



Container shipping: a systematic literature review of themes and factors that influence the establishment of direct connections between countries

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Abstract

The establishment of direct connections between countries in container shipping is largely driven by the underlying trade dynamics. It is also the joint result of various other contributing factors, ranging from land infrastructure to carrier strategies. The literature to date has only partially focused on some of the factors that in theory may affect the establishment of direct connections but has mainly focused on the positive impact that a direct connection between two countries may have on bilateral trade development. However, there has been only limited research on the systematic identification of the factors that should be in place, to promote or prevent the establishment of a direct link between countries in container shipping. This paper attempts to fill this gap by undertaking a Systematic Literature Review that examines the issue from various perspectives and classifies the previous research under five themes: (1) Shipping Network, (2) Connectivity, (3) Port Selection Criteria, (4) Trade and (5) Alternative Transport Modes. A framework is subsequently developed which identifies the set of factors that determine the establishment of direct container shipping connections between trading countries and the expected impact (positive, negative or ambiguous) of each factor. The insights from our research and the framework developed can be of use to interested stakeholders across the research and policy domains who have an interest in both the establishment and continuation of direct container shipping connections between trading countries.

Keywords Systematic literature review · Direct shipping connections · Liner shipping · Container shipping network · Connectivity · Bilateral trade

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1 Introduction

Container shipping and the globalised container shipping network allow importers and exporters of intermediate and manufactured goods to trade with remote partners in foreign countries. Bilateral trade between countries may be supported by either a direct connection or a connection via a third country. Thus, the quality of connectivity to international markets is of critical importance for the containerised trade of a country (Fugazza 2015; de Benedictis and Tajoli 2011). A direct connection between countries is defined as the shipping link which does not involve transshipment via a third country. In container shipping, vessels may stop at multiple ports en route and some containers may be loaded or discharged at each port. However, if a container remains onboard a vessel during its transportation between two countries, regardless of the number of port calls before it reaches its destination port, then this is still regarded as a direct connection (Fugazza et al. 2014). The existence of direct links can also promote trade, because they offer proximity to specific hinterlands with limited or no need for transshipment (Tran and Haasis 2018).

Ducruet and Notteboom (2012b) noted that although the shape of the shipping network follows the trade patterns, it is also characterised by other practical intricacies, comprising technological factors (e.g. infrastructure), as well as territorial factors (e.g. socio-economic developments). Fugazza and Hoffmann (2017) showed that the absence of a direct connection between two countries is correlated to lower export values, and additional transshipment is likely to be associated to 40% less bilateral exports value. Calatayud et al. (2017) showed that a shipping network does not perfectly overlap with the corresponding trade network: a reflection of a hub-and-spoke shipping network organisation which, however, ensures the continuous trade flow between countries. Ultimately, the connectivity of the nodes that form a shipping network is largely dictated by carrier strategies. Wilmsmeier and Notteboom (2011) identified four phases in the development of liner shipping networks: (1) direct services to serve local or regional needs; (2) intermediate hubs to serve the need for further connections overseas; (3) further access to the broader hub-and-spoke network by various ports; and (4) the volumes of several ports are large enough to attract the interest of shipping lines for direct connections to overseas regions. Consequently, the connection of two countries is a decision associated with the strategy of the shipping companies (i.e. network design) and affects operations. At the same time, this decision is largely driven by short-term choices on a tactical level and reflects the market responsiveness of the company (Meng et al. 2014).

In the context of this paper, the establishment of a direct connection refers to the initiation and continuation of an international shipping link between two trading countries. The existing literature has interchangeably used terms such as “countries”, “economies” and “partners” to describe the corresponding international trade relationships. In the context of this paper, the term “country” refers to territories with political independence (The World Bank 2022) controlled by their own government (Britannica 2022). The paper reports on a systematic literature



review which was conducted to examine the different perspectives adopted in the relevant literature, with the intention to identify the factors that may encourage—or discourage—the establishment of a direct shipping connection between two trading countries. Specifically, the systematic literature review aims to answer the following Research Question: what are the factors that liner shipping companies consider in order to establish a direct shipping connection between two trading countries?

The paper is organised as follows: Sect. 2 describes the systematic literature review methodology employed; Sect. 3 details the results obtained; Sect. 4 discusses the findings in groups of distinct themes and summarises the use of the results; and finally, Sect. 5 concludes the paper and outlines recommendations for further research.

2 Systematic literature review (SLR)

2.1 Theoretical background and approach

A systematic literature review follows an audit structure which is clearly documented and includes all relevant decisions regarding the process and the outcome of the decisions made by the researcher (Cook et al. 1997). The method avoids the possible bias introduced by the implicit likings of the researcher, achieving thoroughness (Wang and Notteboom 2014) and thus making a decisive step towards scientific conclusions (Rousseau et al. 2008). In a systematic literature review, the collected evidence is summarised by a well-defined and explicit methodology and this ultimately differentiates the systematic approach from traditional approaches (Khan et al. 2003, Lavissière et al. 2020).

