throughput in the GDP, using a traditional growth model, which is applied to the country's main and biggest port, Bandar Abbas.

TRANSPORT AND ECONOMIC DEVELOPMENT IN IRAN

Apart from attracting international investors to projects in the energy sector, Iran also needs to attract investment into sectors such as tourism and transport that yield sustainable development and employment for the economy (see for example, UN Symposium, Tehran, 2016; Seghir, *et al,* 2015; UN, 2002). The Statistical Centre of Iran (2016) indicates that transport and warehousing sector contributed almost 7% of total GDP in 2013. Iran is strategically located and shares borders with sixteen different countries, five of which are land locked. Iran borders Afghanistan, Armenia, Azerbaijan, Iraq, Pakistan, Turkmenistan and Turkey by land and the United Arab Emirates, Bahrain, Kuwait, Oman, Qatar and Saudi Arabia by sea. The land-locked countries are: Turkmenistan, Azerbaijan, Afghanistan, Armenia, and Kazakhstan.

Improved transport infrastructure in Iran would provide better access to the Caspian Sea (CS) countries for the EU and facilitate trade with the region. As mentioned in the introduction, there are a few emerging opportunities that Iran can exploit them in the favour of its economic development, as described below.

Growth in GDP of Iran: The World Bank (2016a) predicted a more business- oriented environment for Iran, with 4.8% growth in the real GDP of Iran in 2017. This growth will be mainly reliant on the oil sector. Exports would be the main driver of growth, followed by consumption and investment (ibid). The expected increase in exports may put more emphasis on investment in and development of transport infrastructure. Moreover, the banking system, driven by activity in the gas and oil sector and government fiscal policies, would be improved which could in turn result in lower transactions costs and strong capital inflow including foreign direct investments (FDI) (ibid). The result would be a significant increase in the primary hinterland demand for Iranian ports.

Post sanctions' trade: Post sanctions' re-established trade relationship with the EU. Prior to the establishment of sanctions in 2007, the EU had been Iran's main trading partner. This relationship was hampered by the imposition of EU sanctions against Iran. Significantly, national port development in Iran has also been adversely affected. It is expected that in the post sanctions time, this relationship, and consequently ports activities will be upgraded.

Increased gas demand: The EU-28's energy provision policies, following the removal of sanctions, can result in increased gas demand of Iran which in turn stimulates the economic growth of Iran. The EU-28 is facing a general decline in primary energy production, which has caused increased reliance on imports to satisfy demand. In 2014, close to one quarter (25.5 %) of the EU-28's total production of primary energy was accounted for by renewable energy sources, while the share for solid fuels (19.4 %, largely coal) was just below one fifth and the share for natural gas was somewhat lower (15.2 %). Crude oil (9.1 %) was the only other major source of primary energy production (Eurostat, 2016).

To ensure a stable and adequate supply of energy, the European Commission in its 2014 "Energy Security Strategy" proposed action in five areas. Diversifying supplier countries was one of the long-term policies outlined. Iran did not play any role in the EU's energy supply policy due to sanctions and the oil boycott (Eurostat, 2016; European Commission, 2016b). However, the JCPOA did allow the EU to explore Iran's gas and oil reserves in light of its energy security strategy (European Commission, 2016c).

As of 2016, the EU is designing a comprehensive new strategy for re-establishing relations

with Iran. This move will develop the EU-Iran relationship by means of a Co-operation and Trade Agreement (CTA) and will also support Iran's accession to the WTO (European Commission, 2016a; European Commission, 2016c; Cronberg, 2016; European Parliament, 2016).

Port transhipment function and demand generation: Iran has borders with sixteen different countries, stretching from the Persian Gulf in the south to the CS in the north. Five of these neighbouring countries are landlocked. Iran's geographical location makes Persian Gulf ports of Iran strategic regional ports with extensive hinterland and strong possibilities of increased transit cargo from the CS to the Persian Gulf. Secondary hinterland of Iranian ports could be expanded as a result of predicted economic growth of the CS countries (e.g. World Bank, 2016a; World Bank, 2016b; World Bank, 2016c; GOJ Online, 2016) as well as Turkmenistan and Afghanistan (World Bank, 2016b; World Bank, 20106c; GOJ Online, May 2, 2016; Global Security, 2016).

