presence of a strong private consortium and a realistic cost/benefit assessment.

Table 2. Characteristics of the main types of public-private partnerships

Type of PPP	Mode of entry	Operation and maintenance	Investment	Ultimate ownership	Typical duration (years)
Management contract	contract	Private	Public	Public	3-5
Leasing	contract	Private	Public	Public	8-15
Rehabilitate, operate and Transfer (ROT)	concession	Private	Private	Public	20-30
Rehabilitate, Lease/Rent and Transfer (RLRT)	concession	Private	Private	Public	20-30
Merchant	greenfield	Private	Private	Public	20-30
Build, Rehabilitate, Operate and Transfer	concession	Private	Private	Public	20-30
Build, Operate and Transfer (BOT)	greenfield	Private	Private	Semi-private	20-30
Build, Own, Operate and Transfer (BOOT)	greenfield	Private	Private	Semi-private	30+
Build, Lease and Own (BLO)	greenfield	Private	Private	Private	30+
Build, Own and operate (BOO)	greenfield	Private	Private	Private	30+
Partial privatization	divesture	Private	Private	Private	30+

Source: Hammami et al. (2006)

Overall, PPPs offer advantages in terms of the acceleration of public infrastructure provision; faster implementation and lifecycle cost reduction thanks to the private involvement in construction, operation and maintenance; better risk allocation where the risk is transferred to the party best able to manage it; better performance and higher efficient use of resource by the private operator; and improvement of public management by focusing on the roles of regulating, planning and monitoring (European Commission, 2003). In the case of Chinese investment in African ports, the term 'private' in the PPP context is somewhat misleading as the Chinese partners in

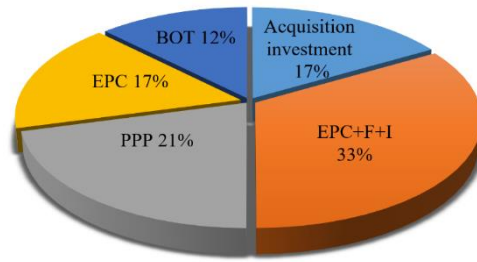
PPP arrangements in African ports typically are state-owned companies as will be discussed in section 4. Still, the overall PPP settings and modalities apply.

As *Build-Operate-Transfer (BOT)* is a common PPP type used in African port development, BOT will be discussed as a separate investment mode. Under BOT, a government or public authority grants a concession or a franchise to a company to finance and build a specific port facility. The company is entitled to operate the facilities and to obtain revenue from specified operations or the full port for a designated period. The operator takes all commercial risks during the concession. At the end of the concession period, the government retakes ownership of the improved assets.

Acquisitions in the context of this study typically are equity shares in a Special Purpose Vehicle (SPV) set up to hold a port concession (e.g. CMHI's Tin Can Island acquisition). A shareholding of more than 50% allows the acquirer to make decisions about the newly acquired assets. An acquisition allows the acquirer to achieve economies of scale, diversification, greater market share, increased synergy, cost reductions, or new niche offerings. It can also serve as a means to enter a foreign market, as a growth strategy, to reduce excess capacity or to gain access to technology.

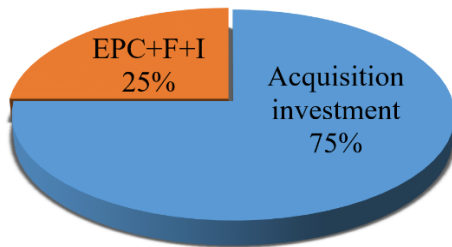
The choice of port investment mode is mainly determined by the project's background, the investing bodies or actors involved, and the socio-economic conditions in the host country. The investment mode will affect the benefits of the investors, the risk distribution between the parties involved, the strategies and policies of the host country and the bilateral relationships between China and the project-host country.

The modes used in relation to China's investment in African ports are summarized in the top part of Figure 2. It can be seen that EPC+F+I is the most widely adopted entry mode, accounting for 33%, followed by the PPP mode (21%; excluding BOT), EPC mode (17%), the acquisition mode (17%) and the BOT mode (12%). As we will discuss later, the acquisition mode has only been adopted by CMHI.

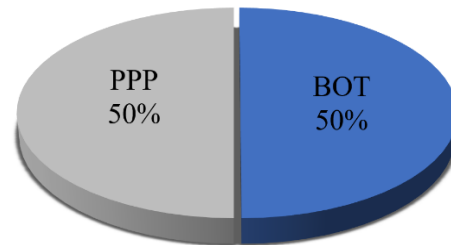


Modes used in China's port investment in Africa in terms of project numbers (1997-2017)

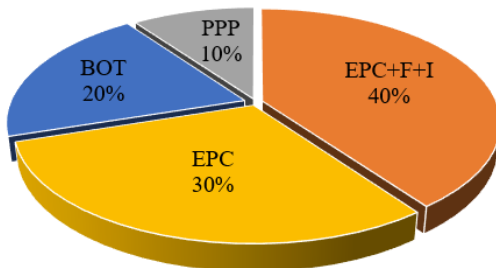
Note: PPP here includes all PPP types except for BOT



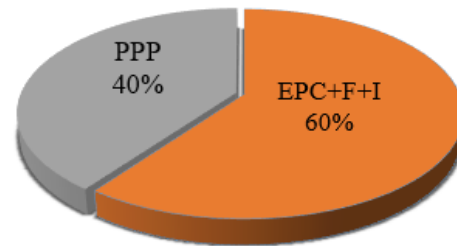
China Merchants Holdings (International) (CMHI)



China State Construction (CSC)



China Harbour (CHEC)



China Road and Bridge (CRBC)

Figure 2. The entry mode of major Chinese investors in terms of project numbers in African ports