Following the approach outlined by Tranfield et al. (2003), the majority of systematic approaches to literature review are organised in discreet phases, either in broad stages (e.g. Parola et al. (2017) or in detailed steps [e.g. (Fruth and Teuteberg 2017; Lavissière et al. 2020; Raza et al. 2020; Wang and Notteboom 2014)]. In our SLR, we combine the 3-stage approach of Parola et al. (2017) with the respective 5-step structure applied by Wang and Notteboom (2014) (Fig. 1). The format followed by Parola et al. (2017) and Wang and Notteboom (2014) indicates that although these authors have followed two different approaches (the former in stages, the latter in steps) they share a similar rationale which can form a single framework. The stages outline the milestones of our methodology. The corresponding steps within stages outline the detailed actions taken in order to reach each of the milestones. The first stage relates to the Planning of the review and corresponds to the formulation of the Review Question (2.2). The second stage proceeds with the Execution of the review and includes the search and collection of the studies (2.3) as well as their evaluation and selection according to preset criteria (2.4). Finally, the third stage comprises the Reporting of the results. This starts with the Analysis and Synthesis of the findings (3.1) and—following the discussion of the results—concludes with the Use of the results (4.2).



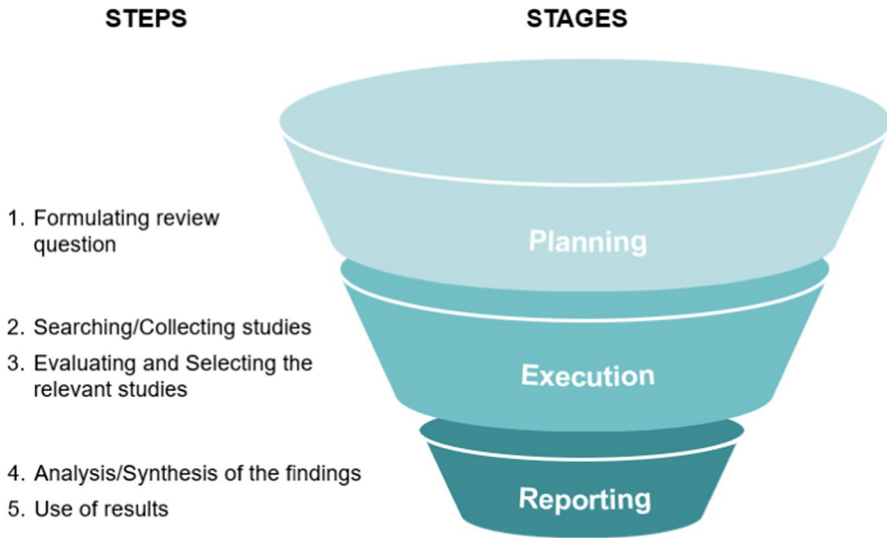


Fig. 1 Systematic literature review approach. Adapted from Parola et al. (2017) and Wang and Notteboom (2014)

2.2 Formulating review question

Routes in container shipping are organised as sequences of port calls which collectively form the container shipping network. The consideration towards establishing pairwise connections may be triggered by specific dynamics (e.g. the momentum of bilateral trade) but may ultimately depend on whether specific countries constitute good candidates in a carrier's route sequence. Hence, the review was designed to include previous studies that have discussed routes in a container shipping network context, with a particular focus on direct connections.

Consequently, the SLR has been conducted as a structured deep-dive into the existing literature, with the intention to provide insights to the Research Question (SLR Step 1—Planning Stage) which, as already noted above, is: *what are the factors that liner shipping companies consider in order to establish a direct shipping connection between two trading countries?*

Thus, during the review of each publication, the researchers aimed to systematically identify references to factors that could promote or, respectively, prevent a direct shipping connection between two trading countries.

2.3 Searching/collecting studies

A core step of a systematic literature review is the identification of the search keywords in accordance with the scope of the study (SLR Step 2—Execution



stage). We applied a series of queries which utilised relevant keywords in accordance with the study scope.

The body of the SLR was built by interrogating the Scopus database. However, the main research queries were also fed to Google Scholar, so as to broaden the research (Fruth and Teuteberg 2017), and possibly include other sources and publications, generated and published outside of the acknowledged academic channels, such as working papers or reports by national or international institutions (Calatayud et al. 2016).

Thus, Query 1 was input to Scopus and included the keywords of “*route*”, “*network*”, “*container shipping*” and “*liner shipping*”. The search was enriched with a set of Boolean (i.e. AND, OR) operators (Raza et al. 2020) and also allowed for possible variances (Fruth and Teuteberg 2017) of the utilised keywords (i.e. rout*, network*). The search was executed based on title, abstract and keywords:

Query 1: TITLE-ABS-KEY (“rout*” OR “network*” AND “container shipping” OR “liner shipping”).

Since the focus of the research is towards direct routes, the results of Query 1 were thoroughly studied with the aim to identify synonyms of “*route*” which have been used in the literature in conjunction with “*direct*”. This effort revealed a set of additional keywords, comprising “*call*”, “*shipment*”, “*operation*”, “*delivery*”, “*service*”, “*connection*”, “*transport*”, “*link*”, and “*port*” as well as their variances. The new set of keywords formed Query 2 which was also applied to the Scopus database as follows and yielded 57 additional publications:

Query 2: TITLE-ABS-KEY (“direct”) AND (“rout*” OR “call*” OR “ship*” OR “operation*” OR “deliver*” OR “service*” OR “connect*” OR “transport*” OR “link*” OR “port*”) AND (“container shipping” OR “liner shipping”).

As noted above, the research was extended to Google Scholar in order to widen the potential results. Thus, Query 3 was executed as a repeat of Query 1 and 2 on a Google Scholar search (full article):

Query 3: Query 1–2 on Google Scholar.

In order to explore any parallels and good practices with regard to routes for other transport modes, Query 1 was also applied to Scopus by substituting the shipping element with “*rail freight*” or “*railfreight*” or “*air freight*” or “*airfreight*”.

Query 4: TITLE-ABS-KEY (“rout*” OR “network*” AND (“rail freight” OR “railfreight”) OR (“air freight” OR “airfreight”)).

