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Dhows Tramping in the Horn of Africa: an Initial Characterization of their Specific Services Using Djibouti Port Data

Emeric LENDJEL

CES/PRODIG, Université Paris 1 Panthéon-Sorbonne, lendjel@univ-paris1.fr

Achaa ABDILLAHI AHMED

Université de Djibouti, achaa_abdillahi@univ.edu.dj

Abstract

The persistence of dhow shipping around the Arabian Peninsula is puzzling nowadays, since almost every commodity can be carried easily and cheaply through the global network of container shipping lines (Song and Panayides 2015). Yet, dhow shipping is still active in the region, not only for local trade but also for long range trade such as between East Africa and Indian or even Sri Lanka. In the absence of an available database on dhow trade, this article uses port data to deduce the way dhows differentiate their services from liner and bulk shipping to find a place in maritime transport. Using data provided by the Djibouti Port and Free Zone Authority (DPFZA) on dhows' stopovers during the 2014-2018 period, this article shows that dhows perform a taxi-like on-demand tramping service to supply coastal retailers with consumer goods that are not carried by liner shipping. Through the particular case of dhows in Djibouti, the article sheds light on the part played by transport vectors as norm interfaces to distribute standardised consumer goods to populations in developing countries.

Keywords: dhows, Gulf of Aden, downstream logistics, tramping, service differentiation

1. Introduction

The word “dhow” may have come from the Swahili word *Dau* (Sheriff 2010), before the Arabic دَوَّ (dāw) while its English popularisation during the nineteenth century was used to characterise a wide variety of traditional sailing tramp ships all around the Arabian Peninsula (Agius 2005). The persistence of dhow shipping is puzzling for the maritime economist. Indeed, nowadays, almost every commodity can be carried easily and cheaply through the global network of container shipping lines, directly or through a hub (Song and Panayides 2015). Given the difference in capacity between a dhow (with a 2000-tonne payload for the biggest) and a containership (even for a small 1,200 TEU feedership), it may be asked how dhow shipping survives with such differences in

economies of scale. Of course, in the 1,000-year history of dhows (Martin 1980; Sheriff 2010), the emergence of new containerised transport services since 1956 (Stopford 2009, 581) has occurred over several decades, alongside existing structures in the region, following the general pattern of innovation (Schumpeter 1911). Writing during the 1960s on dhow trade in East Africa, Noble concluded that:

“...the trade is dying. Small dhows will still be used for some time to come, but within a lifetime the long-range coastal dhows will disappear in face of the competition from long-distance lorries. As the standard of living rises, they will become uneconomic to operate with their large crews, and already the educated young men have no interest in them as a part of their heritage” (Noble 1963, 501).

Likewise, Stopford wrote 11 years ago that “...obsolete traditional liner vessels [...], year by year, are being squeezed out by the more efficient container-ships” (Stopford 2009, 585). Yet, dhows are still active nowadays around the Arabian Peninsula (Picture 1) and the Horn of Africa (Picture 2), although their load is marginal: in a representative port for dhow transport such as Djibouti, dhows carried 36,430 tonnes of cargo in 2016: i.e. less than 1%, compared to the volume of non-containerised cargo handled in Djibouti.

Picture 1: *Al Adam*, a large (around 50m long) Indian dhow loaded with second-hand cars about to leave Sharjah for Yemen (Sharjah, December 2019).

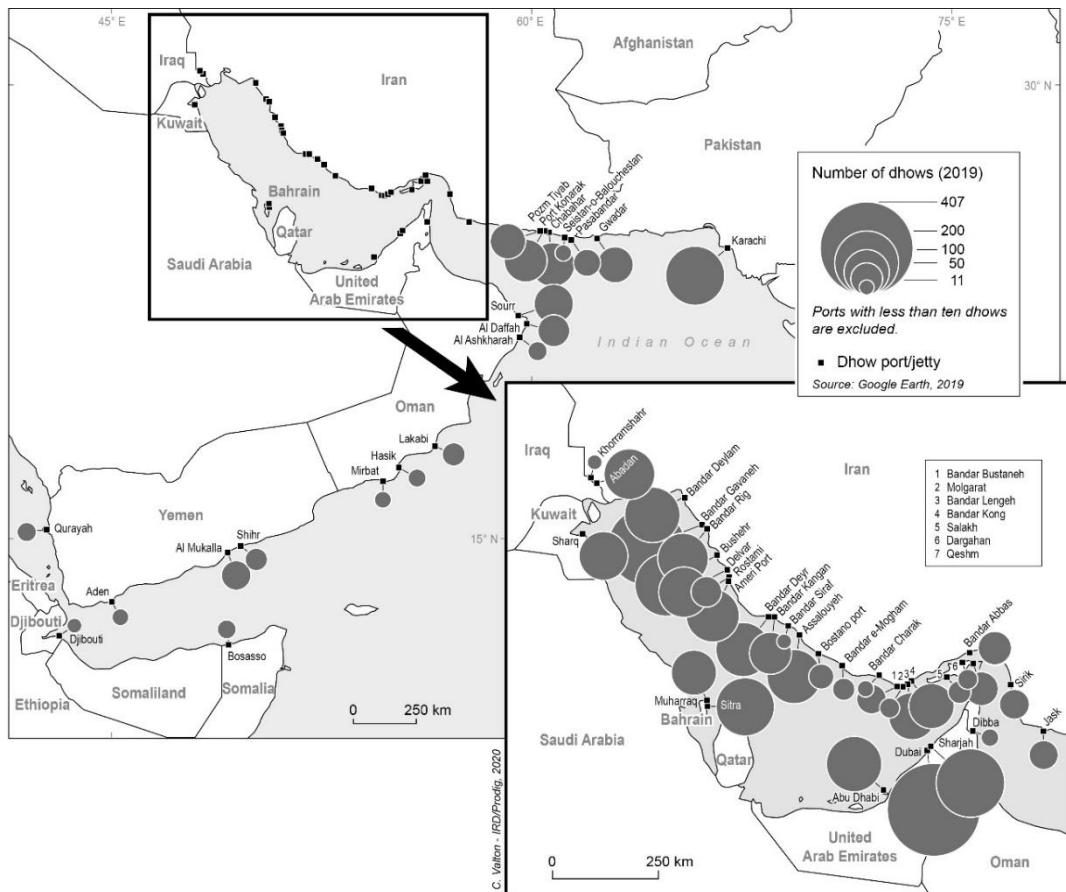


Picture 2: *Al Amanat 2*, a 400 GT Djiboutian dhow waiting in the Djibouti bay (January 2020).



But in a recent communication, Lendjel and Marei (2019) identified more than 4,300 dhows (longer than 20m) operating across six countries (in a census based on satellite pictures). In the UAE for instance, more than 400 dhows can be seen on a regular basis (Map 1).¹

Map 1: Localisation of dhows in 2019 (Lendjel and Marei 2019)



¹ According to a website called “dhowber”, “About 1,500 dhows make 13,000 trips annually, transporting around 2.2 million tonnes of cargo with a value of Dh22 million” to and from Dubai. <http://www.binujose.com/dhowber.html>

Given the size difference between dhows and container ships, dhows likely survive by providing different services from those supplied by regular container lines. But which services, how and for which shippers and with what cargoes? As Baumol and Vinod (1970) put it, the abstract characteristics of a given transport service have somehow to match those of some goods and their shippers' expectations. As any transport mode can be abstractly characterised by a vector $m_i = (m_{i1}, \dots, m_{in})$ in a n -dimension space where m_{ij} is the value of the j^{th} attribute of the mode i , dhows clearly display different abstract characteristics than regular container lines in all of the four dimensions identified by Baumol and Vinod (1970, 414): shipping cost per unit, mean shipping time, variance in shipping time, carrying cost per unit of time while in transit. Even if no economic data is available, several comments can nonetheless be drawn from direct observations of dhows. Regarding the first dimension for instance, cost of compliance cannot but affect shipping costs and lead to sorting shippers according to their ability to bear these costs. Dhows are cheaper in this respect. Likewise, the carrying cost per unit of time while in transit displays major differences between dhows and container ships, either with regard to scale economies or to insurance and the risk of damaged cargo. Dhows and containerships actually do not belong to the same commercial space, with different origins-destinations and total transit times, nor to the same institutional environment with different norms and insurance systems. As a dhow shipowner stated during an interview in March 2019 in Djibouti, "dhows go where containerships can't go".

In themselves, dhows are interesting to study as an unknown subcontinent of the shipping industry. But they also deserve to be studied due to several theoretical issues they raise.

First, models usually do not deal with trade-offs related to cargo conditioning. Containers or pallets are considered as successful and efficient innovations that need only time to be used universally in their maturity (Rodrigue and Notteboom 2009). For instance, Baumol and Vinod (1970) reduced this aspect to a single variable (shipping cost per unit) without taking into account the number of load breaks and their related costs – including time – that could lead the shipper to internal trade-offs between different kinds of cargo conditioning. However, Rodrigue and Notteboom (2009) have already stressed that the success of containerisation depends on the gain in time for shippers. Dhows show that containerisation is a costly process for some shippers which

needs to be taken into account by theoretical models of short-sea shipping around Arabian Peninsula and the Horn of Africa.

Second, a subsequent theoretical issue concerns the modelling of alternative maritime transport solutions. In the set of sub-transactions describing containerised transport, the use of a warehouse for packing and unpacking goods into containers is omitted, though this is an expensive sub-transaction. Dhow transport entails easier processing without warehousing through the direct unpacking of cargo from lorries (or from the containers when used) straight on the quay before the dhows are loaded. This simpler sub-transactions chain entails ex-ante and ex-post transaction costs that will be examined in more detail in a further paper, especially with regard to dhows' institutional environment.

A third theoretical issue deals in particular with compliance costs borne by shippers for any containerised transport. Transport systems have to comply with different standards (technical, legal and social). Dhows' standards are clearly different from conventional ships (for instance, Art. 2, § 4 of the 2006 Maritime Labour Convention excludes dhows from its scope). These different standards entail different levels of costs for shippers. In developing countries, low cost transport systems are a necessity to supply low-income populations. Modal choice models usually do not take these costs into account, which may however be especially high for short-sea shipping in developing countries. Comparing dhow shipping costs with containerised freight may thus contribute to measuring cost of compliance indirectly. Moreover, as Buhler (2015) put it, the agent in economic models is considered to have no control over the terms of her or his choice, which is considered as a parameter. With dhows, the respect of standards is clearly an issue and may alter the parametric character of a shipper's set of alternative options. This aspect also illustrates indirectly the risks of the deregulation advocated by Rodriguez *et al.* (2017) in the short-sea shipping industry.