There are several reasons for the EPC+F+I mode ranking first. First, most African countries are developing countries. Currently, their economies are growing rapidly, but many of the infrastructures are outdated (Wang, 2018). The available internal funding typically is insufficient to meet the investment needs in transport infrastructure, such as ports, highways and railways. Therefore, EPC mode has gradually lost its advantage as Chinese contractors are increasingly asked to meet the finance and investment needs. Zhang (2018) believes that EPC+F mode has gradually become an important means for local governments to promote infrastructure construction, which can help local governments raise funds and solve practical problems. Moreover, the operation of this mode is relatively simple, which can better meet the requirements of local government and the construction party for implementation efficiency and short-term performance. In addition, in recent years, facing the ever-increasing financing threshold, Chinese

enterprises had to change from “single entity” to “cooperative entity group”. This implies that the high financing thresholds pushed Chinese companies involved in design, construction, shipping, freight delivery and industrial development into forming consortia in view of investment in and operation of port terminals in Africa. These clusters of Chinese companies help to solve the problems related to the lack of funds and of technologies or skills in the field of engineering, design and construction in the project-host countries. Therefore, the EPC+F+I mode has gradually become mainstream.

Secondly, giant Chinese state-owned enterprises, which have actively been involved in African business for a long time, have developed a competitive advantage in engineering design and construction. Still, their comprehensive competitiveness in some specialized professional fields is insufficient. By providing differentiated services (such as funding, business management and operation) in addition to technical services in the area of engineering, design and construction, these state-owned enterprises can gain a stronger competitive position in attracting projects in the African large-scale infrastructure construction market. Therefore, giant China’s state-owned enterprises gradually abandoned the EPC mode and adopted the EPC+F+I mode to invest in African ports. On the one hand, the EPC+F+I mode supports the integration of China’s high-quality financial resources in view of developing new markets in Africa. On the other hand, this mode proved to be more in line with the needs of African countries to develop port infrastructure in a timely manner despite a lack of funds and financing channels. Many African countries not only have limited knowledge and experience in state-of-the-art technologies for port terminal design and construction, but also need huge amounts of money for developing such mega projects. Tan (2016) believes that the EPC+F mode integrates project financing and contracting links, giving full play to the competitive advantages of large international engineering contracting enterprises in financing, design, procurement and construction while helping owners to solve the source of capital, and promoting the expansion of enterprise scale and the growth of benefits.

Finally, the EPC+F+I based project of G2G (Government to Government) priori buying (low cost of preferential export buyer’s credit) is a strong support pillar for China’s ‘going out’ strategy. When using the EPC+F+I mode, the Chinese company conducts business negotiations with the owner to determine the cooperation and financing intentions. After signing the MOU, the Chinese company will make a feasibility study to determine the project scale and investment quota, and then conduct a contract negotiation with the owner. After that, a main contract will be signed by the two parties upon the Chinese company obtaining the “License for Negotiating Bids” from the Chinese embassy in the host country. The follow-up works will be done simultaneously. On the one hand, the owner issues a loan application letter accompanied with the related applying materials. On the other hand, the investment equity will be allocated to each party and a corresponding agreement will be signed. Finally, all of the documents will be submitted to the Chinese governmental financing agency. The EPC mode is beneficial to the overall planning and coordination of an entire project. The adding of the “F” (finance) component helps to solve the problem of insufficient funds in the current development stage of African countries. Chen (2018) believes that the application of the EPC+F mode can not only bring forward the advantages of advanced technology and the management level of China’s large engineering enterprises, but also, with the support of national strategic policies, coordinate financial and insurance institutions to jointly solve the problem that overseas owners are eager to implement infrastructure projects but lack the corresponding funds. The “I” component (invest) enables China-funded enterprises to share risks with project-host countries in Africa and to reduce owners’ risks. The EPC+F+I mode serves the mission of building a community of interests with relevant countries. It also enables Chinese state-owned enterprises to obtain dividends from equity investments and to increase the return

on investment.

The second most adopted business mode of China's port investment in Africa is the PPP mode (excluding BOT), which in the China-Africa context implies a combination of local governmental resources with the resources from China's state-owned enterprises to achieve an efficient construction and operation. Lee (2017) believes that the guarantee is provided by the Chinese government. The involvement of multilateral development banks, and existence of a dedicated PPP unit are important for a project's success. Through the PPP mode, Chinese state-owned enterprises acquire the rights to manage and use the asset, and assets must be returned to the public sector at the end of the lease period. The state-owned Chinese enterprises, which have abundant money and strong operational capability, can sign contracts with the government of the host country to construct and operate port terminals. Although the host countries lose the rights to manage and use the asset, the port terminals funded and operated by the Chinese side will not only provide transport services for local the economy but also serve as powerful engines for economic and social growth.

African countries with a low operational efficiency, a strong competitive pressure, and lack of funds and technology for supplying public goods are likely to adopt the PPP mode. African countries prefer PPPs to wholly private investments in ports with full ownership rights because they wish to maintain some level of control over what they regard as strategic assets. In this situation, win-win situations are envisaged through the multiplier effects of the PPP mode on economic growth and social development of the host country.

The share of the BOT mode in total China's investment in African ports is rather small. Savvides and Demetris (2016) mentioned that BOT schemes have effectively gained international recognition and acceptance as a finance apparatus to design, construct, operate and manage large scale public functions and projects by private investors at no or minor costs to public authorities worldwide. Nonetheless, one may need to bear in mind that BOT project financing entails significant risks. Public authorities are encouraged to put in force special guidance and legislation for the viable governance of the various dimensions involved in BOT project financing. Also, Yan (2010) found that BOT projects are usually risky and induce huge capital investments.

The BOT mode has been mainly adopted in host countries which are short of money and technology but have strong port demand, a high port terminal operating profit and good investing prospective. As explained earlier, under the BOT mode, a Chinese investing body is given a concession for operating a port terminal for a specific period after completion of the construction phase. After the concession period, the operator must transfer the port facility to the authority in the host country. The host country does not have the ownership, the management and operating rights of the port terminal during the entire concession period. However, BOT makes it possible for the host country to obtain much-needed terminal capacity and services and to enjoy the external benefits induced by port construction and operation. Furthermore, the country will receive the ownership and operating rights once the concession term ended. The BOT mode helps the host country to solve bottlenecks in economic development caused by poor port service delivery and capacity. For China's investors, the BOT mode offers the possibility to recover investment costs in a short period of time and to realize high profits during the concession period.