Finally, with the aim of accounting for any omitted relevant publications, we applied the Snowballing technique (Raza et al. 2020; Fruth and Teuteberg 2017) which allows a researcher to track additional literature by using a reviewed paper as a starting point.

2.4 Evaluating and selecting the relevant studies

Following the implementation of each query, a structured and standardised appraisal of the collected studies was conducted (SLR Step 3—Execution stage). This included a crucial classification of the collected studies based on their relevance to the review question, as well as their reliability (Wang and Notteboom 2014). The



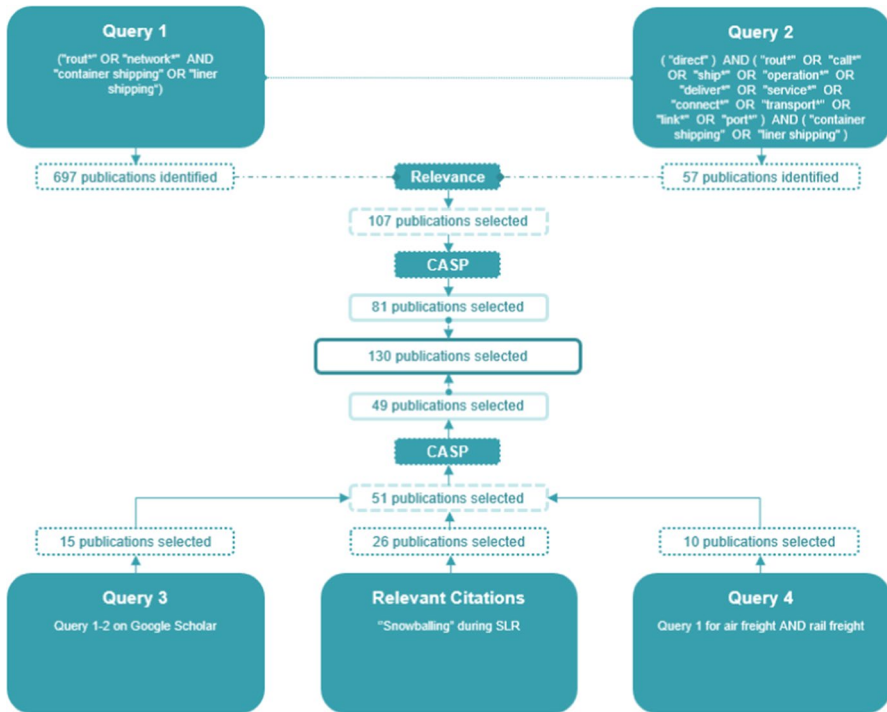


Fig. 2 Systematic literature review process

appraisal of the collected studies comprised two phases. In the first phase, the results of the queries were evaluated with regard to their relevance to the research scope and, in the second phase, with regard to their quality (Calatayud et al. 2016). The relevance evaluation was carried out based on title, abstract and keywords. For the quality evaluation, assessment forms such as the one suggested by the Critical Appraisal Skills Program (CASP) are commonly used (Campbell et al. 2003), although CASP has primarily focused on the training of healthcare professionals. For the inclusion of studies in the final list, we applied a modified version of the CASP checklist, as suggested by Wang and Notteboom (2014). A relevant sample is shown in the [Appendix](#).

The conduction of the SLR led to the selection of 130 publications and the overall progression through the 3 stages/5 steps is illustrated in Fig. 2.

3 Results

3.1 Analysis/synthesis of the findings

The evaluation of the publications should be followed by the extraction of the relevant information from each publication through analysis, and the integration of



the findings through synthesis (Wang and Notteboom 2014; Mulrow 1994) (SLR Step 4—Reporting stage).

The final list included 130 publications spanning from 1998 to 2021 and consisted of 114 journal articles and 16 publications from other sources (i.e. book sections, working papers and conference proceedings).

In accordance with Wang and Notteboom (2014) and since the reviewed studies included both quantitative and qualitative results, we adopted an integrative approach that allowed the aggregation of the results in a manner of “general sense from each study”. Wang and Notteboom (2014) noted that such an approach imitates a similar approach, previously adopted by Yin (1989). With regard to the identified factors, the SLR reports both enablers as well as possible barriers towards the establishment of a direct shipping connection between countries. Table 1 presents a brief description of the identified factors (see Sects. 4.1.1 to 4.1.5 below for detailed lists of references discussing each factor):

It is recommended (Tranfield et al. 2003) that, following on from the SLR, a thematic analysis is conducted. This aims to classify the reviewed publications into themes, on the basis of the discussed topics and problems (Raza et al. 2020), or the shared characteristics and perspectives (Calatayud et al. 2016). In our SLR, various factors have been identified that are pertinent to the establishment of direct connections by liner shipping companies. These factors can be categorised into 5 broad Themes: (1) Shipping Network: discussing how carriers’ decision to connect directly two countries may be influenced by certain shipping network characteristics as well as opportunities or considerations for the enhancement of the network; (2) Connectivity: discussing how carriers’ decision to connect directly two countries may be influenced by country-level connectivity characteristics; (3) Port Selection Criteria: discussing how carriers’ decision to connect directly two countries may be affected by specific port selection criteria; (4) Trade: discussing how carriers’ decision to connect directly two countries may be affected by trade dynamics and needs and (5) Alternative Transport Modes: discussing factors considered by the stakeholders of air freight and rail freight networks. The rationale of each Theme is further discussed in Sects. 4.1.1 to 4.1.5.