Bearing in mind that these land-locked countries can only have access to the global maritime network through Iran, it becomes even more imperative to improve the transhipment performance of Iranian ports and exploit its geographical and geopolitical advantage. In reaction to mentioned emerging opportunities, Iranian ports can act as an infrastructural facilitator to harness this set of circumstances so that it leads to sustainable national economic development. Appropriate investment in port infrastructure would provide the prerequisites to turn Iranian ports into the region's hub.

PORT EVOLUTION TO A COMMERCIAL CLUSTER

The concept of cluster is broadly discussed in the literature (see for example Krugman (1998) and Porter (2000) as the initial academic works which introduced the concept of 'cluster formation in new economic geography). We suggest "commercial clusters" that are formed in unique locations are referred to as "commercial locations" that have a geographical comparative advantage in transport and commerce. A commercial cluster forms in a location that can provide shippers with entire commercial and logistics requirements. In other words, it is the outcome of commercial decisions by commercial actors who are attracted by the ability of the cluster to provide the desired level of logistics and commercial services which add value in terms of customisation, frequency, flexibility, efficiency, effectiveness and accuracy. Commercial activities need to be in a region with distribution infrastructures that can maintain trade between numerous partners.

We propose that firms would split their main types of activities (financial, manufacturing and commercial) to different locations. If a particular port develops and acquires a competitive advantage as a commercial location, domestic as well as foreign firms will relocate to this particular port because of its commercial competitiveness. Several changes have occurred in container transport and its role in the supply chain in recent years. Arguably, these developments are associated with the processes of economic and industrial globalization which are creating a new global business environment. Global competition puts pressure on firms to outsource, for which the establishment of global supply chains is a necessary condition. A progress that supports this new phenomenon is Global Container Transport System (GCTS) which is a door-to-door operations transport network connecting spatially diverse manufacturing centres and consumer markets.

To succeed in this global business environment in which production is separated by thousands of miles from consumer markets, firms' global supply chain strategies do not only aim

to reduce manufacturing costs, but also seek to achieve a smooth commodity flow at minimum cost (Marcus, 2010). Thus, transport productivity has become more important and strategic than ever in the contemporary complex global economy as it connects players in the supply chain.

Spatial economic geography, Modern Industrial Dynamic (MID) and global supply chain strategies have a profound effect on port functions. The formation of commercial clusters will in turn have cluster effects which have implications on a port's competitive position and hinterland expansion. The proposed commercial cluster specifies that port development and competition in modern time is not only dependent on port investment and hinterland connection but also on the commercial cluster (network) effects. To better understand the globalization influences on port competition, Figure 1 shows the evolutionary trends in the global business environment and its impact on Supply Chain Management (SCM) and transport.

The diagram traces evolutionary trends in the global business environment and in the operating and functional characteristics of ports, transport and supply chains from the 1960s to present day. These trends are the main influential factors for modern port competition. The figure specifies four interconnected developments, namely, global business developments, global supply chain developments, global transport developments and port developments. The diagram illustrates that the development in global business has impacts by triggering knock-on developments in other sectors. While these trends are not easy to quantify, they are investigated indirectly through the traditional factors in the growth model.