The biggest difference between BOT and other PPP types in a Chinese investment context is found at the level of "transfer" and "risk". Under most other PPP modes, the government of the host country needs to share the investment risk. Chan and Albert (2011) indicated that an objective, reliable, and practical risk assessment model for PPP projects and an equitable risk allocation mechanism among different parties are crucial to the successful implementation of PPP

projects. The two sides can maximize the total investment benefits through negotiation on gain and loss sharing. When opting for the BOT mode, the Chinese investor takes almost all the risks in investment, construction and operation. The business risks are high, but so are the potential profits. If both sides want to obtain profits by holding the port terminals for a long period of time, it will be difficult to sign a contract that can satisfy the needs of both sides.

4. Differences in port investment modes between various Chinese investors in Africa

The next part of the presented research consists of an assessment of the use of the identified modes by the main Chinese companies active in African ports, i.e. the four companies presented in Table 1 (mainly construction enterprises).

Figure 2 shows the investment modes used by the four enterprises. CMHI is the only large investor which opted for acquisitions through purchasing PPP concession rights of three African ports, accounting for 75% of its total port investment projects in Africa. The acquisition projects include the equity purchase of the Tin Can Island container terminal limited company, the Lome container terminal project and 23.5% of the issued share capital of Djibouti Port.

CMHI mainly opts for direct ownership of PPP concession rights of African ports or terminals. The threshold for foreign enterprises to invest in African ports is relatively high because ports are national strategic resources and are often managed by national port authorities (e.g. Kenia Ports Authority, Namibia Ports Authority or Tanzania Ports Authority). CMHI makes use of its existing resource advantages in the port of the country where the project is located. From CMHI's viewpoint, it usually involves quite substantial investments in port operations (e.g. mechanical equipment, terminal operating systems etc.). At the same time, CMHI can obtain profits in a short period of time through this method. Moreover, through acquisitions in Africa, CMHI can achieve economies of scale by saving costs and raising its bargaining power. This investment mode closely relates to its unique identity. CMHI is a holding company of China Merchants Group, which is a large Chinese state-owned enterprise based in Hong Kong. Since its establishment in 1872, China Merchants Group has mainly focused on the shipping and port business. After 145 years of development, China Merchants Group now owns 51 concessions in 20 countries and regions around the world. CMHI ranks sixth globally in terms of equity-adjusted throughput (Drewry, 2019). The launch of the BRI made China Merchants Group to restructure its business contents, ranges and scopes. The China-Africa Development Fund and the implementation of BRI accelerated the pace of CMHI's internationalization path with a particular focus on investments in ports with a strategic position in the global shipping network, such as Djibouti (Wang et al., 2019). During China's national "13th five-year plan" period, CMHI began to develop an integrated service concept based on the "big port + large logistics" principle, involving the creation of comprehensive port logistic ecosystems. Its aim is to develop CMHI into a world-class integrated port service provider. CMHI has its own port and investment businesses. It is more willing to strengthen and accelerate its port and terminal business by investing in new projects or acquiring good-quality terminal assets and business.

Four of the African port investment projects of China Harbour (CHEC) are based on the EPC+F+I mode, accounting

for 40% of the company's investment portfolio in African ports. These projects are Sudan Port Contracting project, expansion of Abidjan port project in Ivory Coast, Madagascar Tamatave Deepwater Port Project and Guinea Conakry Port Upgrading and Renovation Project. For another three projects (i.e. Egypt's Port Said Container Terminal project, Ghana's Tema Port Expansion project and Tanzania's Dar Es Salaam Port Expansion project), the mode of EPC has been adopted. BOT was used for two projects, namely the construction project of Cameroon's Kerry Deep water Port and Mozambique's Techobanine port (south of Maputo). The latter project is combined with the planned Ponte Techobanine Rail Line connecting Mozambique, Zimbabwe and Botswana.

China Harbour relied on the PPP mode for the São Tomé and Príncipe's deep-water port project. Thus, CHEC mainly invests in African ports using the EPC+F+I mode. CHEC is one of the first Chinese companies to engage in the international engineering business. Its main business is in countries outside China. Africa is its most important market. At present, CHEC has 9 regional centers across the world, among which four in Africa. They are the regional centers of East Africa, West Africa, Central Africa and South Africa. In the past ten years, CHEC has deployed its strengths in the field of construction engineering to build port terminals in more than ten African countries. For example, the operation of the Container Terminal in Kribi Port was its first market-oriented port equity project. In other words, it was the company's first international market-oriented operation of a deep-water port project. This step was partly taken to promote the transformation and upgrading of the company from an industrial one to a commercial entity, and to cultivate talents in port operations. This step allowed CHEC to gain experience in managing and operating port terminals in Africa, while continuing its investments to upgrade African port's infrastructure. This means that CHEC is gradually transforming from the EPC+F+I mode to the BOT model.

Two ports in Africa received investments from China State Construction (CSC). The BOT mode was adopted by CSC for the new port of Cherchell in Algeria, while the EPC mode was used for the port of Doraleh in Djibouti. CSC is China's largest engineering contracting company active in developing countries and regions. It is the world's largest residential construction builder and the only construction enterprise with three qualification certificates respectively in railway engineering, highway engineering and construction engineering. CSC operates in 100 overseas markets and is strong at infrastructure construction. For example, it has finished the Djibouti Doraleh multifunctional port (Phase I) project in a short period of time at the highest quality standards. In terms of port operations, China State Construction holds 49% of the shares of the Algerian port project. GSP, a subsidiary of its joint venture with Algiers port group, is responsible for the design, construction, operation and infrastructure management of the port. CSC is more inclined to adopt the EPC and BOT modes when investing in African ports.