Our research analyses the factors that may determine the establishment of a direct connection in container shipping. A shipping connection is an integral element of the Shipping Network (Theme 1); it can be influenced by the characteristics of a country’s Connectivity (Theme 2); materialises if certain Port Selection Criteria are fulfilled (Theme 3); derives from the dynamics of Trade (Theme 4) between countries; and may generally share a number of similar features across Alternative Transport Modes (Theme 5). Thus, there is evidently an interaction between themes but each theme examines a given factor from a distinct perspective on the basis of the topic that each reviewed publication discussed.

Overall, 23 factors have been identified across the 5 Themes as potential drivers towards the establishment of a direct connection between trading countries in container shipping (see left axis of Fig. 3).

The values in the X axis in Fig. 3 correspond to the number of publications that discussed each factor in the SLR and do not imply the importance of the factor



Table 1 Description of the identified factors

#	Factor	Description
	Affiliated terminal	A container handling facility which is affiliated with a container shipping company
	Colonial ties	The relationship between two countries when one has been a colony of the other or the pair has shared a common coloniser
	Common border	A land border shared by two neighbouring countries
	Common language	An official language shared by two countries
	Connectivity	The degree of a country's integration into the container shipping network
	ECA routing	A shipping itinerary that crosses an established Emission Control Area (ECA) while connecting two countries
	GDP per Capita	The Gross Domestic Product (GDP) of a country per capita, as a prosperity indicator at country level
	Logistics performance	The overall efficiency of the logistics network of a country
	Market concentration	The relative power of shipping companies in a route, based on the deployed shipping capacity shares
	MSR routing	A shipping itinerary that crosses the Maritime Silk Road (MSR) while connecting two countries
	Nautical distance	The actual maritime distance in nautical miles that a vessel covers in order to connect two countries
	Political stability	The level of social unrest in a country that may lead to the destabilisation of the government
	Port infrastructure	The quality and efficiency of the port facilities in a country
	Reefer Cargo	The importance of the refrigerated cargo for the overall containerised market of a country
	Route deviation	The additional nautical distance that a vessel needs to cover when an intermediate call is added between two—already connected—nodes
	Seasonality	The fluctuation of the cargo volume during specific periods within a year
	Security issues	Security threats and concerns regarding actions of crime and violence in a country
	Trade agreement	The participation of an analysed pair of countries in a multilateral or bilateral trade agreement
	Trade facilitation	The streamlining and improvement of trade processes in a country
	Trade flow	The overall trade exchanges between two countries
	Trade imbalance	The difference between the value of exports and imports of a country
	Transit time	The overall travel time of a shipment between the origin and the destination country



Table 1 (continued)

#	Factor	Description
	Voyage Cost	The sum of the major cost categories for running a container shipping service (i.e. capital cost, fuel cost and daily operating cost)



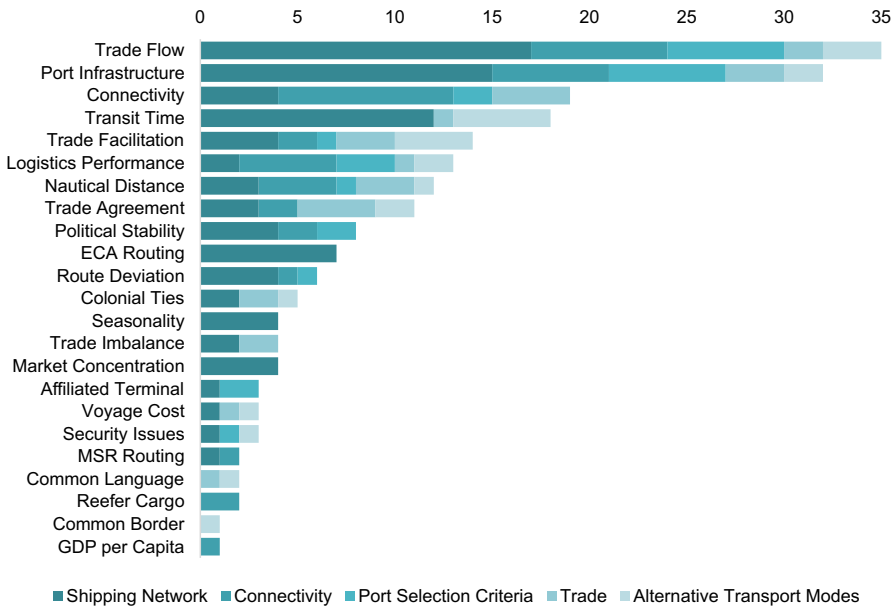


Fig. 3 Number of Publications per Theme per Factor

as such. Several factors are shared across the themes, although each theme has explored the reviewed topic from a distinct perspective.

4 Discussion

4.1 Themes

The decisive factors of a direct shipping connection have been considered by the literature from various angles. The thematic discussion of the SLR that follows has been organised by grouping the corresponding papers under each identified factor. The aggregation of the results aims to reveal the expected impact of each factor towards the establishment of a direct shipping connection between two countries based on the “general sense from each study” (Wang and Notteboom 2014).

4.1.1 Theme 1: Shipping network

The theme includes publications discussing how carrier decisions to connect directly two countries may be affected by (a) the characteristics of the current shipping network; (b) opportunities for its enhancement and (c) route design considerations and practices. Carriers may consider to establish *those* direct connections which can serve their deployment strategy in targeted markets. Moreover, carriers are expected to select *those* nodes which can broaden their maritime footprint and are supported by an efficient wider business network that allows access to the



corresponding captive hinterlands. Finally, the decision-making process of the carriers regarding the addition of a certain country to their network may also consider operational aspects including costs and volumes, and promote countries which can be seamlessly integrated within an existing network.