Fourth, if dhows are used to supply low-income populations, unable to afford the level of infrastructures and standards required by containerships or even multipurpose ships, they are far from being an endangered species, given the slow speed of economic development in the Horn of Africa. Serving marginal populations, dhows are behind the scenes, eclipsed by the dominant containerised regime. Thus, studying dhows helps to unveil a fringe area of globalisation and how this network interfaces with standardised ones to supply developing countries populations.

But before tackling these theoretical issues, preliminary work entails characterising dhow activity which is still unfamiliar even to most transport economists. Unfortunately, data on dhows is very scarce – Djibouti excepted. For instance, no financial data is available that could contribute to explaining the economics of dhows, their cost structure, their shareholder structures, etc. Given the exploratory nature of this initial research, no specific model has been used here, except Stopford's (2009) through its characterisation of tramping activity, and Baumol and Vinod's (1970) for their abstract approach of transport services. Descriptive statistics are the main tool used to provide an economic outline of dhows' activities.

Given these limits, this article aims at demonstrating two nested theses. Firstly, in contrast to container shipping lines, dhows mainly carry out on-demand tramping for coastal communities in the Indian Ocean. Secondly, dhows perform specific tramping which is similar to downstream logistics, *i.e.* a capillary distribution of consumer goods to coastal retailers. Dhows service shippers who are different to those using containers, for populations beyond the reach of standard containerised transport for various reasons (income and education level, cultural habits, location, etc.), such as “Charchari” women (Somali traders) or populations located far from large coastal agglomerations.

If “the proof of the pudding is in the eating”, port data should be able to provide the characteristics of services provided by dhows. This first economic characterisation of dhow activity is mainly based on the sole data available, provided by the Djibouti Port and Free Zone Authority (DPFZA 2015, 2016, 2017, 2018, 2019b). Interestingly, Djibouti and its Doraleh Container Terminal is one of the three major container terminals of East Africa, which handled almost 1 million TEUs in 2016 (870,746 TEUs in 2018; DPFZA 2019a). This port and its data thus provide a good basis to assess how dhow services differ from containerised transport in the region.

After a short survey of the literature (Section 2) and a presentation of data provided by DPFZA (Section 3), Section 4 shows that dhow activity matches the main attributes of tramping (as characterised by Stopford, 2009: on-demand trips, activity volatility, atomised production units, irregular waiting times, etc.). Then in Section 5, I show that dhows perform a specific kind of tramping service, similar to passenger taxis, which I call “downstream logistics tramping”. In short, with specific cargoes and destinations, dhows supply transport services that are not provided by container shipping lines.

2. A Survey of the Literature

The literature on dhows is scarce. The most recent work is Verne's (2017) ethnographic approach of dhow trade between Zanzibar and Jakarta. As Verne's survey puts it, the existing literature on dhows is very poor and often too outdated to catch recent evolutions in dhow trade, such as the use of fibre glass for hulls and the scrapping of sail power for diesel propulsion. For instance, the latest book on transport and logistics in East Africa (Adbillahi Ahmed, Chitou, and Smeesters 2015) does not mention the part played by dhows in this region.

Most of the literature (Martin 1979, 1980, 1981; Gilbert 2002; Agius 2005) is devoted to the sailing period of dhows in the Aden-Oman-Persian Gulfs and the Indian Ocean, and does not include their conversion to internal combustion engines. Historical and ethnographic approaches dominate in the literature (Agius et al., 2010; Sheriff 2010; Verne 2017). The last real studies on the economics of dhows date back to the 1960s (see Villiers 1948; Talbot 1962; Noble 1963; McMaster 1966; Hoyle 1968), except for Gilbert's book (2004), devoted to the part played by dhows in the colonial economy of Zanzibar between 1860 and 1970, which stresses their resilience and ability to adapt to major economic changes.

The decline of dhows is described by Martin (1980) and Dharmasena (1987), who depicted the impacts of the container revolution in Oman (Martin 1980) and in Bombay/Mumbai and Colombo (Dharmasena 1987); and by Agius et al. (2010), who stated that wooden dhows are no longer built and that traditional boatyards only maintain and repair remaining ageing dhows. So, the declining literature on dhows echoes the surge of containerised trade since the late 1960s that has almost-entirely focused the attention of maritime economists.

The literature on Dhow ports (which is mainly written by geographers) is also very rare (Talbot 1962; Hoyle 1968; Walker 1981; Martin 1982; Dharmasena 1987; Margariti 2007), probably due to the very low capital intensity ratio of their infrastructures and stevedoring companies. Gilbert (2002) already stressed that "dhows went to places that steamers could not go to", due to their low draught. This constraint on port draughts has lasted all the more so with the growing size of feeder containerships (Monios 2017). Martin (1982) described lots of aspects of dhow shipping, including main ports, the handling of dhows, boatyards, etc.

Martin (1982) also contributed, along with Walker (1981, 108-121), to the rare studies on the actual movement of goods carried by sailing dhows in the Indian Ocean and the Persian Gulf during the 1970s. While Sheriff (2010, 172) includes these aspects in his book, he accurately depicts Dhows' routing networks in the Indian Ocean during the 1940s (53) but also their religious dimension since this “half of the Indian Ocean was every bit a Muslim lake” (239). Walker's map (1981, 123) of dhow flows in the Persian Gulf in 1971 complements Sheriff's pattern, confirming the importance of Dubai as a main hub for dhows through a hierarchy index of dhow routes (*idem*, 125).

If the economic literature about dhows is outdated, lots of aspects of their economy are already depicted elsewhere. Several works tackle the characteristics of tramping (Stopford 2009; Gratsos, Thanapoulou and Veenstra 2012), such as its volatility (Kavussanos 1996; Chen and Wang 2004), size effects (Kavussanos 1996), and its logistics (Song and Panayides 2015). Many studies help to characterise dhows' economic environment in East Africa, like transport costs (Teravaninthorn and Raballand 2009), piracy (George 2010, Dua 2014), East African port characteristics (Haralambides *et al.* 2011), and their widespread use as an “intermediate means of transport” or in two-tier systems (Mareï and Ninot 2018; Monios, Wilmsmeier and Ng 2019): “carrying capacity (generally in the range of 50 kg to 1000 kg) is greater than humans can conveniently carry themselves, but below that of large-scale transportation systems” (Starkey 2001, vii).

The emphasis Baumol and Vinod (1970) placed on the importance of total shipping time for a shipper is also useful in understanding the survival of dhows in the region, for container shipping lines are in competition and design their networks with this factor in mind. Notteboom called this the “time factor” (Notteboom, 2006). Indeed, any additional port of call in the loop of a feeder ship adds costs and causes time losses (Guy and Urli 2006; Wiegmans, Van der Horst, and Notteboom 2008; Ducruet and Notteboom 2015). By contrast, dhows conduct direct transport, on-demand and without any intermediate stopovers. The service differentiation of dhows is thus dependent on such trade-offs made by big shipping lines that allow – or do not allow – dhows to sail in between the mesh of container shipping schedules. Additionally, transaction costs play a significant part in the shipping industry, particularly for tramping (Pirrong 1993). Even if they are not explicitly included by Baumol and Vinod (1970), Pirrong's characterisation of transaction costs in bulk shipping helps to assess the role they are

likely to play for shippers willing to use dhow services. Finally, the cost of complying with shipping standards is also well-documented (OCDE 1996), even if dhows are not covered by the International Maritime Organisation (IMO). ISPS standards in modern ports are part of these costs, and they add to the expenses and time avoided by dhows calling at non-ISPS ports.

But above all, dhows share many features with barge transport and short-sea shipping. Like barges, dhows interface between large scale maritime transport and last-mile delivery. As an intermediary link in the most complex supply chain for shippers (Guilbaut *et al.* 2008), river transport faces intermodal coordination issues (Van den Horst and De Langen 2008; Caris *et al.* 2014) which are very similar to those of dhows, including: i) the importance of transaction costs related to the number of actors involved in long and complex supply chains (Van Der Horst and De Langen 2008; Lendjel 2013); ii) access to port facilities and handling resources for clusters of waiting dhows in Dubaï or Sharjah (Fu, Liu and Xu 2011; Tong and Natchmann 2017); iii) the importance of waiting time relative to sailing time (Hekkenberg, van Dorsser and Schweighofer 2017); and iv) draught and available infrastructure constraints that determine a structural inelasticity in the modal choice of dhows/barges to supply cities often unreachable by big ships (Rich, Kveiborg and Hansen 2011; Yang *et al.* 2014), etc. But dhows do not carry containers whereas most of river transport literature deals with coordination issues in containerised transport. While containers require warehouses to store and bundle/unbundle cargoes with road haulage at both ends of the chain, dhow transport entails a simpler process without storage, through bundling/unbundling cargoes directly on the quayside before and after their loading/unloading. Those costs are logically not taken into consideration in the literature, whereas Msakni *et al.* (2020) stress the importance of including neglected transshipment costs in short-sea shipping networks design. Dhows implicitly reveal this hidden aspect that could help to improve the modelling of these networks. Consequently, dhow transport chains raise more coordination issues with consignors and consignees handing over and retrieving their cargo. A complete formalisation of dhow chains would need to include those ex-post transaction costs. Finally, like many independent boatmen in France (Fischman and Lendjel 2010; 2012), dhow shipowners face important search costs (Pirrong 1993) and waiting times (Zhang, Chang and Fuller 2015) to get consignments, even when they accept to return empty. This fragile

economic environment may lead to various forms of cross-subsidies, legal or not, depending on institutional environments in the region.

3. Material and Methods

The data provided by Djibouti Port Authority for the 2014-2018 period includes the name of the dhows, their dates of release, the nature and the tonnes of cargo discharged/charged by their shipping agents/stevedore companies. This data is gathered manually by the port authority, with usual collecting errors that need to be reprocessed (mostly spelling errors of dhows' names in Arabic when transcribed into French). Moreover, records are not homogenous over the years: for instance, the statistical census of cargoes only started in 2015 and likely concerns only each ship's main cargo. Likewise for dhows' arrival dates and time, and their payloads that were only recorded during 2018Q3, while the origins and destinations were only recorded during the second half of 2018.