China Road and Bridge (CRBC) has invested in three African ports using the EPC+F+I mode, i.e. the expansion of Nouakchott Port Terminal in Mauritania, the reconstruction and expansion of Bata Port in Equatorial Guinea and the Mandji Deepwater Port project in Gabon. The construction of the three berths at the Lamu Port in Kenya adopts the PPP

mode. In February 2016, CRBC signed a contract with the Ministry of Land and Resources Improvement and Large-scale Engineering in Republic of the Congo which would involve CBR in a PPP mode to construct the new port of Pointe Noire in Republic of the Congo for a contracted amount of USD 2.3 billion. CRBC entered the African market already in 1974. Its main business in Africa consists of the construction of roads, bridges, railways and tunnels. CRBC has undertaken hundreds of engineering projects in over 20 African countries. Only four of its 75 African projects are port related. Although CRBC has performed well in international engineering contracting and infrastructure investment, it has been innovating its business model and is trying to make the leap from engineering contractor to contractor, investor, operator, service provider and developer. Due to CRBC's traditional advantages as well as business innovation strategy, the EPC+F+I mode has become the best choice when investing in African ports with a gradual transformation to also include the PPP mode.

5. Suggestions on Mode Selection for Investment in African Ports

5.1 Investment Modes for Chinese Investors

In this section we develop and apply a methodology to assign investment modes to Chinese firms and also elaborate on which investment modes are expected to be most suited for specific African countries.

Based on Lu and Liu (2016) and Yao (2018), we identified relevant investor attributes for overseas port investment through the modes EPC, EPC+F+I, PPP and BOT respectively. Table 3 lists three categories of attributes and in each category for each mode there are several factors. To determine the importance of each factor, we have interviewed 10 experts (2 professors from Hong Kong Polytechnic University, 2 professors from Dalian Maritime University, 2 professors from Shanghai Maritime University, 2 professors from Ningbo University, and 1 professor from China Ocean university, 1 doctor from Hefei University of Technology) to give a score from 1 to 10 in terms of importance (with 1 being the lowest importance) for each factor. The average scores of the 10 interviewees are listed in Table 3. Here, we use x_{ij} representing the average score of factor j for mode i .

In a second step, a questionnaire were sent to 20 technicians and managers from the companies of CHEC, CRBC, CSC, CMHI and some related companies to make them grade the attributed factors with scores for each company. The statistics of the surveyed scores are shown in Table 4. Here, we use y_{jk} to represent the average score of factor j for company k . Then the advantage score of a company (A_{ki}^0) for an investment mode can be calculated as follows:

$$A_{ki}^0 = \sum_j x_{ij} y_{jk} \quad (1)$$

Furthermore, to make some cross comparisons, we have standardized the advantage score of a company as follows:

- (1) Assuming that all attribute factor scores equal 10, namely $X_{ij} = 10$;
- (2) Calculating the highest advantage score of a company by $\bar{A}_{ki} = \sum_j X_{ij} y_{jk}$
- (3) Adjusting the actual advantage score of a company to a standard one by $A_{ki}^1 = A_{ki}^0 / \bar{A}_{ki}$

Table 3. Importance of Factors of Investors for different Investment Modes (x_{ji} , i =mode, j =factor)

Mode \ Factor	Category 1		Category 2		Category 3	
	Factors	Score	Factors	Score	Factors	Score
EPC	<ul style="list-style-type: none"> ◇ Active in various businesses ◇ Crossing several sectors 	<ul style="list-style-type: none"> ◇ 5.57 ◇ 6.08 	<ul style="list-style-type: none"> ◇ Good international performance ◇ 50% income from international projects 	<ul style="list-style-type: none"> ◇ 5.82 ◇ 6.94 	<ul style="list-style-type: none"> ◇ Experience in many EPC projects ◇ Strong at general contracting 	<ul style="list-style-type: none"> ◇ 8.26 ◇ 8.90
EPC+F+I	<ul style="list-style-type: none"> ◇ Active in various businesses ◇ Crossing several sectors 	<ul style="list-style-type: none"> ◇ 6.32 ◇ 6.13 	<ul style="list-style-type: none"> ◇ Strong at financing capabilities ◇ Access to multiple financing channels ◇ Good at investment 	<ul style="list-style-type: none"> ◇ 7.42 ◇ 7.93 ◇ 8.28 	<ul style="list-style-type: none"> ◇ Experience in many EPC projects ◇ Strong at general contracting 	<ul style="list-style-type: none"> ◇ 7.52 ◇ 8.03
PPP	<ul style="list-style-type: none"> ◇ Having abundant funds ◇ Strong at terminal operations 	<ul style="list-style-type: none"> ◇ 5.85 ◇ 7.35 	<ul style="list-style-type: none"> ◇ Business mainly focusing on investment 	<ul style="list-style-type: none"> ◇ 6.62 	<ul style="list-style-type: none"> ◇ With various businesses ◇ Crossing several sectors ◇ Strong at risk management 	<ul style="list-style-type: none"> ◇ 6.62 ◇ 6.61 ◇ 8.25
BOT	<ul style="list-style-type: none"> ◇ Having abundant fund ◇ Strong at terminal operations 	<ul style="list-style-type: none"> ◇ 7.26 ◇ 7.54 	<ul style="list-style-type: none"> ◇ Strong at financing ◇ Access to multiple financing channels ◇ Good at investment 	<ul style="list-style-type: none"> ◇ 8.00 ◇ 7.66 ◇ 7.25 	<ul style="list-style-type: none"> ◇ Own construction team ◇ Own technicians for operation ◇ Ability of design, procurement & construction 	<ul style="list-style-type: none"> ◇ 7.60 ◇ 7.38 ◇ 7.10
Acquisition	<ul style="list-style-type: none"> ◇ Active in various businesses ◇ Crossing several sectors ◇ Strong at risk management 	<ul style="list-style-type: none"> ◇ 6.50 ◇ 6.45 ◇ 8.12 	<ul style="list-style-type: none"> ◇ Terminal operating capabilities 	<ul style="list-style-type: none"> ◇ 7.9 	<ul style="list-style-type: none"> ◇ Strong at financing ◇ Access to multiple funding channels ◇ Good at investment 	<ul style="list-style-type: none"> ◇ 7.81 ◇ 7.43 ◇ 7.67