The identified factors within the Shipping Network theme are summarised in Table 2. The notation in the last column (\pm) indicates the impact that each identified factor is expected to have towards the establishment of a direct connection according to the reviewed literature (e.g. the existence of an affiliated terminal at a country is expected to encourage (positive impact—“+”) more direct connections with other countries, while the establishment of an Emission Control Area (ECA) that includes the same country is expected to discourage (negative impact—“-”) direct connections with other countries).

4.1.2 Theme 2: Connectivity

Connectivity is a topic with a large body of literature. For instance, Yap and Zahraei (2018) underlined that a hub port in order to retain its connectivity should take into consideration the needs and preferences of all partners within a shipping alliance rather than accommodating only the needs of a single key carrier. Notteboom et al. (2021) discussed the negative impact of the COVID-19 crisis on aggregate liner shipping connectivity, although they indicated a regional variation on this trend. Saeed et al. (2021) assessed the likelihood of maritime connectivity improvements derived from infrastructure investments related to the Belt and Road Initiative (BRI). Wang et al. (2022) proposed a combination of “basic” connectivity (i.e. “*the degree of difficulty of a port to connect to other ports in a global maritime network*”) with centrality measures derived from network theory in order to evaluate the attractiveness of hub ports.

In the context of direct connections, the theme includes publications discussing how carrier decisions to connect directly two countries may be influenced by country-level connectivity characteristics. As defined in Table 1, connectivity in the context of this research reflects the degree of a country’s integration into the container shipping network. A number of publications discuss connectivity explicitly as a standalone factor, whereas other publications refer to factors that impact connectivity such as macroeconomic as well as trade-related factors. Additionally, the SLR revealed that connectivity may be impacted not just by geographical (i.e. the relative position of a country regarding its partners and main trade routes) but also geopolitical factors. Finally, the connectivity of a country may also be affected by its proficiency to provide a business-friendly environment for maritime operations.

The identified factors within the Connectivity theme are summarised in Table 3:

4.1.3 Theme 3: Port selection criteria

Port Selection Criteria is also a topic with a large body of literature. For instance, Tiwari et al. (2003) suggested that shippers in China tend to select ports which are in proximity to their premises but are not congested and are equipped with adequate infrastructure (i.e. number of berths). Lirn et al. (2004) indicated that



Table 2 Identified factors, theme 1: shipping network

Theme	Factor	References	Expected impact towards a Direct Connection
Shipping network	Affiliated terminal	Parola and Veenstra (2008)	+
	Colonial ties	Ducruet et al. (2010a, b), Ducruet and Zaidi (2012)	+
	Connectivity	Calatayud et al. (2017), Gadhia et al. (2011), Notteboom (2004c), Wilmsmeier and Sánchez (2010)	+
	ECA routing	Chen et al. (2018), Dai et al. (2018), Dittmer et al. (2017), Doudnikoff and Lacoste (2013), Fagerholt et al. (2015), Franc and Sutto (2014), Schinas and von Westarp (2017)	-
	Logistics performance	Notteboom (2004a), Wang et al. (2012)	+
	Market concentration	Jensen and Bergqvist (2011), Lam et al. (2007), Lim and Das (2009), Notteboom (2004c)	-
	MSR routing	Wang et al. (2020)	+
	Nautical distance	Ducruet and Notteboom (2012a, 2012b), Notteboom (2012b)	-
	Political stability	Ducruet (2008), Fang et al. (2018), Fraser et al. (2016), Pham et al. (2018)	+
	Port infrastructure	Calatayud et al. (2017), Ducruet (2008, 2020), Ducruet et al. (2008, 2010a, b), Ferrari et al. (2015), Fraser et al. (2016), Lam and Yap (2011), Notteboom (2004c), Pham et al. (2018), Pierre et al. (2019), Robinson (1998), Rodrigue and Ashar (2016), Wang et al. (2012), Wilmsmeier and Notteboom (2011)	+
	Route deviation	Notteboom (2004c), Pierre et al. (2019), Rodrigue and Ashar (2016), Tran and Haasis (2014)	-
	Seasonality	Brouer et al. (2014), Cheng and Wang (2021), Huang et al. (2015), Panayides and Wiedmer (2011)	±
	Security issues	Fu et al. (2010)	-
	Trade agreement	Ducruet (2008), Fraser et al. (2016), Lee and Lee (2012)	+
	Trade facilitation	Calatayud et al. (2017), Ducruet (2008), Fang et al. (2018), Walenciak et al. (2001)	+
	Trade flow	Chen et al. (2020), Ducruet et al. (2020), Ferrari et al. (2015), Fremont (2007), Fremont and Parola (2016), González Laxe et al. (2012), Guy (2003), Kang and Woo (2017), Li et al. (2015), Lin and Huang (2017), Notteboom (2012a, 2004c), Robinson (1998), Rodrigue and Ashar (2016), Tran and Haasis (2018), Wang and Wang (2011), Wilmsmeier and Sánchez (2010)	+
	Trade imbalance	Imai et al. (2009), Notteboom and Rodrigue (2008)	-
Transit time	Benedyk and Peeta (2018), Brouer et al. (2014), Cheaitou and Cariou (2012), Jiang et al. (2020), Meng et al. (2014), Notteboom (2004b, 2006), Pham et al. (2018), Tran and Haasis (2018), Wang et al. (2016, 2018), Wu et al. (2017)	-	
Voyage cost	Pham et al. (2018)	-	