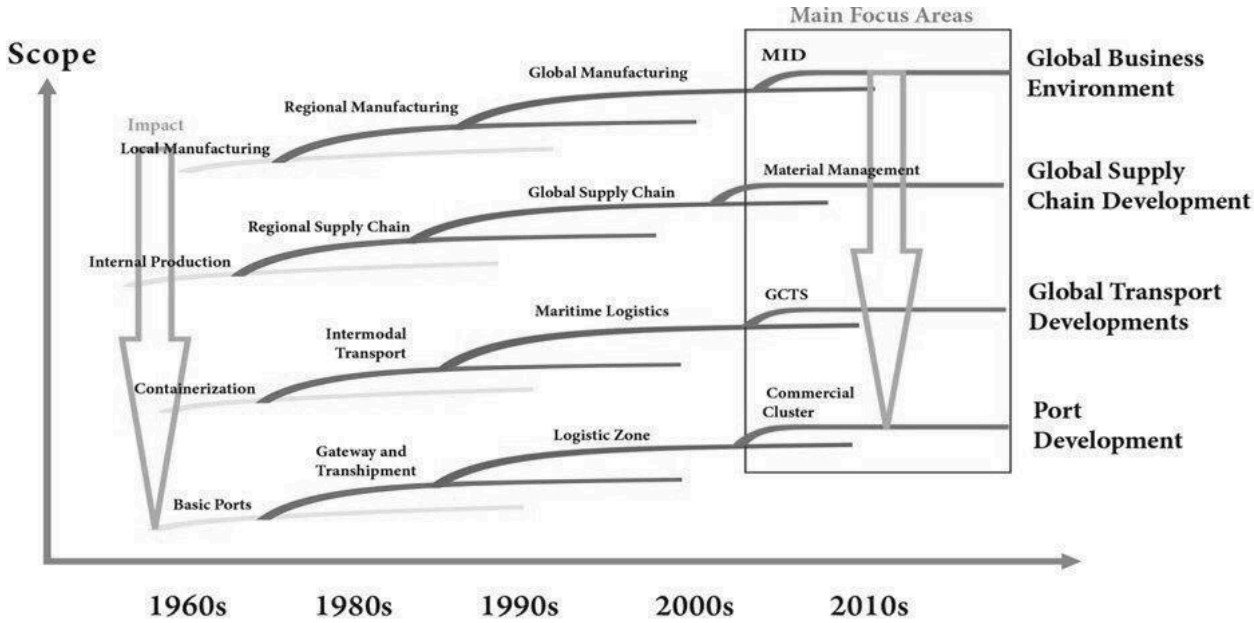

Figure 1. Evolutionary trends in global business environment and its impact on SCM and transport.

Findings of the literature indicate that global competitive pressures make the establishment of global supply chains by firms a necessary part of firms' operations. Transport productivity has become more important and strategic than ever as it connects players in the supply chain. This emerging phenomenon emphasizes the prospective role of ports in regional economic development in the future. In this context, we suggest a different approach to contemporary literature for a port competition study, which is based on cluster theory. It extends the concept of clusters to consider business function clusters in which business functional activities form the

fabric of the links and networks which give rise to competitive advantages in specific locations.

Commercial activities as an important business activity for many industries can be in the same location to form a commercial cluster. In cluster theory, any cluster has network effects. This is due to the synergy that the network of business activities would create. Built on this theory, we propose that network cluster effects in commercial location would provide a competitive edge for the port, since commercial location accommodates many different industries ranging from car manufacturers to pharmaceutical companies and many others.

If Bandar Abbas develops into the regional hub, it will not only serve the land locked countries in the Caspian Sea region but would also serve the west bound ports of the Persian Gulf as the regional spokes and their hinterland as the secondary hinterland. The secondary market is mainly subject to competition from neighbouring ports where there is an overlap between the market areas. This area is called the competition margin. The competitive advantage of a port in the competition margin would be strengthened by developing strong functional links with the cluster as a distribution centre within the immediate hinterland.

As a commercial cluster offers business connections that could expand the secondary market, then the boundary of the hinterland will be pushed back, thus expanding its geographical area. Moreover, the competitive advantage of the cluster will lead to an increase in market share as the territory in distant locations could be taken away from the hinterland served by competing ports. Since the competitive margins of hinterlands become increasingly indistinct, competition between ports within the same port system gets intensified.