Table 4. Average and standard deviation of the Scores of Factors of each company (y_{kj} , k =company, j =factor)

	CMHI		CSC		CHEC		CRBC	
	Average	St. Dev.	Average	St. Dev.	Average	St. Dev.	Average	St. Dev.
Active in various businesses	7.89	1.80	7.16	1.93	6.89	1.25	5.89	1.83
Crossing several sectors	8.00	1.92	6.26	2.10	5.58	2.16	5.47	2.06
Good international performance	7.42	2.01	6.47	1.82	8.95	0.22	6.47	2.04
50% income from international business	8.11	1.68	7.16	1.31	8.79	0.52	7.32	1.49
Strong at financing	8.68	1.17	7.58	1.27	7.42	1.39	7.42	1.27
Experience in many EPC projects	5.89	2.75	6.84	2.28	7.00	2.27	7.42	2.18
Strong at general contracting	6.21	2.69	8.00	1.41	7.79	1.15	7.74	1.33

Own construction team	6.84	0.81	8.32	2.10	7.32	2.64	5.32	1.56
Own technicians for operation	8.89	0.31	6.26	2.65	6.58	2.76	4.11	1.21
Ability of design, procurement and construction	5.89	2.73	8.26	1.68	7.79	2.26	7.79	2.24
Access to multiple financing channels	6.63	1.04	7.79	1.15	7.05	1.57	9.00	0.00
Good at investment	7.05	1.00	6.95	1.47	6.47	1.57	8.89	0.31
Having abundant funds	8.11	2.31	7.26	2.24	6.74	2.22	6.89	2.29
Terminal operating capabilities	9.00	0.86	7.42	1.66	7.05	1.70	6.74	1.83
Business focusing on investment	6.84	2.60	5.32	2.34	5.00	2.32	5.05	2.21
Strong at risk management	8.89	0.31	8.16	1.14	7.68	1.59	6.74	0.91
Strong at terminal operations	9.00	0.00	4.05	3.05	5.32	3.08	3.84	1.90

The standardized advantage scores of a company on each investment mode are shown in Figure 3. All of the standardized advantage scores are higher than 65 points, which indicates that all four Chinese companies in principle have attributes to adopt all five port investment modes in Africa. While the overall scores are not that far apart, some differences can be observed when comparing the results. CMHI achieves the highest scores among the four companies for the investment modes PPP, Acquisition and BOT. CMHI is strong at financing (8.68) and risk management (8.89), own operational technicians (8.89) and terminal operating capabilities (9.00). CSC scores high on the modes BOT and EPC+F+I. The giant general construction company is strong at financing (7.58), at general contracting (8.00) and risk management (8.16), and has a strong own construction team (8.32) and strong ability in the areas of design, procurement and construction (8.26).

Both CHEC and CRBC are wholly-owned subsidiaries of China Communications Construction (CCC). CHEC attains the highest score of all four companies for the EPC investment mode, while CRBC shows the strongest results for the EPC+F+I mode. On behalf of their parent company CCC, the two companies work on overseas port related projects and highway related projects respectively. Currently, CHEC has a good international performance (8.95) with about 50% of its revenue coming from international businesses (8.79). It is also strong at general contracting (7.79) and has a strong ability in the area of design, procurement and construction (7.79). While CRBC is strong at general contracting (7.74) and good at investment (8.89) and has ability of design, procure and construction (7.79) and multiple financing channels (9.0).