Table 3 Identified factors, theme 2: connectivity

Theme	Factor	References	Expected impact towards a Direct Connection
Connectivity	Connectivity	Bartholdi et al. (2016), Calatayud et al. (2016), Cullinane and Wang (2009), Jiang et al. (2015), Song et al. (2019), Yap and Notteboom (2011), Wang and Cullinane (2014), Wilmsmeier et al. (2011), Xu et al. (2020)	+
	GDP per Capita	Vidya and Taghizadeh-Hesary (2021)	+
	Logistics performance	Ojala and Çelebi (2015), Saeed and Cullinane (2021) Shibasaki et al. (2019), Schwartz et al. (2009), Yap et al. (2006)	+
	MSR routing	Pan et al. (2020)	+
	Nautical distance	Fugazza et al. (2014), Fugazza and Hoffmann (2017), Hoffmann et al. (2014), Pan et al. (2019)	-
	Political stability	Xu et al. (2015), Yap et al. (2006)	+
	Port infrastructure	Fugazza (2015), Schwartz et al. (2009), Wilmsmeier and Hoffmann (2008), Vidya and Taghizadeh-Hesary (2021), Xu et al. (2015), Yap et al. (2006)	+
	Reefer Cargo	Schwartz et al. (2009), Wilmsmeier et al. (2011)	+
	Route deviation	Fugazza (2015)	-
	Trade agreement	Vidya and Taghizadeh-Hesary (2021), Yang et al. (2014)	+
	Trade facilitation	Lin (2015), Vidya and Taghizadeh-Hesary (2021)	+
	Trade flow	Fugazza (2015), Saeed and Cullinane (2021), Wang and Cullinane (2008), Yang et al. (2014), Yap (2019), Yap et al. (2006), Xu et al. (2015)	+



Table 4 Identified factors, theme 3: port selection criteria

Theme	Factor	References	Expected impact towards a Direct Connection
Port selection criteria	Affiliated terminal	Notteboom et al. (2017), Wiegmans et al. (2008)	+
	Connectivity	Chang et al. (2008), Wiegmans et al. (2008)	+
	Logistics performance	Wiegmans et al. (2008), Tran (2011), Wong et al. (2008)	+
	Nautical distance	Malchow and Kanafani (2001)	-
	Political stability	Gohomene et al. (2016), Jia et al. (2020)	+
	Port infrastructure	Clark et al. (2004), Gohomene et al. (2016), Jia et al. (2020), Tang et al. (2011), Ugboma et al. (2006), Wong et al. (2008)	+
	Route deviation	Yeo et al. (2008)	-
	Security issues	Clark et al. (2004)	-
	Trade facilitation	Clark et al. (2004)	+
	Trade flow	Chang et al. (2008), Halim et al. (2015), Hsu et al. (2020), Gohomene et al. (2016), Tang et al. (2011), Wiegmans et al. (2008)	+



Table 5 Identified factors, theme 4: trade

Theme	Factor	References	Expected impact towards a Direct Connection
Trade	Colonial ties	Biermann (2012), Saeed et al. (2020)	±
	Common language	Saeed et al. (2020)	-
	Connectivity	Chang et al. (2020), Hoffmann et al. (2020), Saeed et al. (2020), Wilmsmeier and Martínez-Zarzoso (2010)	+
	Logistics performance	Chang et al. (2020)	+
	Nautical distance	Biermann (2012), Guerrero et al. (2015), Saeed et al. (2020)	-
	Port infrastructure	Biermann (2012), Bottasso et al. (2018), Hummels and Schaur (2013)	+
	Trade agreement	Biermann (2012), Chang et al. (2020), de Benedictis and Tajoli (2011), Prokopowicz and Berg-Andreassen (2016)	+
	Trade facilitation	Bertho et al. (2016), Biermann (2012), Hummels and Schaur (2013)	+
	Trade flow	Bertho et al. (2016), Guerrero et al. (2015)	+
	Trade imbalance	Bertho et al. (2016), Wilmsmeier and Martínez-Zarzoso (2010)	-
	Transit time	Hummels and Schaur (2013)	-
	Voyage cost	Deardorff (1998)	-



Table 6 Identified factors, theme 5: alternative transport modes

Theme	Factor	References	Expected impact towards a Direct Connection
Alternative transport modes	Colonial ties	Hwang and Shiao (2011)	+
	Common border	Gong et al. (2018)	-
	Common language	Gong et al. (2018)	+
	Logistics performance	Li et al. (2020), Walcott and Fan (2017)	+
	Distance ^a	Gong et al. (2018)	-
	Infrastructure ^b	Chu (2014), Islam et al. (2013)	+
	Security issues	Islam et al. (2013)	-
	Trade agreement	Hwang and Shiao (2011), Walcott and Fan (2017)	+
	Trade facilitation	Chu (2014), Gong et al. (2018), Hwang and Shiao (2011), Walcott and Fan (2017)	+
	Trade flow	Gong et al. (2018), Hwang and Shiao (2011), Kreutzberger and Konings (2016)	+
	Transit time	Andersen and Christiansen (2009), Boonekamp and Burghouwt (2017), Islam et al. (2013), Jeong et al. (2007), Li et al. (2020)	-
	Voyage cost	Islam et al. (2013)	-

^aIn Theme 5, *Distance* refers to the "Great Circle Distance", while the corresponding factor within the maritime context (Themes 1, 2, 3 and 4) is the *Nautical Distance*

^bIn Theme 5, *Infrastructure* refers to the quality and condition of the track (rail freight) or the existence of state-of-the-art cargo handling equipment (air freight), while the corresponding factor within the maritime context (Themes 1, 2, 3 and 4) is the *Port Infrastructure*.