AN EMPIRICAL ESTIMATE OF PORT CONTRIBUTION TO GDP

A quantitative analysis is carried out to estimate port infrastructure contribution to economic development in the existing conditions. This estimation provides a base which the main of discussion of this chapter will be built on. The theory stems from cluster theory and discusses that ‘port evolution to a commercial location” is a key element to turn a modern port to a source of value added, economic development, and employment for the national economy.

Modelling and methodology: Several methods – Input Output Analysis, social cost-benefit analysis (SCBA), Auto-Regression (VAR) model, and traditional growth model - could be adopted to analyse empirically the impact of transport infrastructure on Iranian economic activity and trade. Due to the limited number of observations, the log linear model is considered the most suitable and applicable model for the purpose of this study.

We apply a single equation in this study.

The cointegrating relation is estimated and its residuals are tested for stationarity: if they are, the estimated relation is the cointegrating relation. The model specification is:

$$y = f\,(l, \text{int}, open,\ p) \tag{1}$$

Where

y = the ratio of total GDP to total capital.

l = the ratio of total employment to total capital.

int = the ratio of total investment in transport sector to total capital.

open = the ratio of openness degree of economy ((Import+ Export) /GDP) to total capital.

p = the ratio of total sea transport to total capital.

The following log linear model has been used to estimate the long run relationship between the above variables as this form theoretically and empirically provides more reliable results than the linear form (Layson, 1983; Ehrlich, 1977).

$$\ln(y_t) = \alpha_0 + \alpha_1 \ln(l_t) + \alpha_2 \ln(\text{int}_t) + \alpha_3 \ln(open_t) + \alpha_4 \ln(p) + \varepsilon_t \quad (2)$$

Equation 2 captures the long-run relationship between variables of the model.

Data: The related data of Iran covers the period 1974 to 2012 - collected in the form of annual time series including port throughput, investment in transport infrastructure, employment. The primary data to calculate openness degree are collected from the Central Bank of Iran (CBI, 2017).

Empirical results: The first part is dedicated to the unit roots (stationary) test. This part discusses the underlying properties of stationary and non-stationary (unit roots) processes. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are applied to test the stationarity of a series. The results show that all the variables have unit root at level. However, their first differences are stationary, meaning that they are integrated of order one (I(1)). Given that the time series under consideration are I(1), in the next step cointegration test is employed to test for cointegration between variables.

The cointegration methodology enables investigation of equilibrium relationships among non-stationary series. Johansen (1988) cointegration test identifies that there is one cointegrating relationship between variables at the conventional significant level. Table 1 shows the results of the estimated model; the dependent variable is Ln y.

Table 1. OLS estimation of the long run relationship between variables.

Variable		Coefficient	Std. Error	t-Statistic	Prob.
C	α_1	7.000112	1.317189	5.314433	0.0000
LL	α_2	0.437026	0.205831	2.123221	0.0411
LOPEN	α_3	0.467069	0.082118	5.687765	0.0000
LINT	α_4	0.723992	0.101134	7.158704	0.0000
LP	α_5	0.114912	0.045715	2.513679	0.0168
R-squared		0.925336	Mean dependent var		-1.246112
Adjusted R-squared		0.916552	S.D. dependent var		0.269970
S.E. of regression		0.077987	Akaike info criterion		-2.145330
Sum squared resid		0.206789	Schwarz criterion		-1.932053
Log likelihood		46.83394	Hannan-Quinn		-2.068808
F-statistic		105.3427	Durbin-Watson s		0.961942

The elasticity of GDP regarding total employment/total capital (l) is 0.43 - positive and significant - meaning that one percent increase in the total employment/total capital results in a 0.43% increase on average in the real GDP/total capital. Total investment/total capital in the transport sector (int) for the investigated period is found to have the largest impact on GDP (0.72%). One percent increase in the openness ratio/total capital (open) and sea transport/total capital (p) increase on average the real GDP by 0.46% and 0.11% respectively.

Apart from direct effects, investment in the transport sector can raise GDP by triggering related transport sector – supporting activities such as cargo handling, cargo storage, forwarders, agencies, and postal services.