Due to informal aspects of dhows' activity, eight semi-directive interviews were conducted between March 2019 and January 2020 in Djibouti, in order to complete quantitative port data by qualitative insights. Port issues were addressed through interviews of the marketing general manager of the DPFZA, the former manager of the DPFZA dhow department, and the general manager of the dockers company (Port Labour Service). Dhow service attributes were addressed through interviews with a shipper, a shipowner, 2 shipping agents, a dhow captain and one seafarer. Additionally, 187 pictures were taken of 34 dhows calling at Djibouti port during the same periods, and have been used to support the analysis.

As stated above, no specific model has been used here, given the exploratory character of this initial research, except Stopford's (2009) characterisation of tramping activity and Baumol and Vinod's model (1970) for their abstract approach to transport services.

4. An economic activity based on tramping

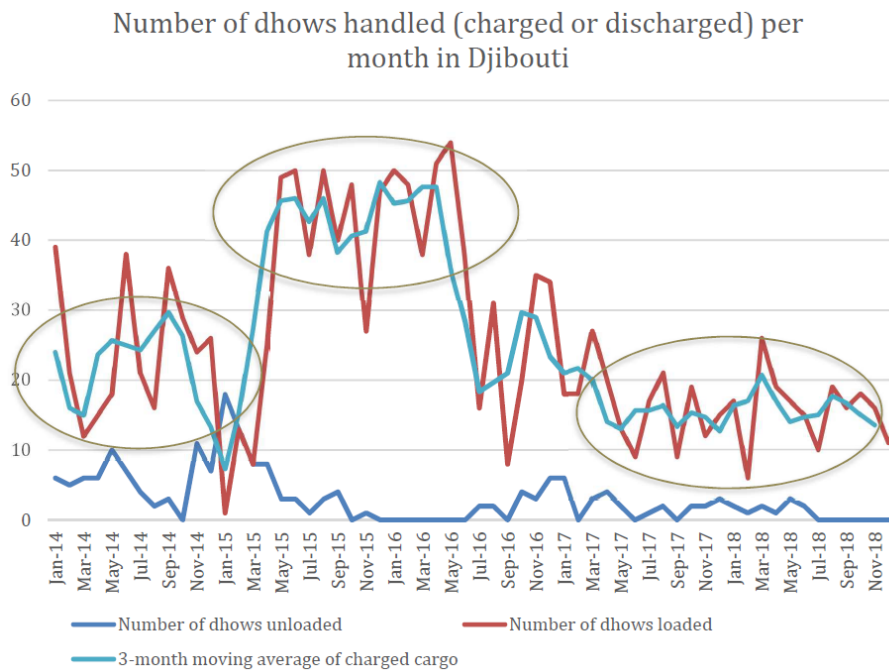
Stopford (2009) distinguishes two well-known forms of shipping: liner shipping, whereby ships' rotation follows a predefined scheduled order of stopovers in different ports; and tramping, when tramp ships sail anywhere, without predefined routing schedules, so as to meet any shippers' demand. As we will see successively, three

features taken from the Djibouti port data testify that dhows transport on demand and tramp around from port to port: i) the volatility of their activity; ii) the frequency of their stopovers at Djibouti; and iii) the importance of their waiting time.

4.1. Volatility of activity

The first characteristic of tramping is the volatility of demand and transport prices (Kavussanos 1996; Chen and Wang 2004; Stopford 2009). Only the demand side is measurable here through Djibouti Port data. If 29 dhows per month are on average handled (unloaded or loaded) in Djibouti, the activity varied in the period 2014-2018 between two limits (Figure 1): a low-level activity period from May 2017 to May 2018 (15 dhows per month) and a high-level activity period from May 2015 to May 2016 (45 dhows per month). Leaving aside 2015 (with 455 stopovers), there was a decreasing trend, with a fall to 201 stopovers by dhows in 2018.

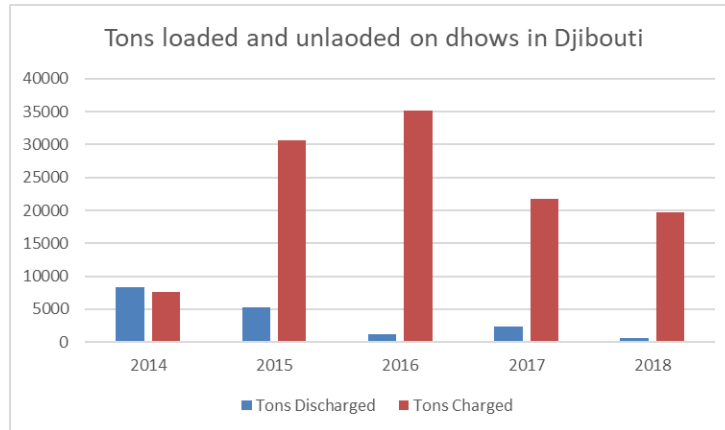
Figure 1. Number of dhows handled per month in Djibouti (based on DPFZA 2015, 2016, 2017, 2018, 2019b)



As with any kind of transport, demand drives the activity level and its volatility. Although small compared to the 847,000 TEUs handled by Djibouti’s Container Terminal in 2018, the amount of cargo unloaded and loaded on dhows in Djibouti remains significant, with an average of 3,500 tonnes unloaded for 23,000 tonnes loaded

per year during the 2014-2018 period. So Djibouti appears to be an export port for dhows.

Figure 2. Tons loaded and unloaded on dhows in Djibouti (based on DPFZA 2015-2019b)

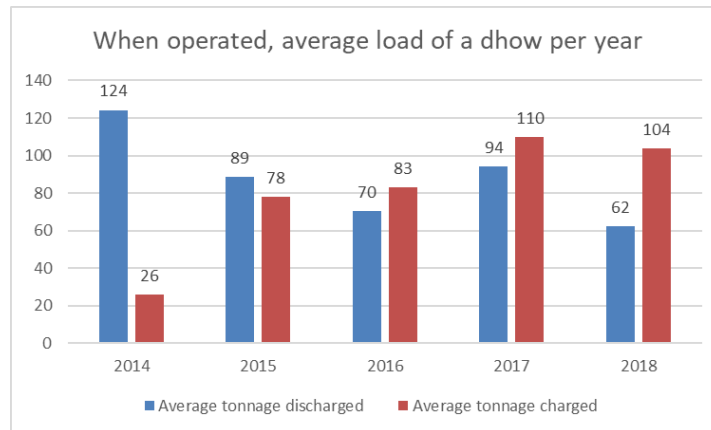


But tonnage fluctuations are important. These fluctuations have several causes: i) as of 2015, the Yemen conflict has impacted clearly on dhow shipping, as regular shipping lines have momentarily stopped calling at Yemeni ports;² and ii) port competition and port-switching of some dhows toward Berbera (Somalia) are said to have contributed to their decline in Djibouti since 2016.³ However, the volatility of demand and ship mobility are inherent to tramping activity in any case. This volatility also manifests through the mean loads for dhows. When a dhow has a cargo, its mean load is 99 tonnes in imports (unloaded) and 77 tonnes in exports (loaded), ranging from 21kg (with five out of six dhows arriving empty) to 1,080 tonnes in imports and 100kg (in small dhows) to 1,141 tonnes in exports. Additionally, important discrepancies appear between years (Figure 3).

Figure 3. Average load of a dhow per year (based on DPFZA 2015-2019b)

² Interview with O. Siozac, CMA-CGM multimodal regional manager in Dubai office, December 2019.

³ Interview with H. Abdourahman Cher, DPFZA Commercial Manager. Note that 13 dhows can be spotted on Google-Earth satellite picture of Berbera in 2019 compared to 8 in Djibouti.

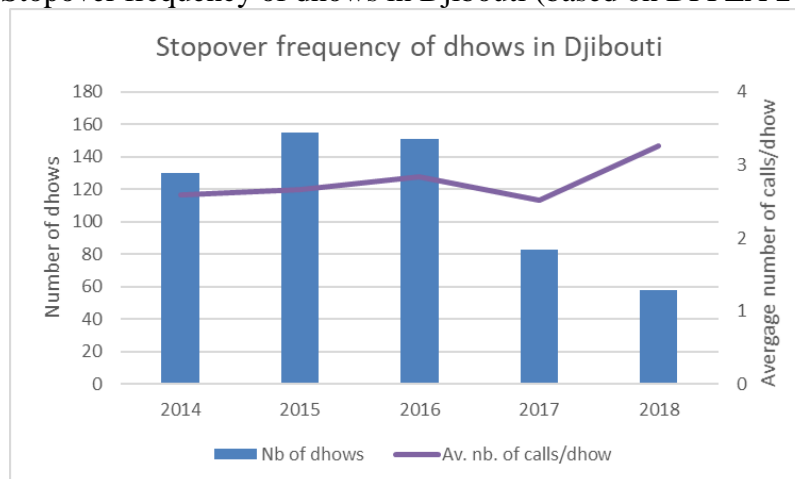


The mean annual tonnage discharged (when the dhow carries a load) varies by a factor of two (62 tonnes in 2018 and 124 tonnes in 2014), while the mean tonnage loaded can vary by a factor of four (26 tonnes in 2014 to 110 tonnes in 2017).

4.2. Frequency of stopovers in Djibouti per dhow

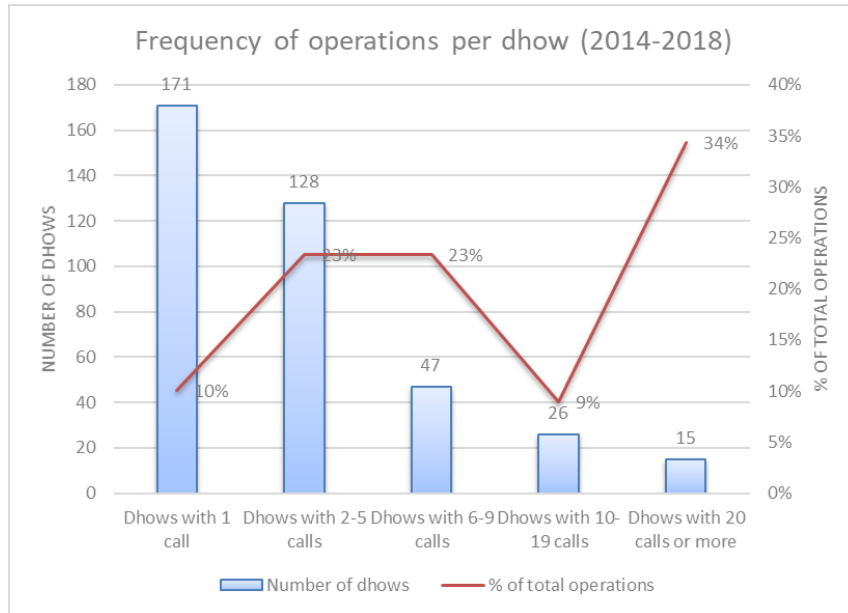
The second main characteristic of tramping is the absence of ship stopover regularity in a given port. Contrary to container shipping lines, dhows displayed no stopover regularity in Djibouti over the period 2014-2018. While 387 different dhows stopped over in Djibouti during the period 2014-2018, their mean number of stopovers was quite low, with 2.77 calls per dhow each year (Figure 4).