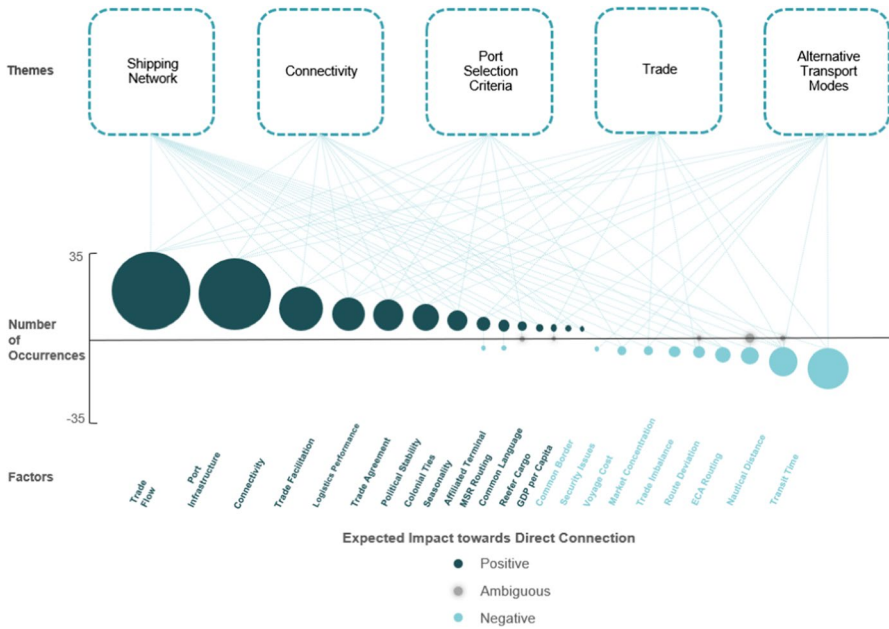


Fig. 4 Occurrences of identified factors throughout SLR

carriers and port operators largely share a common perspective on the attributes that are considered important for the selection of a port as a transshipment hub, but do not rank those attributes on an identical order. Baştuğ et al. (2022) also confirmed that port operators and carriers do not necessarily “see eye to eye” with each other regarding the factors that define port competitiveness. Guy and Urli (2006) assessed the drivers of choice between New York and Montreal and suggested that the latter would be preferred if access to the hinterland was considered a priority for carriers, coupled with a competitive advantage in cost and/or service. Chang et al. (2008) noted that deep-sea carriers tend to seek value-added services and are more price-sensitive compared to feeder operators when selecting a port as a hub. Garcia-Alonso and Sanchez-Soriano (2009) analysed the topic from a hinterland perspective and highlighted the importance of port’s proximity to cargo origin or destination as a port selection criterion in Spain. Caballé Valls et al. (2020) also evaluated the port selection criteria in Spain and concluded that a port’s proximity to cargo origin or destination, maritime distance from a specific world region, maritime connectivity and intermodal connectivity are influential in the port selection process.



In the context of direct connections, the theme includes publications discussing how carrier decisions to connect directly two countries may be affected by specific port selection criteria. Those criteria define the accessibility and the attractiveness of a port, both from a carrier and a cargo owner perspective. The accessibility (i.e. the ability of a port to be reached) and the attractiveness of a port are largely defined by its ability to accommodate maritime trade. Nevertheless, they can also be impacted by geographical criteria as well as the port's capability to provide a secure and efficient operating environment. Ports are the ultimate facilitators of bilateral trade at country level and thus certain of their characteristics may play a central role in the establishment of a shipping connection between trading countries.

The identified factors within the Port Selection Criteria theme are summarised in Table 4:

4.1.4 Theme 4: Trade

The theme includes publications discussing how carrier decisions to connect directly two countries may be affected by trade dynamics and needs. Carriers may be encouraged to deploy shipping capacity between countries with existing bilateral trade exchanges. Such trading relationships are often underpinned by cultural aspects and bonds between specific countries, while geography may also be influential to a certain extent. The individual characteristics of a country regarding its ability to efficiently accommodate and sustain trade exchanges may also affect bilateral connectivity. Finally, bilateral trade flows are pivotal in order to attract the interest of a carrier, but shipping companies will also evaluate whether a connection serves their network and financial requirements.

The identified factors within the Trade theme are summarised in Table 5:

4.1.5 Theme 5: Alternative transport modes

The theme includes publications discussing factors that the stakeholders of air freight and rail freight networks tend to consider as contributors towards the establishment of connections among countries for the respective transport modes. The organisation of the network around the hub-and-spoke concept or, instead, through direct connections, is also a topic of discussion in the road transportation literature (e.g. Lumsden et al., 1999; Zhang et al., 2007). However, road transportation mostly serves domestic and last mile deliveries, while the focus of our (maritime) research is largely around international and overseas connections. Thus, the SLR has attempted to find parallels with air freight and rail freight networks only.

The identified factors within the Alternative Transport Modes theme are summarised in Table 6:



4.2 Use of results

Following on from our thematic analysis, a framework is subsequently developed which identifies the set of factors that determine the establishment of direct container shipping connections between trading countries. As illustrated in Fig. 4, the identified factors may have a positive, ambiguous, or negative impact, based on our interpretation of the reviewed publications (SLR Step 5—Reporting stage). The number of occurrences (i.e. the size of the circles) in Fig. 4 corresponds to the number of publications that discuss each factor in the SLR, and not to the magnitude of the factor.