However, ports contribute to GDP through other channels as well (indirect effects), openness degree of the economy being the best example.

The estimated results are consistent with theoretical arguments that investment in transport infrastructure functions as an economic growth resource. Results from previous studies (Barzelaghi, et al, 2012; Sojoodi, et al, 2012) and the input output tables for Iran in 1991, 1996,

2001, 2006, and 2011 identified the importance of the contribution made by the transport sector – including the impact of re-exporting - to the total Iranian GDP. Although the results reveal positive and significant role of sea transport for GDP, it still lags behind its regional competitors. Port of Dubai, for example, is using its competitive advantages efficiently as the share of port of Dubai in the national GDP reached 2.5% in 2014 (Government of Dubai, 2015). Whereas, in terms of primary hinterland (inside Iranian borders), accessibility to the secondary hinterland (land-locked neighbouring countries), and safe passage, Iran has greater advantages over the port of Dubai.

Our findings show demand for transport infrastructure of Iran is anticipated to increase. It has been forecasted that Iran would add 570,000 TEUs per year to its containership capacity, 2 million deadweight tonnage per year of dry bulk vessels, and 1.6 million deadweight tonnage per year of tankers by the year of 2020 (Mooney, 2015). For these forecasts to materialise, much depends on the current demand being maintained for gateway business. Furthermore, if Iran's transhipment capacity, which will give access to the westbound ports in the Persian Gulf and the CS's land-locked countries, is taken onto account, this has the capacity to generate a significant rise in the level of national economic activity. However, Iran is suffering from the lack of investment and exploitation of transport sector.

Competitive state of ports of Iran: Ports of Iran - specifically Bandar Abbas - have the prerequisites to be strategic in trade and shipping networks, as they can act as an important node in the East-West network configuration, connecting the Caspian Sea (CS), land-locked countries and global shipping lines.

However, despite this unique potential and the growing demand of both gateway and transhipment activities, Iran's transport infrastructure and the capability lag behind in terms of the ability to respond to the emerging demand. The World Bank (2017) ranks Iran 170th out of 190 economies for ease of trading across the borders. Table 2 shows Iran's position compared to other Middle East and North African (MENA) countries, in terms of indicators related to the shipment of goods through sea or land transport modes.

Table 2: Summary of export and import time and cost for trading across borders in Iran

	Iran	Middle East and North Africa
Time to export: Border compliance (hours)	101	61
Cost to export: Border compliance (UDS)	565	437
Time to export: Documentary Compliance (hours)	152	74
Cost to export: Documentary Compliance (USD)	143	248
Time to import: Border compliance (hours)	141	115
Cost to import: Border compliance (UDS)	660	527
Time to import: Documentary Compliance (hours)	270	96
Cost to import: Documentary Compliance (USD)	197	290

Source: World Bank, 2017

Further information is provided by the World Bank (2015) regarding Iran's attractiveness for exports and imports. In 2015, 25 to 37 days were needed to export and import goods from and to Iran. This compares unfavourably with 13 and 14 days for Turkey, and 19.4 and 23.8 days for

MENA during the same period. In terms of documentation required, Iran also compares less favourably to Turkey and MENA with 11 documents required importing goods to Iran, while only 8 were needed for Turkey and MENA.

The cost of exporting and importing to Iran compared to Turkey and MENA was respectively 36% and 16% higher (World Bank, 2015). With regards to the quality of overall infrastructure, Iran's 82nd place is far behind that of its competitors, Turkey and Malaysia that are ranked 33rd and 20th respectively (World Bank, 2017).