Figure 4. Stopover frequency of dhows in Djibouti (based on DPFZA 2015-2019b)



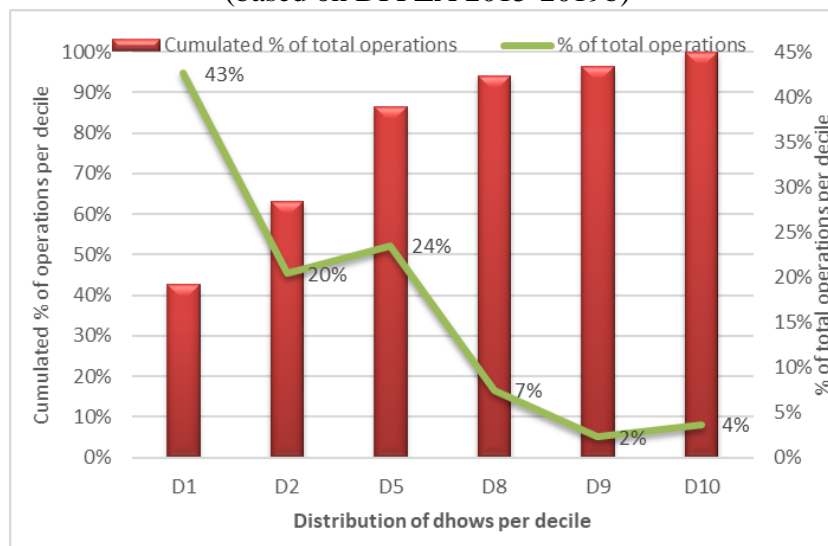
As shown in Figure 5, almost one dhow out of two (44%) only called once at Djibouti over the whole period. And only one dhow in four (23%) can be said to be “frequent or regular”, with 6 stopovers or more in Djibouti over the 2014-2018 period.

Figure 5: Frequency of operations per dhow (based on DPFZA 2015-2019b)



Considering a Pareto distribution of the number of operations per dhow, we find that the 20% of dhows visiting the port most frequently (D2) accounted for almost two thirds of the total loading and unloading operations in Djibouti, during the whole 2014-2018 period (see Figure 6). This represents 77 dhows out of the 387 different dhows spotted in Djibouti over the period.,

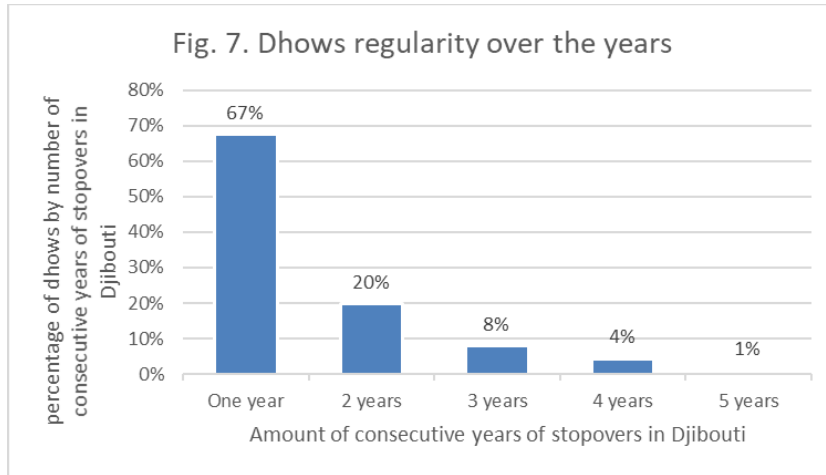
Figure 6: Pareto distribution of dhows operating in and out of Djibouti (based on DPFZA 2015-2019b)



Only three dhows (0.8%) made at least one stopover per year in Djibouti during the whole 2014-2018 period (Figure 7). While the number of stopovers of a dhow in Djibouti is correlated (0.744) with the duration of its loyalty to this port over the years, half of the dhows that most-frequented the port (D2 above mentioned) completely ceased to call at Djibouti after one or two years (respectively 14.3% and 35.1%), as if

they had tried to start a regular shuttle service that only a few of them were able to sustain. Usually, two thirds of dhows only made stopovers during a single year (figure 7).

Figure 7. Dhows regularity over the years (based on DPFZA 2015-2019b)



This result seems to confirm that dhows mainly tramp from port-to-port and do not carry out regular shuttles between a given pair of origin-destination ports. Note that a 0.0436 normalized Herfindahl-Hirschman index⁴ close to zero confirms the atomistic structure of the market. Even the most frequent dhows have market shares that are too small to be able to influence the market: this means they are essentially price-takers.⁵

4.3. *Waiting time and correlated attributes of tramping*

Waiting time is part of tramping, a logical consequence of the previous characteristic. But two components need to be distinguished: dwelling time in ports related to port operations, and waiting time in bay to get a shipment.

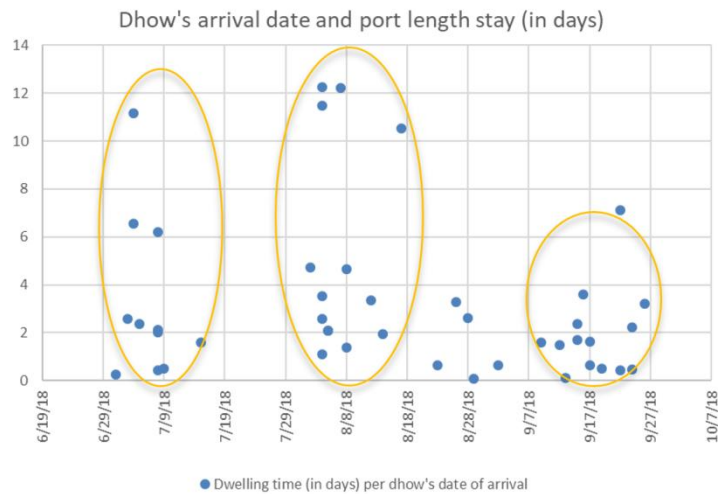
Dwelling times in the port of Djibouti were recorded during 2018Q3 for 44 dhows. On average, a dhow stayed 3½ days, running from 2 hours (which is a very short time to load a cargo, etc.) to 8 days. Dhows dwelling time in port have many different causes here, but no direct causal factor can be identified using Djibouti port data. The first factor is waiting time to get access to the quay or/and even to handling facilities. But no correlation ($r=0.003$) can be observed between the dhow stopover frequency and its mean port dwelling time, which means that a dhow – whatever its

⁴ https://unctadstat.unctad.org/FR/ToutSurIndicateurs/statie2018d2_fr.pdf

⁵ Communicated price in our interviews are dubious: \$25-\$35/tonne for a standard trip between Djibouti and Aden according to a shipping agent, \$12/tonne according to another one for the same kind of trip.

stopover frequency – waits a random duration at each stopover. Indeed the low frequency of dhows calling at Djibouti implies that no permanent facilities are allocated to them. And when big ships dock, they have an access priority to quays and handling facilities. The second factor is related to the volume to be loaded/unloaded. But there is also no correlation between port dwelling time and the tonnage loaded ($r=0.001$). As dhows arrive frequently in clusters of successive waves (Figure 8), their dwelling time is also likely to be influenced by the number of dhows per wave.

Figure 8 Dhows’ arrival date and port length stay in days (based on DPFZA 2015-2019b)



But again, a regression of dwelling times on the two main logical explanatory variables related to port operations (number of dhows waiting in the port and tonnage loaded) does not display any significant results (Table 1). Hence, port dwelling times do not only follow from loading time.

Table 1: Regression of dwelling times on the number of dhows waiting and tonnage loaded

Results	<i>Tonnage loaded</i>	<i>Waiting dhows</i>	<i>constant</i>
Est. coefficient	0.18635671	8.85304475	36.9647694
Stand. deviation	0.1689626	6.6894476	30.2134066
R ²	0.05900421	Est. st. dev. of error	1.25408028

This means that other factors influence dhows’ dwelling time, such as the space available at quays, the number of bigger ships waiting for the same facilities with a higher priority rank, administrative waiting time, dockers productivity, the level of difficulty to load/unload different types of cargo, crane failure, dhow maintenance, etc. The possibility of a seasonal component was not tested here due to the limited number of data.

Dhow waiting time is longer than just port dwelling time, according to a dhow shipping agent interviewed during the visit of the port of Djibouti. He stated that the Yemeni dhow *Al Basil* we visited had waited for 20 days in bay to get a cargo. He added that others could wait almost two months in bay to get loaded. The discrepancy between port data and these statements comes from the fact that dhows have to wait in bay, out of the port, and are authorised to access to the facilities only for loading or unloading. Of the 34 dhows I observed in March 2019 and January 2020, four dhows in ten were waiting in bay. Three factors taken from Djibouti port data display the importance of waiting time to get a cargo that validates the third characteristic of the tramping nature of dhow activity.

Firstly, dhow trade through Djibouti is highly unbalanced because the number of loading operations on average exceeds by 8.3 times the number of unloading operations, for the period 2014-2018 (with a peak of 25 times in 2016; see Figure 2 above). On average, only one in six dhows unloads cargo in Djibouti, while nine out of ten boats load cargo. But the data also reveals odd behaviour, namely that dhows which unloaded cargo may have different names from those that loaded. As Djibouti is an export port for dhows, one would expect that dhows unloading in Djibouti get a cargo to carry for their return haul. But this is not automatically the case. Only nearly one out of six dhows (including dhows frequently stopping over) displays trade that is at least partially "balanced" (with cargoes that are often less important for imports than exports). This imbalance exists also for tonnages that are 4.8 times greater for goods loaded than unloaded on dhows. A classification per dhow shows that only eight dhows (1.8%) have a balanced traffic, i.e. with similar volumes of inbound and outbound cargoes. Obtaining cargo is not automatic, even when dhows wait for a long time. Sometimes, a dhow may even leave Djibouti for a neighbouring port where an awaiting shipper will charter it. Ex-ante transaction costs are definitely part of tramping activity (Pirrong 1993) and of dhow economics.