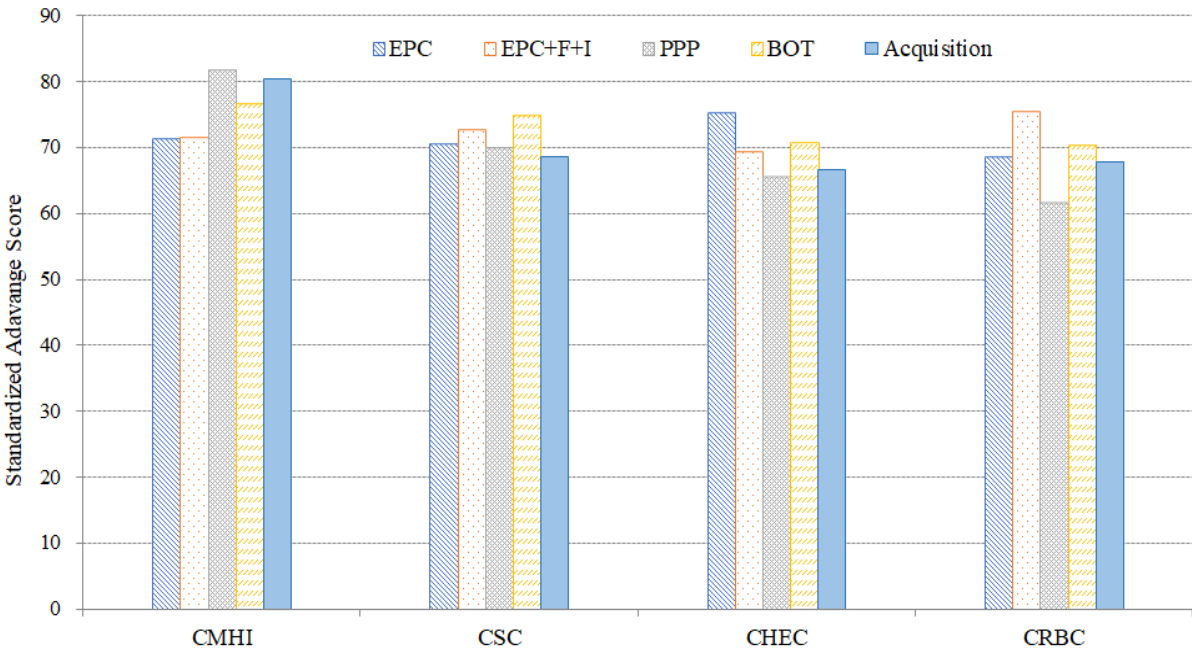


Figure 3 Advantages of the 4 Companies on modes of port investment in Africa

5.2 Suggestions on mode selection for African countries

Not all investment modes might be equally suitable for an African country. In an explorative analysis, Lu and Liu (2016) identified a small number of attributes which can help to guide the selection of the most appropriate investment mode for a country. They limited the list of attributes to current and historical geo-economic aspects such as economic development level of the countries involved, the colonial links and the availability of oil and mineral resources in African countries. There are undoubtedly many other attributes which might determine the suitability of particular countries for particular investment modes e.g. political stability, levels of inter-port and intra-port competition, the general business environment, etc.. While this research topic demands further detailed research, the remainder of this section provides a first very preliminary exploration and indication of the suitability of specific investment modes for African countries.

Quite a few port terminals in Africa were built during the colonial period and therefore need to be renovated and expanded. In such cases, China and the host African countries could consider the EPC contract as an appropriate investment mode, next to the commonly applied PPPs. As the port facilities have been in operation for many years, they have the capacities to make profits based on a proven access to overseas and hinterland markets. Furthermore, most of the host countries have good economic conditions and abundant funds for the renovation or extension of terminal facilities. The host country typically is challenged to find a general contractor with excellent engineering skills, good reputation and rapid working speed to complete the renovation or extension with the aim to put the terminal into operation again quickly to make profits. CHEC is well placed as the general contractor for these kinds of projects.

While there are more EPC+F+I contracts in West Africa than in East Africa, there are also some ports in East Africa suitable to adopt the EPC+F+I mode. Currently, the demand for EPC+F+I contracts in West Africa may have reached a saturation level. The EPC+F+I mode has often been adopted in ports with good profitability prospects and market benefits, such as many of the ports along the African east coast. However, since the host country often lacks funds to launch the project, there is need for both a general contractor responsible for the construction and a company capable of providing finance and investment. China's investors should adopt the EPC+F+I mode to undertake such type of projects. In this way, the investors can gain considerable dividends from equity investment and raise the profit level from port investments in Africa.

Projects involving the export of natural resources and infrastructure construction projects are often suitable for the PPP mode (excluding BOT) (Wang et al., 2017), although also BOT and EPC+F+I contracts are quite common in such cases. The PPP mode is most applicable to North Africa and West Africa. For example, the oil-rich countries such as Algeria, Libya, and Egypt are in North Africa, and the mineral-rich countries such as Nigeria and Guinea are in West Africa. CMHI is among the most experienced Chinese investment companies to adopt the PPP mode in these countries.

The BOT mode is mainly applicable to large container terminal projects with a strong demand, a good profitability prospect and a high return. Investors can not only recover the invested money within the concession period, but also gain a considerable investment profit. CHEC is among the most suitable entities to engage in the BOT mode for African

port projects.

A sustainable involvement of Chinese interests in African ports requires a well-designed selection process and practical implementation of the investment modes to generate a win-win situation for all parties involved. Mainly Western countries made critical comments on the Chinese port investment wave in Africa. Devermont et al. (2019) argue that some Chinese port investments pose a direct security risk to US and African interests as the Chinese investments concerned go beyond pure commercial motives by including broader military and/or geo-political objectives. Another concern is that China relies heavily on Chinese construction companies to find and develop projects with some deals said to have been struck without any real open tenders and with risks for overpricing. Other sources criticize China's role in setting credit terms linked to project funding which could function as huge debt traps to bring African developing countries under stronger political control of China. China's overseas outstanding loans have risen from almost nothing in 2000 to more than USD 700 billion in 2019 making it the world's largest official creditor (The Economist, 2019). Horn et al. (2019) found that nearly half of China's lending to developing countries is hidden, in that neither the World Bank nor the International Monetary Fund has data on it. Some claim that China has used debt pressure to establish control over key assets (such as ports) in strategically located countries. A much-cited case relates to Djibouti which is projected to take on public debt worth 88% of its GDP, the majority owned by China (Hampstead, 2018). However, the idea that the Chinese government is using debt strategically in Africa, for its benefit, is not supported by facts (Brautigam, 2019). The debt level in the countries concerned often was already very high in the past and China, as late comer on the international investment scene, in many cases only owns a small portion of the debt.

Furthermore, a number of African countries have voiced concerns in the context of specific port projects. Although Chinese firms remain the dominant investor in African infrastructure (especially ports), the earlier mentioned Bagamoyo port dispute is a clear case demonstrating that African leaders are requesting that Chinese-funded projects are more aligned with African needs, at least with African political interests. After long rounds of negotiations, Tanzanian officials did not feel that the terms of the project would benefit the country. This case demonstrates Chinese investors may face more scrutiny over current and future development projects. Large-scale port infrastructure projects remain attractive to political leaders in Africa. However, they are more cautious to agree to projects unless the national or regional economic gains can be clearly determined and a fair balance can be achieved between the need to improve infrastructure to support economic development and trade while also maintaining control of strategic assets such as ports. Thus, African countries have become more alert and dedicated to carefully leverage the risks and opportunities brought by Chinese investments, for example, by demanding higher (national) returns and greater transparency in negotiations.