Table 3: Infrastructure ranking in Iran and in comparator countries (ranking among 144 economies unless indicated otherwise)

	Iran	Turkey	Malaysia
Quality of overall insurance	82	33	20
Quality of roads	63	40	19
Quality of railroad infrastructure	45	49	12
Quality of port infrastructure	80	57	19
Quality of air transport infrastructure	122	34	19
Available airline seat km/week. millions	56	17	22
Quality of electricity supply	61	72	39
Mobile telephone subscriptions 100/pop	112	105	30
Fixed telephone lines 100/pop	27	65	73

Source: World Bank, 2016b

Table 3 provides a comparison of different transport modes in the three competing countries. From the data, while Iran scored well in terms of the quality of railroad infrastructure, electricity supply and fixed telephone lines, it still lags behind the other two countries in terms of the transport infrastructure that is required for international trade and global communications such as port infrastructure, air transport infrastructure, available airline seat per km/week and mobile telephone subscriptions.

Bandar Abbas is the biggest port of Iran, handling 80% of the country's container throughput. Its throughput fell from 2.8 million TEUs to 1.82 million TEUs from 2011 to 2014 and lost 43 places (from 44th to 87th) in the ranking of the world's top container ports at the same time. Following removal of the sanctions, the expectation is that its throughput will increase by 25% per year for several years (Mooney, 2015).

If Bandar Abbas develops into the regional hub, it will not only serve the land locked countries in the Caspian Sea region but would also serve the west bound ports of the Persian Gulf as the regional spokes and their hinterland as the secondary hinterland. The secondary market is mainly subject to competition from neighbouring ports where there is an overlap between the market areas.

This area is called the competition margin. The competitive advantage of a port in the competition margin would be strengthened by developing strong functional links with the cluster as a distribution centre within the immediate hinterland. The competition margin represents an area where a terminal can be competing with other terminals. The competitiveness becomes a matter of differential accessibility, costs and quality and reliability of service.

Previous studies have shown that technical factors are the most influential for port competitiveness. These include the factors that are mentioned in tables 14.2 and 14.3 (see for example, Nazemzadeh, 2016; Sayareh and Rezaee Alizmini, 2014; Pires da Cruz et al, 2013; Panayides and Song, 2012; Onut et al, 2011; Sanchez et al, 2011; Aronietis et.al, 2010). The

factors are generally classified as port cost, quality of hinterland connection, geographical location, productivity, capacity and reputation.

As a commercial cluster, ports offer business connections that could expand the secondary market, then the boundary of the hinterland will be pushed back, thus expanding its geographical area. Moreover, the competitive advantage of the cluster will lead to an increase in market share as the territory in distant locations could be taken away from the hinterland served by competing ports. Since the competitive margins of hinterlands become increasingly indistinct, competition between ports within the same port system gets intensified. Therefore, well- developed transport infrastructure in Iran, specifically at the Port of Bandar Abbas would be essential.

The conceptual framework that we proposed in this paper specified that outsourcing and relocating different business functions is the main theme in the strategic decision making for the freight transport sector, and consequently in the formation of the new economic geography. In this line of thought, Bandar Abbas must not only develop itself to reach its competitors, but must also play the role of a hub in the region, especially for countries in the Caspian Sea's region. Once this has been achieved, it can become a key commercial location in the region that would lead to even higher value added being realised for the national economy.

CONCLUSION

The main theoretical argument of this study is that a port should provide additional value adding fundamentals by developing into a commercial location through creating a commercial cluster. Transport infrastructure in general, and port infrastructure in particular, are economic growth resources, especially for the countries with locational advantages such as Iran. Iran's position makes it a cross road between many nations.

A port location can develop into a commercial location that attracts commercial activities of businesses and become a cluster that creates value added above the traditional direct and indirect effects of transport. Port regional competitiveness is a key development factor.

The high potential level of openness of the Iranian economy and contribution to global trade requires globalized national supply chain and transport infrastructure. Once achieved, it results in the economy being further affected by transport infrastructure performance and productivity.

Both technical and structural factors' improvement are essential to move Bandar Abbas towards a regional commercial location. Technical factors range from berthing depth to the container services and are under control of the PMO. Structural factors range from trade policies to policies relating to port charges and FDI. Adjustment of these structural factors is within the remit of the government. Iranian industrial policy makers should take ports and their evolution to commercial location into account when formulating policies and strategies for achieving sustainable development and creating employment.

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