Secondly, the load factor (ratio of loaded tonnes to payload) of inbound dhows is 22% on average, and 49% for outbound dhows. Load factors are therefore generally low (47%), even if some goods have a very low density (especially cigarettes for which shipments were important in 2014-2016). This low load level, combined with imbalanced trade and important dwelling times, seems again to confirm the third characteristic of tramping: the fact that very few cargoes (1.01%) overload dhows'

payloads; this odd result can be interpreted as stemming either from erroneous data (which is likely the case for such rates as 622%, etc.), or as actual, non-compliant practices (three out of four overloaded dhows have a load factor below 150%). While tariff equalisation or internal cross-subsidies exist in any transport business model, non-compliance can but contribute to the economic sustainability of dhows.

Thirdly, dhows in Djibouti carry mainly single-product cargoes according to port data, and only a few of them (0.7% of consignments) bundle cargoes such as foods or humanitarian goods. These data seem to indicate that dhows leave Djibouti as soon as a shipment is entrusted to them – whatever the loading ratio – so as to gain time. The availability and speed of dhows would thus be a great advantage for shippers. But a shipping agent interviewed in Djibouti stated the opposite: shipowners bundle their cargo themselves for different shippers, as would a freight forwarder. Accordingly, a shipowner would allocate cargoes bundled per destination between his dhows if he manages a fleet, or wait for complementary freight for his sole dhow. Dhows' reactivity would thus be tempered by the waiting time required to get significant loading rates. As counterpart, dhows could be used temporarily as floating warehouses free of charge, as is sometimes seen in river transport.

In any case, waiting time plays an important part in the economy of dhow transport. Thus, dhows display characteristics (waiting time, volatile activity and stopover irregularity) that converge on the economic model of tramp shipping described by Stopford.

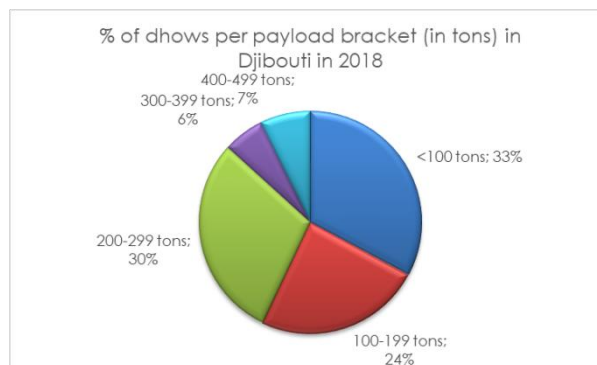
5. A Downstream Logistics Form of Tramping

If dhows are involved in tramping, this is not then activity prevailing nowadays for bulk commodities. As unveiled by Djibouti port data, on-demand tramping for dhows is a kind of downstream logistics function for finished goods supplying local hinterlands. The abstract characteristics of their services differ from those supplied by the two main maritime service types (bulk tramping and liner shipping) in many respects: by size of the production units, types of cargo, size of ports of call, handling and the organisational aspects of shipments.

5.1. The dhows, small-sized production units of the shipping industry

Services provided by dhows are limited by their payloads, which are much smaller than containerships or general cargo ships. Unfortunately, Djibouti port data on dhows' payload are available only for one quarter in 2018, whereas bigger dhows have loaded or unloaded bigger volumes outside of this period. During the period, the range of dhows' payloads in Djibouti ran from 36 tonnes to 400 tonnes, but the most frequent weight was 200 tonnes, while two thirds of dhows had a payload of 100 tonnes or more (Figure 9).

Figure 9: Percentage of dhows handled per payload category in Djibouti in 2018 (based on DPFZA 2019b)



A shipping agent interviewed in Djibouti confirmed these results and benchmarked the biggest dhow's payload in Djibouti with total capacity of 18 lorries. In comparison, the mean size of the 16 CMA-CGM containerships deployed in feeder loops in the whole region is much bigger, with 40,707 DWT (or 3,141 TEUs) per ship.⁶

Note that the correlation coefficient between dhows' payloads and their load factors (without empty trips) is close to zero (0.17), and, while it is even lower for exporting (0.08) than for importing (-0.36), only dhows with a payload superior to 100 tonnes carried import cargoes during the period. This tends to prove that, even if the correlation coefficient between the payload and tonnes loaded is logically significant (0.68), the size is not the key factor in the improvement of transport efficiency: big dhows are loaded no more efficiently than small ones, especially for import flows (with a zero correlation coefficient between payload and tonnes discharged).

It should also be noted that the mean payload of 153 tonnes for dhows calling at Djibouti is smaller than for big dhows (654 tonnes on average),⁷ that were seen in

⁶ CMA-CGM is not the only shipping line operating in the region, but its website provides a coherent and convenient source of data to compare dhows with the services of one of the top five operators.

⁷ Based on my own data to be presented in a forthcoming article.

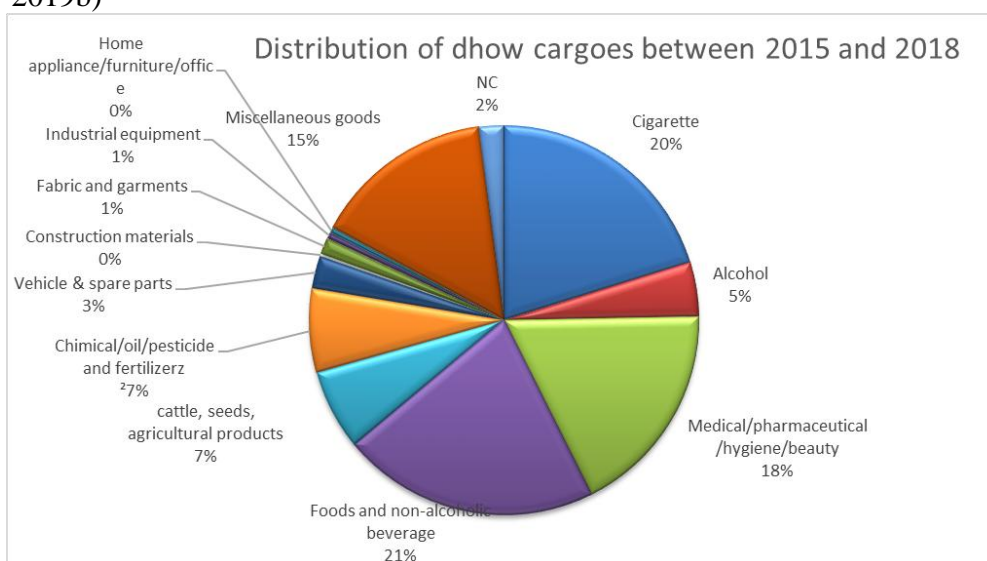
December 2019, mooring at the main UAE ports (Corniche Deira in Dubai and Port Rashid in Sharjah). But, if dhows' capacity cannot compete with containerships and their economies of scale, which markets/shippers need their services?

5.2. The type of cargo carried by dhows and downstream logistics

Following Stopford's typology, dhows carry "general cargo", i.e. "small parcels of loose items – e.g. boxes, bags, packing cases, drums, a few cars, machines" (Stopford 2009, 573). As such, like any general cargo ship, dhows are unspecialised ships.

In contrast to the usual form of tramping, dhows carry mainly food and miscellaneous finished goods for the final consumption by households (that could be carried by containerships). But this also means that they do not take part in industrial supply chains, agriculture excepted. Indeed, as shown in Djibouti port data during the 2015-2018 period, dhows mainly carried three kinds of cargo (Figure 10): food and beverages (26%, including alcohol), cigarettes (20%) and a set of goods made up of humanitarian/pharmaceutical/hygienic/cosmetic products (18%).

Figure 10. Distribution of dhow cargoes between 2015 and 2018 (based on DPFZA 2016-2019b)



As mentioned above, dhow trade is strongly unbalanced, and this invites some comments. First, imports of cigarettes and alcohol by dhows are null, which means that they are imported by containers or lorries (and not locally produced, because Djibouti produces only services), discharged (and sometimes reconditioned in warehouses) in Djibouti and loaded on dhows for re-export. Given the existing network of container shipping lines, dhows are used to deliver goods in places unconnected by this network.

Second, the two main products imported by dhows are foodstuffs (onions, dairy, eggs, sugar, etc.) and agricultural products (cattle, hay and other feed for animals). Such trade is interesting because: i) the importation of these agricultural products confirms the existence of regional trade for local products; and ii) agricultural products also constitute the biggest cargo ever carried by dhows to Djibouti during the period (1,080 tonnes of white sugar sent from Mumbai, India), which attests to the existence of long distance trade by dhows.

Third, the export of alcohol, even if in small quantities (4.52%), seems a bit odd for Muslim countries of the region but implicitly testifies to the involvement of dhows in smuggling. This trade, combined with the cigarettes, confirms interview information given by a Djiboutian freight forwarder about the semi-legal character of shipments by several small, but fast dhows.⁸

Fourth, only a few dhows carried 82% of alcohol consignments. Indeed, dhows seem often specialised in specific types of trades. Two thirds of dhows visiting Djibouti most frequently (with 6 stopovers and more) carry most cargo in a given category (i.e. over 50%), and three out of ten dhows with the most frequent stopovers have Herfindahl-Hirschman indexes of over 0.5, which indicates their dependency on a specific category of cargo.⁹ For instance, the 10 most frequent carriers of medical/humanitarian/hygiene products (56% of the consignments) are different from the 10 most frequent carriers of cigarettes (34% of the consignments) or those of foodstuffs (36%). Trade specialisation is a common way to differentiate a service.

Fifth, the quasi-absence of any containers carried by dhows – and thus of any trans-shipment – confirms that these networks are not directly connected. Dhows clearly do not belong to containerised transport networks.

Containerised trade displays the exact opposite imbalance of dhow shipments through Djibouti: the containerised inbound traffic is 10 times greater than its outbound traffic (DPFZA 2014). Given the capacity of empty containers leaving the port of Djibouti and the characteristics of goods carried by dhows, the latter should not be able to export a single kilo, unless they have specific advantages.

⁸ Khat is also likely to be imported from Yemen by dhows, according to another local source. See also Lesourd (2019).

⁹ The Herfindahl-Hirschman index is normally used to measure the market power of a firm, but can be used conversely to measure its specialisation/dependency toward a category of market, or a type of cargo as here.