6. Conclusion

Since the “going out” strategy in 1998, China has successively invested in mining and transport industries overseas. China’s investment in Africa covers many fields such as natural resources exploitation, finance and infrastructure construction. Ports are key infrastructures and act as gateways to international trade and transportation. The share of China’s port investment in Africa in China’s total investment in Africa significantly reduced during the 2008 financial crisis and the Libyan civil war but rose sharply after the Belt and Road Initiative was launched in 2013. Three research themes formed the core of this paper: the spatial distribution of the investments of Chinese interests in African ports; the main forms of participation used for investment and operations in African ports, and the use of the forms of participation by the main Chinese companies active in African ports. The findings demonstrate that Chinese state-owned companies have directed large amounts of expertise and resources to African ports with commercial potential. A range of different investment modes have been deployed to support Chinese investments in African ports, not only to deliver benefits to the investing parties, but also to contribute to a more effective and efficient African port industry. China’s port investment in Africa is mostly concentrated on the west coast of Africa. The EPC+F+I mode is the most common arrangement adopted by Chinese enterprises in view of port investment in Africa. The different investment modes have their advantages and disadvantages. China’s enterprises are challenged to choose suitable modes when investing in African ports by taking into account their own attributes, the development status of the host countries and the port characteristics. This study also elaborated on the specialization of major Chinese companies in terms of investment modes, and the use of specific investment modes across Africa.

From a macro-economic perspective, Chinese investments in African ports are aimed at promoting a better cooperation between China and African countries and at driving African growth and development forward. Chinese companies have proven to be very instrumental in the realization of key port expansion and rehabilitation projects across Africa which facilitate trade by reducing port and logistics inefficiencies. These projects have positively contributed to the reputation of Chinese companies as professional and high-skilled development partners. Still, Chinese investments in Africa are being scrutinized by (western) countries in terms of the direct security risk they might pose to western and African interests, the need for open and fair contracting procedures and China’s credit terms imposed on the African developing countries involved. Claims and accusations in these areas potentially damage China’s reputation. Therefore, the Chinese government and Chinese companies are developing a more restrictive and prudent approach. For example, in late 2019, China decided to slow down its lending to Ethiopia on worries about the country’s debt profile and ability to repay. At the same time, the BRI now focuses more strongly on softer aspects such as cultural exchange to complement the hard economics behind international investments and transactions. This rebalancing, also at investment level, could ultimately have an impact on the magnitude of Chinese investments in African ports and the preferred investment modes. In addition, there is a need to make Chinese deals more transparent,

so that the port authorities and governments of host countries could get the information they need to evaluate whether they are being offered a good deal.

While the presented analysis is rather descriptive in nature, the study builds on a rich and rather unique dataset on China's investments in African ports. The associated data collection process was complex given scattered information sources and the required merging of different aspects related to investors, forms of participation and port project characteristics. The dataset facilitated cross-over analyses on investors-investment modes and on hosting countries-investment modes. The findings provide more detailed insights on which African ports have welcomed Chinese investments, which Chinese companies are involved, what forms of participation have been adopted and why. A correct factual analysis of these issues can serve as valuable input for future discussions between all parties involved, regardless of whether they endorse or oppose to a Chinese involvement in African ports.

There is room for further research. As stated earlier, some parts of the analysis (in particular, the examination of the suitability of specific investment modes for African countries) present a first very general exploration and thus need to be further detailed and extended in future studies. Further research is also needed in view of analyzing the differences between the investment modes and the (state-owned) companies involved in African seaports and Chinese investments in other sectors and industries in Africa such as mining or energy. Furthermore, future studies can focus on the effectiveness of the chosen investment modes in terms of reaching corporate and societal objectives from the Chinese and African perspectives. This would require the development and application of a comprehensive set of key performance indicators (KPIs) to compare and benchmark individual port infrastructure and terminal operation projects in Africa.

REFERENCES

- Aerts, G., Grage, T., Dooms, M., Haezendonck, E. (2014). Public-private partnerships for the provision of port infrastructure: an explorative multi-actor perspective on critical success factors. *The Asian Journal of Shipping and Logistics*, 30(3): 273-298.
- Brautigam, D. (2019). Is China the World's Loan Shark?. *The New York Times*, 26 April 2019
- Bush, A. (2008). PPP and donors lead new funding. *African Business*.
- Chan, A.P., Yeung, J.F., Yu, C.C., Wang, S.Q. and Ke, Y. (2011). Empirical study of risk assessment and allocation of public-private partnership projects in China. *Journal of management in engineering*, 27(3),136-148. Chen J. M. (2018). Correct understanding of the "Belt and Road". *Business Observation*, (7):72-75.
- Chen, J., Fei, Y., Lee, T. W., & Tao, X. . (2018). Overseas port investment policy for china's central and local governments in the belt and road initiative. *Journal of Contemporary China*, 1-20.
- Chen P.R., Wang C.J., & Liu W.D. (2019). The Spatial Evolution and Mechanism of China's Overseas Port Investment Pattern. *Progress in Geography*, 38(7): 973-987.
- Chen, W., Dollar, D., and Tang, H. (2016). Why is China investing in Africa? Evidence from the firm level. *The World Bank Economic Review*, 32(3): 610-632.
- Chen Y. Q. (2018). Financial risk and management strategy of overseas EPC+F engineering projects. *Accounting Learning*, (30):3-5+17.
- Chen, Y. W., Lin, B., Zhao B.B. (2014). Development Pattern and Path Choice of African Coastal Ports. *Chinese Port*, (4):56-57.
- Cheng, C., Zhang, W. (2018). Competing for African Port Operations. *Chinese Investment*, (8):56-57.
- Devermont, J., Cheatham, A., and Chiang, C. (2019). Assessing the risks of Chinese investment in Sub-Saharan African ports. Center for Strategic & International Studies, Washington DC, June 2019.
- Drewry (2019). Global Container Terminal Operators Annual Review and Forecast 2019. Drewry Maritime Research, July 2019
- Du Q.Y., & Deng D.Q. (2015). A study on the spatial distribution of China's direct investment in Africa and its influencing factors. *Chinese Geographical Science*, 35(4): 396-401.
- European Commission. (2003). Guidelines for Successful Public-Private Partnerships [online]. DG Regional Policy. http://ec.europa.eu/regional_policy/sources/docgener/guides/ppp_en.pdf
- Farrell, S., Vanelander, T. (2015). Comparison of public-private partnerships in airports and seaports in low-and middle-income countries, *Transport Reviews*, 35(3): 329-351.
- Guo J., & Liu Y. (2018). Analysis of the situation of Chinese enterprises investing in African ports. *China National Conditions and Strength*, 0(4): 31-34.
- Hammami, M., Ruhashyankiko, J.F., & Yehoue, E. (2006). Determinants of public-private partnerships in infrastructure. IMF Working Paper, IMF Institute.
- Hampstead, J.P. (2018). Five years in, China's Belt and Road looks like a giant debt trap [online]. *Freight Waves*, 28 August 2018.
- Horn, S., Reinhart, C.M., Trebesch, C. (2019). China's Overseas Lending. Kiel Working Paper, No. 2132, Kiel Institute for the World Economy (IfW), Kiel
- Huang Y. Q. (2018). China's investment in Africa in the new era. *China's National Conditions*, (1):33-37.
- Lee, P. T.-W., Hu, Z.-H., Lee, S.-J., Choi, K.-S., & Shin, S.-H. (2018). New Maritime Silk Road. *Maritime Policy & Management*, 8(2):