5.3. How dhows' services are differentiated in space and time

For unspecialised vessels such as dhows, service differentiation happens through destinations and speed (Stopford 2009). Regarding speed, the 8-10 knots average speed of dhows, which can be monitored on ship tracking websites, is lower than containerships. But, as Salvanes, Steen and Sjørgard (2005) have demonstrated for airline competition, carriers also compete on departure slots, in a kind of space-time differentiation of services. Moreover, Baumol and Vinod (1970) have shown that shippers operate trade-offs between the volume and frequency of their consignments, according to their full logistical costs (the time-sensitivity of cargo, cargo value, storage costs, transaction costs, etc.) and their “preferences” in the supply chain process (i.e. pushed production vs. just-in-time supply chains). Thus, given the greater availability of taxi-ships, dhows should be able to transport cargoes faster than containerships, if the frequency of departure of the latter is too low.

In this respect, regular container ships may sometimes display an insufficient frequency of call in Djibouti for shippers' needs. For instance, CMA-CGM's Red Sea loop (“Mona express”) is a service with two stopovers per month in Djibouti. For any urgent shipment, a freight forwarder in Djibouti must wait 14 days (at worst) before being able to load a cargo on a feeder containership sailing toward Massawa (Eritrea) or Berbera (Somalia), two of Djibouti's neighbouring ports. For any more distant destinations, the shippers need to wait for a ship belonging to bigger loop to call at Djibouti.¹⁰ For example, CMA-CGM's “Swahili express” loop between Nhava Sheva (India) and Mombasa (Kenya) has a 35-day period; likewise for their India-Middle East-East Mediterranean loop. As summed up by the logistics director of the World Food Programme (WFP), “the transport of a container ship from Djibouti to Hodeidah takes 4 to 6 weeks if we include customs clearance time, porting time, the containership's available rotations. You should count on no less than 3 weeks; with dhows, in 72 hours or in one week, it's over. Their transit time is therefore a real advantage”.

Besides, a shipper probably needs to wait longer if the scheduled container ship does not have sufficient capacity at the expected time (which is highly unlikely in

¹⁰ This fact was confirmed by the WFP's senior logistics officer during our interview.

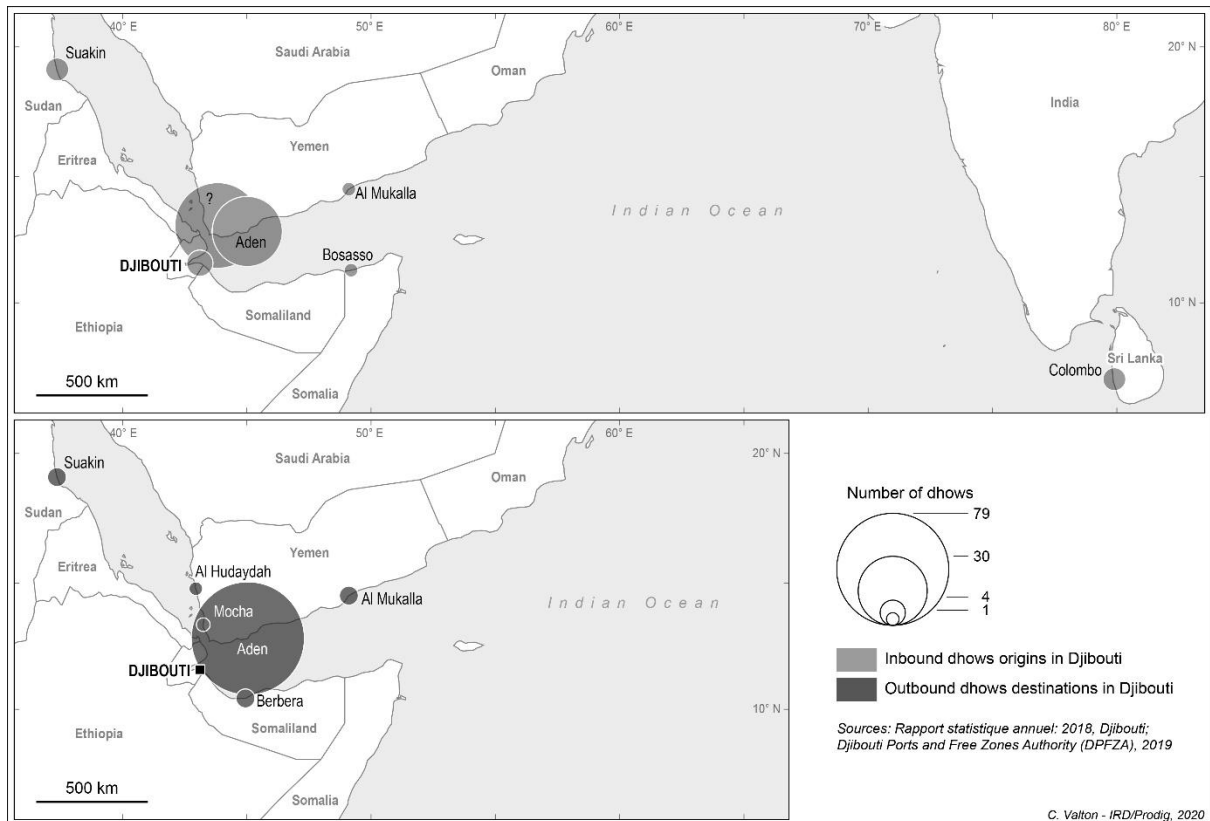
Djibouti, given the current imbalance of flows). This would imply additional storage time at the container terminal.

Finally, container shipping lines are not as regular as claimed. According to Monios (2017, p. 4), a classic feeder vessel has a rate of reliability of 70%, which means that one ship in three may be delayed. By comparison, dhows involve no waiting time and are able to perform a Djibouti-Aden trip in 24 hours, according to a shipping agent. Hence, for time sensitive cargo, shippers are likely to use dhow services. As the shipping agent interviewed in Djibouti in March 2019 noted, “Charchari women choose dhows firstly because the latter accept consignments of small quantities of goods; secondly because dhows are faster (with loading in less than a day) than containerships and their bundling process of cargoes”.

Service differentiation in transport also happens through destinations. Dhow routes help to delimit the range of their downstream logistics. Unfortunately, data provided on the origins and destinations only relate to the second half of 2018 for 87 dhows. But even though limited, they allow for a first appraisal of dhows routings.

First and foremost, the range of dhows routes runs from 240 km (Djibouti to Aden, Yemen) to more than 4,000 km (from Djibouti to Sri Lanka for two, 400-tonne dhows). But the Djibouti-Yemen route is by far the most important one, because nearly nine in ten dhows calling at Djibouti come from Yemen and, conversely, nine and a half out in ten dhows leave Djibouti for that destination. Interestingly, the provenance of dhows is slightly more diversified (7 ports from Yemen, Somalia, Sudan and Sri Lanka) than are their destinations (6 ports in Yemen, Somalia and Sudan), as seen in Map 2 below.

Map 2. Origins and destinations of dhows in Djibouti (based on DPFZA 2019b)



Four remarks have to be made on this port distribution to understand the structural inelasticity of dhows as a modal choice (Rich, Kveiborg and Hansen 2011). First, while Aden or Al Hodaydah are deepwater ports with container terminals, this is not the case for the 11 other Yemeni dhow ports (Al Mukalla, Al Urj, etc.) that have shallow draughts and, consequently, are often unreachable by container ships. Stopford (2009, 578) estimates that one in four world ports is inaccessible to ships with more than 7-9 metres draughts. Part of dhows' niche markets is thus protected against competition from container ships.

Second, low level demand implies a low frequency of call for capacity container ships that can only propose a limited range of available direct destinations. Yemeni ports are small with small hinterlands: Aden, the biggest city, has less than one million inhabitants. The great availability of dhows able to reach any given destination without any delay is thus another advantage related to a lower global transit time for coastal communities. Here, the time and site specificity (Williamson 1996) of available assets (dhows) are of great importance for time sensitive shippers.

Third, maritime cabotage is a practical – and often efficient – means of supplying populations dispersed along a coastline. But its relevance also depends on the level of economic development of populations supplied and the presence of alternative

road infrastructures. The correlation between the level of GDP per capita and the implicit monetary value imputed to transport time explains why time-sensitive goods use road haulage, despite a higher cost than short-sea shipping (Bergantino and Bolis 2008). In the case of Oman, the most populous region of the country is spread along the 200km of coast between Fujairah and Muscat, where no dhow is spottable on google maps satellite pictures (Lendjel and Marei 2019). The region is thus supplied by lorries, probably due to the value of time for this high-income population (a GDP per capita of \$37,143 in 2018).¹¹ Comparatively, in the same year, Yemen had an average income sixteen times lower than Oman (\$2,285 per capita), but close to that of Djibouti (\$2,744 in 2011). Therefore, the dhow traffic in Yemen or Djibouti seems to be correlated with the level of income of its inhabitants. Significantly, the countries served by dhows all have a GDP per capita of less than \$10,000 per year, with the exception of Iran. In other words, dhows supply the markets of small isolated coastal communities with a low-cost service, consistent with their income level.

Fourth, and above all, dhows are able to supply isolated regions surrounded by countries in conflict, such as Yemen or Somaliland. North-Western Yemen and all land connections are controlled by the Houthi movement, while the South-Eastern part is controlled by government forces with the help of the Saudi-led coalition, thus impeding shipping trade as well (Balanche and Saleh 2019).¹² Due to blockading and piracy, shipping has become a dangerous activity in the Gulf of Aden, especially for big ships. Security and insurance costs are sometimes too high for regular shipping lines to maintain their services to Yemeni or Somali ports.¹³ “Ports in Somalia are so insecure that local trade depends almost entirely upon Dhows” (NSC 2012, 5). Thus, “small [ships are] beautiful” when supplying areas in conflict. But, due to their size and number, dhows are difficult to spot and to identify (NSC 2012). Indeed, monitoring and control costs are too high to achieve a complete blockade. And while dhows are also victims of piracy (as noted in recent ICC-International Maritime Bureau reports), they have been hijacked only three times (in 2017) during the last four years (ICC-IMB 2019); a fall compared to the previous period (the two per year during 2005-2013).

¹¹ Purchasing power parity data, in constant 2011 international dollars. Source: World Bank of 8 April 2020, www.google.com/publicdata/

¹² <https://www.monde-diplomatique.fr/cartes/Yemen>, 19.

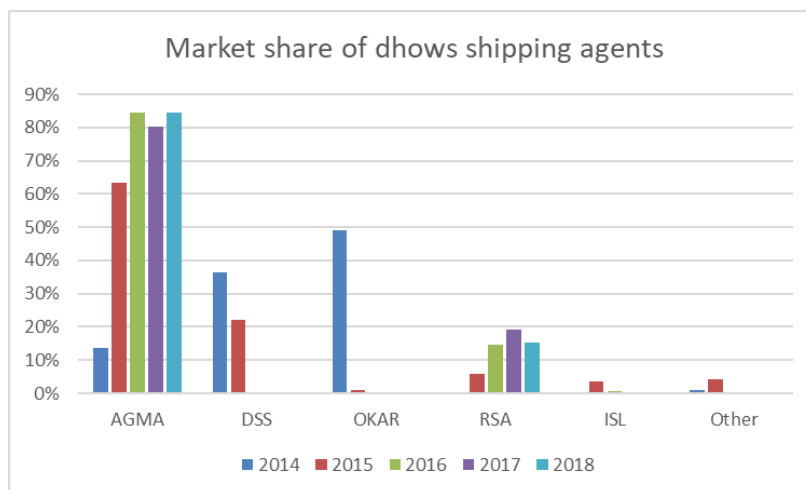
¹³ Interview of O. Siozac, CMA-CGM multimodal regional manager in Dubai, December 2019.

5.4. Handling and informal aspects of Dhows in Djibouti

Little information can be extracted from Djibouti port data regarding the handling and organisational aspects of dhows, and of course there is no information about informal issues. Interviews of actors and pictures are helpful here because informal factors play a part in services provided by dhows. These informal aspects fit specific expectations from some shippers.

Djibouti port data display a sole organisational aspect related to dhows' shipping agents. When asked by a dhow shipowner, a shipping agent monitors the handling and manages port and customs procedures with Djiboutian authorities. Sometimes, a freight forwarder may also ask him to play the part of broker. Due to the low level of dhow activity in Djibouti, only five shipping agents (Agma, DSS, ISL, Okar and RSA) managed dhows in Djibouti between 2014 and 2018 (the six remaining agents (ABY, Clarion, Massida Logis, Med Said Guedi, Red Sea, and UTS) have barely operated dhows, and sometimes only once, like Massida Logis or UTS). The biggest agent (Figure. 11) is without contest Agma (nearly two thirds of the operations over the period), far ahead of DSS (less than one in six operations), RSA and Okar (one out of ten operations for each agent). But, some shipping agents have operated in only one year (like Clarion and Red Sea in 2015) or two (DSS and Okar in 2014 and 2015), or only operate with one dhow (like ABY from 2015 to 2017). Agma started with a low market share in 2014 (14%), to become a quasi-monopoly (85%) in 2016, at the expense of Okar (49% in 2014) and DSS (36% in 2014). But this figure shows that shipping agents' dominant positions are short-lived in Djibouti, due probably to their institutional and informal environment (Gilbert 1997).

Figure 11. Market share of dhow shipping agents (based on DPFZA 2015-2019b)



Monitored by the shipping agent, the handling of dhows in Djibouti is not covered by Labour Port Service, the state-owned stevedore company, but by dockers hired by the shipowners,¹⁴ or sometimes directly by the shipper, as in the case of charcharis women.¹⁵ The loading/unloading of dhows is most often done manually, under the direction of a crew member (who is not necessarily the captain) to control the ship's stability (as dhows have no ballast system). Few technical handling devices are used, often limited to a simple dhow access board, similar to that used in river transport in the 20th century. If the biggest dhows are equipped with a hoist or even a crane, a shore crane is yet often rented in the port for their loading/unloading, as witnessed in the UAE in December 2019. But most importantly, even if the cargo may be loose loaded in a net with the help of a crane, boxes (or any kind of container) are handled one-by-one, out of a net and stored on board so as to avoid the loss of space of palletised cargoes. Once loaded, the cargo is covered with a tarpaulin to shelter it from water projections. Handling dhows is far less capital intensive than containers, and consequently cheaper, when the volume of activity of a port is insufficient to yield scale economies. But if handling costs are an important part of the differentiation of services provided by dhows, they also entails potential ex-post transaction costs for shippers, notably damaged cargo during loading/unloading or during the trip in case of water ingress or if tarpaulins are wrongly fixed, pilferage, etc. Additionally, "cargo (...) will generally have to be stowed broken (...) and can lead to confusion at the destination when cargos are for different clients" (Habib 2018). Since no insurance can be

¹⁴ Interview with Said, dhow shipping agent, February 2020.

¹⁵ Interview with Osman Hassan Osman, Director of Labour Port Service in Djibouti, and Saïd, director of a dhow shipping agency, March 2019.

subscribed to for dhow cargoes (because no insurance broker offers it), these risks are totally borne by shippers.¹⁶

But more generally, some shippers are not able to meet all container compliance procedures and norms. Standards compliance impacts shipping costs and some shippers – mostly local – are unable to meet major shipping line standards and their related costs.¹⁷ For instance, second-hand car procedures are too expensive for Yemeni or Somali shippers.¹⁸ Charchari women used to import lots of commodities from Yemen when port procedures were less formal, according to a former DPFZA Director of the Dhow department interviewed in March 2019. When a trade is prohibited (like for alcohol or khat), small dhows can be used for smuggling (Lesourd 2019). Standards have many dimensions leading to exclusions in Djibouti, starting with the language (few local shippers are able to speak English or French)¹⁹ which is part of ex-ante transaction costs. The cultural and ethnic proximity with dhow shipowners and shipping agents also contributes to reducing ex-ante transaction costs for local shippers.

Conversely, some shippers – mostly involved in international trade – are required to comply with these standards. These shippers are reluctant to use dhow services due to loose procedures, such as unpalletised transport for example. Indeed, “the World Food Program would charter dhows if they were more compliant with international standards, particularly regarding palletized freight”, said its Senior logistics officer in Djibouti in January 2020. “We normally have 150 pages of regulations and legislation for the ships that we charter. But dhows are informal, which is an issue for insurance: (...) one cannot be covered to charter dhows.” An internal report for the WFP (in 2018) identified several potentially non-compliant aspects: cargo stowage conditions, no stability book, electronic safety devices such as EPIRB (emergency position indicating beacon) or SARTS (Search & rescue transponder) equipment exist only on request, etc.

Hence, standards compliance costs contribute to directing some shippers toward dhows instead of containerships. Conversely, the costs of non-compliance encourage other shippers to use containerships.

¹⁶ Interview with J. Collignon, Senior logistics officer, World Food Program, Djibouti.

¹⁷ Interview with Said, dhow shipping agent, February 2020.

¹⁸ But regular shipping lines also often refuse to carry second-hand cars and lorries to Yemen for the sake of security, CMA-CGM multimodal regional manager O. Siozac said in his Dubai office, December 2019.

¹⁹ Interview of Habon Abdourahman, Commercial Director of DPFZA, March 2019.

6. Conclusions

Dhows appear to be an essential link in supplying low-income coastal populations around the Gulf of Aden. As reflected in Djibouti port data, this article first shows that dhow activity has the main attributes of tramping. Secondly, the study demonstrates that dhows perform a kind of downstream logistic tramping, i.e. a capillary distribution of consumer goods to coastal retailers. As “cousins” of light commercial vehicles used in downstream urban logistics, dhows provide the “last mile delivery” of maritime transport networks by carrying all types of goods to ports inaccessible to container ships. If dhows supply different services than those provided by container shipping lines, their shippers are also different as their consignments are addressed to populations beyond the reach of standard containerised transport, or located far from containerised port facilities. By supplying marginal populations, dhows highlight the fringes of globalisation and show how a “traditional” network interfaced with standardised ones is needed to supply developing country populations. Far from being anecdotal, dhows thus play an important, yet often too-neglected, part in understanding the globalisation of economies and how this region is connected with it. As long as strong inequalities in living standards persist, downgraded modes of transport such as dhows will continue to meet the transport needs of these populations. Far from predicting their inexorable decline in the face of the all-mighty “tragedy” of technical and economic progress, as shown in the review of literature, the current trends in our world still promise dhows a bright future. In the context of the still-growing size of mega-containerships, scale economies display limits that are observable at the bottom end of the shipping industry where “small is beautiful”. But part of the service differentiation by dhows comes from their informal character, which entails transaction costs. These aspects need to be examined more closely, to get a deeper understanding of the role of dhows in the region.

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References

Adbillahi Ahmed, A., Chitou, I., and B. Smeesters, eds. 2015. *Stratégie logistique et de transport au service du développement en Afrique*. Paris: L’Harmattan.

Agius, D. A. 2005. *Seafaring in the Arabian Gulf and Oman: The People of the Dhow*. New York: Routledge.

Agius, D. A., Cooper, J. P., Zazzaro, C. and J. J. van Rensburg. 2010. "The dhow's last redoubt? Vestiges of wooden boatbuilding traditions in Yemen". *Proceedings of the Seminar for Arabian Studies*, 40: 71-84. URL: <http://www.jstor.org/stable/41224008>

Agius, D.A., Cooper, J.P., and C. Zazzaro. 2014. "The maritime heritage of Yemen: a focus on traditional wooden 'dhows'". In *Ships, Saints and Sealore: Cultural Heritage and Ethnography of the Mediterranean and the Red Sea*, edited by D.A. Agius, T. Gambin, and A. Trakadas, 143—157. Oxford: Archaeopress.

Balanche R., and M. Ahmed Saleh. 2019. "La Corne de l'Afrique est au Coeur des rivalités entre les pays du Golfe". *Human Village*, 35; Avril 2019.

Baumol W. J., and H. D. Vinod. 1970. "An Inventory Theoretic Model of Freight Transport Demand". *Management Science: Theory series* 16 (7): 413-421.

Bishara, Fahad Ahmad. 2018. "'No country but the ocean": Reading International Law from the Deck of an Indian Ocean Dhow, ca. 1900". *Comparative Studies in Society and History* 60 (2): 338-366.

Buhler, T. 2015. *Déplacements urbains : sortir de l'orthodoxie. Plaidoyer pour une prise en compte des habitudes*. Lausanne: Presses polytechniques et universitaires romandes.

Caris, A., Limbourg, S., Macharis, C., van Lier, T., Cools, M. 2014. "Integration of inland waterway transport in the intermodal supply chain: a taxonomy of research challenges". *Journal of Transport Geography* 41 : 126-136.