- Lee, T.C., Lee, P. T.-W., & Chen, T. (2012). Economic impact analysis of port development on the South African economy. *South African Journal of Economics*, 80(2): 228-245.
- Lee, T. W. , Hu, Z. H. , Lee, S. J. , Choi, K. S. , & Shin, S. H. . (2017). Research trends and agenda on the Belt and Road (B&R) initiative with a focus on maritime transport. *Maritime Policy & Management*(2), 1-19.
- Lee, M., Han, X., Quising, P. and Villaruel, M.L. (2018). Hazard Analysis on Public–Private Partnership Projects in Developing Asia. Asian Development Bank Economics Working Paper Series, (548).
- Li, M., Xia, X.M., Zhu, S.J., & He, C.F. (2017). Spatiotemporal Evolution of China's Direct Investment in Africa and Its Influencing Factors. *Economic Geography*, 37(11): 19-27.
- Li, Z.W. (2017). Honored by Chinese enterprises—Chinese-funded African development booster. *China Trade News*, (007).
- Liu, N. (2008). The Formation of China's Investment Pattern in Africa - Review of China's Investment in Africa for 50 Years. *Journal of Shangluo University*, 22(1):1-12.
- Lu, W. , Liu .H.Y. (2016). Modes and working flow of overseas port projects under new situations. *China Harbour Engineering*, 36(8):76-80.
- Macário, R. (2014). Public–private partnerships in ports: where are we. In: Meersman, H., Van de Voorde, E., Vanelislander, T. (eds.). *Port Infrastructure Finance*. Routledge, Abingdon, 55-68.
- Mooney, T. (2016). Japan reinvigorates African port logistics investment efforts. *Journal of Commerce Online*.
- Mourao, P.R. (2018). What is China seeking from Africa? An analysis of the economic and political determinants of Chinese Outward Foreign Direct Investment based on Stochastic Frontier Models. *China Economic Review*, 48: 258-268.
- Nguyen, L., Notteboom, T. (2017). Public-private partnership model selection for dry port development: an application to Vietnam. *World Review of Intermodal Transportation Research*, 6(3): 229-250.
- PPPIRC (2014). What are Public Private Partnerships? [online]. <http://ppp.worldbank.org/public-private-partnership/overview/what-are-public-private-partnerships>
- Salah, A., Moselhi, O. (2016). Risk identification and assessment for engineering procurement construction management projects using fuzzy set theory. *Canadian Journal of Civil Engineering*, 43(5): 429-442.
- Savvides, D. (2016). The Conceptualisation of a Build - Operate - Transfer (BOT) Project. *European Procurement & Public Private Partnership Law Review*, 11(2): 130-141.
- Shi, C.L. (2010). Safety of Indian Ocean Routes and China's Strategic Countermeasures. *South Asian Research Quarterly*, (3):1-7.
- State Council Bulletin (2006). China's African policy document, (6):41-45.
- Tan, L.Y. (2016). Research on G2G "EPC + F" business model. *International Project Contracting & Labour Service*, (7):49-51.
- Tengfei, W. , Wenzhe, T. , Dashan, Q. I. , & Lei, D. U. . (2016). Enhancing design management in international epc projects based on partnering. *Journal of Tsinghua University (Science and Technology)*.
- The Economist (2019). A new study tracks the surge in Chinese loans to poor countries, 13 July 2019
- The World Bank. (2003). A Railway Concessioning Toolkit [online]. Press release.
- Turpin, F.M. (2013). PPP in ports, landlord port model [online]. Tbilisi, Georgia.
- Wang, H.B. (2018). Research on a F+EPC project management in Zambia.
- Wang, L., Zheng, Y., Ducruet, C., and Zhang, F. (2019). Investment Strategy of Chinese Terminal Operators along the “21st-Century

Maritime Silk Road". *Sustainability*, 11(7).

Wang, X.W. (2013). Bagamoyo: strategic port to be appreciated. *China Times*.

Wang, Y.Y., Feng, K., Wang, S.Q. (2017). *PPP for Franchise Project Financing: 1000 practical Questions & the Answers*. Tsinghua University Press, 2017, Beijing

Xie, Z.B., Liu, W., & Zhang, H. (2017). Discussion on "One Belt and One Road" strategy and thinking on overseas port investment. *Pearl River Water Transport*, 2017(15):82-83.

Yan, M.R. (2011). Multi-criteria Decision Model for BOT Project Selection. In: Wu D. (eds) *Modeling Risk Management in Sustainable Construction*. Computational Risk Management.

Yao, X. (2018). An Analysis of the Development Practice of EPC General Contracting Mode in Foreign Construction Projects. *Technology Innovation and Application*, 0(4):172-174.

Zhang, H.M. (2015). China's soft power construction in Africa: effectiveness, problems and solutions. *African Development Report No.17 2014-2015*, Social Science Literature Publishing House.

Zhang, Y.X. (2013). "EPC + F" mode of compliance. *China Financial and Economic News*, (005).