Chen, Y. S., and S. T. Wang. 2004. "The empirical evidence of the leverage effect on volatility in international bulk shipping market". *Maritime Policy & Management* 32(2), 109–124.

Djibouti Ports and Free Zones Authority (DPFZA). 2019a. "Communication", April 17, 2019, Djibouti.

Djibouti Ports and Free Zones Authority (DPFZA). 2019b. *Rapport statistique annuel: 2018*. Djibouti.

Djibouti Port and Free Zones Authority (DPFZA). 2018. *Rapport statistique annuel: 2017*. Djibouti.

Djibouti Ports and Free Zones Authority (DPFZA). 2017. *Rapport statistique annuel: 2016*. Djibouti.

Djibouti Ports and Free Zones Authority (DPFZA). 2016. *Rapport statistique annuel: 2015*. Djibouti.

Djibouti Ports and Free Zones Authority (DPFZA). 2015. *Rapport statistique annuel: 2014*. Djibouti.

Djibouti Ports and Free Zones Authority (DPFZA). 2014. *Rapport statistique annuel: 2013*. Djibouti.

Dua, J., 2014. *Regulating the Ocean: Piracy and Protection along the East African Coast*. Duke University, ProQuest Dissertations Publishing, 2014. 3629505. https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/9035/Dua_duke_0066D_12519.pdf?sequence=1&isAllowed=y

- Ducruet, C., and T. Notteboom. 2015. "Developing liner service networks in container shipping". In 2015. *Maritime Logistics*, edited by D.-W. Song and P. M. Panayides, 125-148. London - Philadelphia - New Dehli: LoganPage.
- Fischman M., Lendjel E. 2010. "Comment expliquer la permanence de l'artisanat dans le transport fluvial de marchandises ?". *Transports*, 464: 1-13.
- Fischman M., Lendjel E. 2012. "Changements institutionnels et efficience de l'affrètement au voyage dans le transport fluvial de marchandises". *Recherche Transports Sécurité (RTS)*, 28 (3): 228-247.
- Fu, Q., Liu, L., Xu, Z. 2010. "Port resources rationalization for better container barge services in Hong Kong". *Maritime Policy and Management* 36 (6): 543-561.
- George, J. 2010. "UAE dhows switch ports to avoid pirates : Traders now sail to Berbera and Bender Cassim in the Gulf of Aden". www.emirates247.com. Published Sunday, April 04, 2010.
- Gilbert, E. O. 1997. *The Zanzibar Dhow Trade: An informal economy on the East African Coast, 1860-1964*. Bostonne University, ProQuest Dissertations Publishing, 1997. 9713661.
- Gilbert, E. O. 2002. "Coastal East Africa and the Western Indian Ocean: Long-Distance Trade, Empire, Migration, and Regional Unity, 1750-1970". *The History Teacher* 36 (1): 7-34.
- Gilbert, E. O. 2004. *Dhows and the Colonial Economy of Zanzibar 1860-1970*. Oxford: James Currey.
- Gratsos, G. A., Thanopoulou, H. A. and A. W. Veenstra. 2012. "Dry bulk shipping". In 2012. *The Blackwell Companion to Maritime Economics*, edited by W. K. Talley, 187-204. London: John Wiley & Sons/Blackwell Publishing Ltd.
- Guilbault, M. (dir.) 2008. *Enquête ECHO « Envois-CHargeurs-Opérateurs de Transport » : résultats de référence*. Arcueil: Synthèse INRETS 56.
- Guy, E. and B. Urli. 2006. "Port selection and multicriteria analysis: an application to the Montreal-New York alternative". *Maritime Economics and Logistics*, 8: 169-86.
- Habib, M. 2018. *Assessment of Cargo Dhows in Djibouti Harbour*. Djibouti: World Food Program.
- Haralambides, H. Veldman, S., van Drunen, E., and M. Liu. 2011. "Determinants of a regional port-centric logistics hub: The case of East Africa". *Maritime Economics and Logistics*, 13: 78-97.
- Hekkenberg, R. G., van Dorsser, C. and Schweighofer, J. 2017. "Modelling sailing time and cost for inland waterway transport". *EJTIR* 17(4): 508-529.
- ICC-IMB. 2019. *Piracy and Armed Robbery Against Ships: Annual Report 2018*. London: International Chamber of Commerce - International Maritime Bureau.
- Kavussanos, M. G. 1996. "Comparisons of volatility in the dry-cargo ship sector: spot versus time charters, and small versus larger vessels". *Journal of Transport Economics and Policy*, 30 (1), 67-82.
- Lendjel, E. 2013. "Organisation du transport fluvial et coûts de transaction". In Y. Allix and R. Lacoste (eds.), *Logistique et transport des vracs*. Cormelles-Le-Royal: Editions EMS - Les Océanides. Chap. 7: 305-328.

- Lendjel, E. and N. Marei. 2019. "Dubai, a hub for Dhow shipping? Study of the connectivity between standardized networks and local networks". Communication at the International Association of Maritime Economists Conference, Athens, June 26-28.
- Lesourd, C. 2019. *Puissance Khat*. Paris: Presse Universitaire de France.
- Mareï N., and O. Ninot. 2018. "Transformation des transports en Afrique : vers des systèmes à plusieurs vitesses ?" *Questions internationales, La Nouvelle Afrique* 90: 27-31.
- Margariti, R. 2007. *Aden and the Indian Ocean Trade: 150 years in the Life of a Medieval Arabian Port*. Chapel Hill, NC: The University of North Carolina Press.
- Martin, E. B. 1980. "The Decline of Omani Dhows". Australian Association for Maritime History, *The Great Circle* 2 (2): 74-86.
- Martin, E. B. 1982. "The Present-Day Dhow Trade of India". Australian Association for Maritime History, *The Great Circle* 4 (2): 105-118.
- Monios, J. 2017. "Cascading Feeder Vessels and the Rationalization of Small Container Ports". *Journal of Transport Geography* 59: 88-99.
- Monios, J., Wilmsmeier, G. and A. K. Y. Ng. 2019. "Port system evolution – the emergence of second-tier hubs". *Maritime Policy & Management* 46 (1): 61-73.
- Msakni, M. K., Fagerholt, K., Meisel, F., Lindstadt, E. 2020. Analyzing different designs of liner shipping feeder networks: A case study". *Transportation Research Part E* 134: 1-17.
- NSC. 2012. "Identification guide for Dhows, Skiffs and Whalers in the High Risk Area". Northwood (UK): NATO Shipping Center – MARCOM. URL : <https://www.norclub.com/assets/ArticleFiles/NATO-Guidance-for-ID.pdf>.
- Noble, D. S. 1963. "The Coastal Dhow Trade of East Africa". *The Geographical Journal* 129(4); 498-501.
- Notteboom, T. 2006. "The Time Factor in Liner Shipping Services". *Maritime Economics and Logistics* 8: 19-39.
- OCDE 1996. *Questions relatives à la réglementation du transport maritime international*. Paris: Organisation de Coopération et de Développement Economique.
- Pirrong, S.-C. 1993. "Contracting practices in bulk shipping markets: A transactions cost explanation". *Journal of Law & Economics* 36 (2): 937-976.
- Rich, J., Kveiborg, O. and Hansen, C.O. 2011. "On structural inelasticity of modal substitution in freight transport". *Journal of Transport Geography* 19: 134-146.
- Rodrigue, J.-P., Notteboom, T. 2009. "The terminalization of supply chains: reassessing the role of terminals in port/hinterland logistical relationships". *Maritime Policy & Management*, 36 (2): 165-183.
- Rodriguez, L., Hoffmann, J., Youssef, F., Latrille, P. Benamara, H., and M. Weller. 2017. *Rethinking maritime Cabotage for improved connectivity*. United Nations Conference on Trade and Development. UNCTAD/DTL/TLB/2017/1.
- Salvanes, K. G., Steen, F. and L. Sjørgard. 2005. "Hotelling in the air ? Flight departures in Norway". *Regional Science and Urban Economics* 35: 193-213.

- Sheriff, A. 2010. *Dhow Cultures of the Indian Ocean: Cosmopolitanisms, Commerce and Islam*. London: Hurst & Company, Zanzibar Indian Ocean Research Institute.
- Song, D.-W., and P. M. Panayides. 2015. *Maritime Logistics*. LoganPage, London - Philadelphia - New Dehli, 2nd edition.
- Starkey, P. 2001. "Local transport solutions: people, paradox and progress, sur les « modes de transports intermédiaires »". Washington D. C.: Sub-Saharan Africa Transport Policy Program - The World Bank and Economic Commission for Africa: *Working Papers* 56, 73p.
- Stopford, M. 2009. *Maritime Economics*. London: Routledge, 3rd edition.
- Teravaninthorn, S., and G. Raballand. 2009. *Le prix et le coût du transport en Afrique: Etudes des principaux corridors*. Washington D. C.: Sub-Saharan Africa Transport Policy Program - The World Bank. Report n° 46181.
- Tong, J., Natchmann, H. 2017. "Cargo prioritization and terminal allocation problem for inland waterway disruptions". *Maritime Economics & Logistics* 19: 403–427.
- UNCTAD. 2017. *Review of Maritime Transport*. United Nations Publications. Sales n° 17.II.D.10.
- Van der Horst, M. R., De Langen, P. W. 2008. "Coordination in Hinterland Transport Chains: A Major Challenge for the Seaport Community". *Maritime Economics & Logistics* 10: 108–129.
- Verne, J. 2017. "Re-enlivening the Indian Ocean through contemporary trade: East African traders searching for new markets in Jakarta". *Singapore Journal of Tropical Geography* 38: 123-138.
- Walker, A. R. 1981. *Seaports and development in the Persian gulf*. Durham: Durham theses, Durham University. URL : <http://etheses.dur.ac.uk/7838/>
- Wiegmans, B., Van der Horst, A. and T. Notteboom, 2008. "Port and terminal selection by deep-sea container operators". *Maritime Policy and Management* 35(6): 517-34.
- Williamson, O. 1996. *The Mechanisms of Governance*. Oxford: Oxford University Press.
- Yang, Z., Shi, H., Chen, K. and Bao, H. 2014. "Optimization of container liner network on the Yangtze River". *Maritime Policy & Management* 41 (1) : 79–96.
- Zhang, Y. Y., Chang, M.-S., and Fuller, S. W. 2015. "Statistical analysis of vessel waiting time and lockage time on the Upper Mississippi River". *Maritime Economics & Logistics* 17(4); 416–439.