For the majority of the identified factors, there is a strong convergence regarding their potential impact towards the establishment of a direct link between two trading countries. For instance, the reviewed literature unanimously suggests that a well-developed logistics network of a country is expected to have a positive impact (see Logistics Performance in Sects. 4.1.1 to 4.1.5), while security issues in one or both trading countries are expected to have a negative impact on the establishment of a direct connection between them (see Security Issues in Sects. 4.1.1, 4.1.3 and 4.1.5).

Within the reviewed literature, there was a small number of papers that did not agree with the consensus view—evidenced by other papers—regarding the impact of a particular factor:

- *Theme 1: Shipping Network—Affiliated Terminal:* Despite the expected synergies between a carrier and an affiliated terminal, Parola and Veenstra (2008) did not find concrete evidence to support this hypothesis: i.e. that carriers tend to form their deployment strategy, taking into account terminal networks geographically compatible with their operating areas.
- *Theme 1: Shipping Network—ECA Routing:* Although the establishment of an ECA is likely to invoke a possible tendency towards rerouting, this is not regarded as likely in all routes [Doudnikoff and Lacoste (2013), Schinas and von Westarp (2017), Dithmer et al. (2017)].
- *Theme 1: Shipping Network—Nautical Distance:* Ducruet and Notteboom (2012a) underlined that although short-distance shipping connections are common, in the period 1996–2006 long-distance connections became more frequent. This was attributed to an increase in South–South compared to North–North and North–South connections. Thus, connections of short shipping distance remained the norm but this did not exclude the possibility of longer distance connections.
- *Theme 4: Trade—Common Language:* Intuitively, cultural aspects such as common language should act as enablers of bilateral trade (Gong et al. 2018). However, the analysis of Saeed et al. (2020) did not reveal any statistical significance between common language and bilateral trade flows.
- *Theme 4: Trade—Trade Imbalance:* Despite the broadly accepted principle that trade imbalances may harm the attractiveness of a route, this was not statistically confirmed by the analysis of Bertho et al. (2016) at a significant level.



The SLR also revealed some factors for which a general consensus has not been reached and their positive or negative impact towards the establishment of a direct link between two trading countries appears to be directly or indirectly questioned by some researchers. For instance, a divergence has been identified with regard to the following factors:

- *Theme 1: Shipping Network—Seasonality*: the fluctuating demand for transportation may be a reason for the establishment of a service but some of the reviewed papers also implied that the same reason may equally lead to the periodical termination of a connection (Huang et al. 2015).
- *Theme 4: Trade—Colonial Ties*: Although the relationship between two countries when one is a former colony of the other is largely regarded as a factor that promotes bilateral connectivity and trade, this can also be contradicting with the statistical analysis of certain samples pointing to the opposite direction (Saeed et al. 2020).

4.2.1 Limitations

The SLR also revealed that there are some factors which have not been included in the final list because of their unclear importance or untested impact but, nonetheless, they might be worthy of further research:

- *Port Costs*: Carriers may consider port costs (dues for port services along with terminal handling charges) as a factor in their port selection decisions (Wiegman et al. 2008). Based on a case involving Shenzhen versus Hong Kong, Wang et al. (2012) noted that the former port has managed to attract direct calls by carriers at the expense of the latter due to more competitive handling tariffs but also due to a range of other factors (e.g. developments in the ports' hinterlands). Indeed, the traffic interplay between Hong Kong and nearby ports in the Pearl River Delta may be attributed to a wider range of underlying economic forces (Li et al. 2022). According to Fraser et al. (2016), reasonable port tariffs could theoretically assist individual ports to attract more direct calls. However, the SLR did not provide clear evidence that port costs may have the same impact at national level and thus affect the attractiveness of a country as a whole regarding direct calls. In fact, Fraser et al. (2016) indicated that even if there can be collaboration agreements (i.e. interport cooperation on port tariffs), their impact at regional (or national) level remains unclear: competition between individual ports may even be harmed, eventually affecting their ability to entice more direct calls.

Overall, we believe that port costs (dues and handling charges) are seemingly a factor for consideration but regarding the selection between ports rather than countries. While there are port characteristics that may have an impact at country level (e.g. nations with obsolete port infrastructure that cannot accommodate some vessels), port costs have not emerged as a decisive factor for the exclusion



of a country from a service rotation and its impact on the establishment of a direct connection between countries is likely to be discounted by carriers.¹

- *Corruption*: Chen et al. (2020) studied the design of a container shipping network within the Asia–West Africa trade and commented that, although they did not take into account public corruption as part of their modelling effort, we believe that the latter may be an area of concern for carriers when designing their network.
- *Number of Common Direct Connections*: Hoffmann, Van Hoogenhuizen, and Wilmsmeier (2014) proposed the development of the Liner Shipping Bilateral Connectivity Index (LSBCI) which accounts for both direct and indirect connections between countries. The authors aimed to compile an index based on fleet deployment data only, claiming that the index should include the following components: (1) the number of transhipments required to get from A to B; (2) the number of common direct connections; (3) the number of common connections with one transhipment; (4) the level of competition on services that connect country pairs and (5) the size of the largest ships on the weakest route (as an indicator of the infrastructure level and any opportunity for economies of scale). The second component of the LSBCI—the number of common direct connections between a country pair—is the total number of third countries that connect directly to both countries of an analysed pair. Hoffmann et al. (2014) utilised the example of LinkedIn and claimed that the number of common direct connections between a country pair would be the equivalent of the “shared” or “1st” common contact(s) between two people participating in this social network. The equivalent in the container shipping network would be the number of alternatives that a shipper would theoretically have in order to send a cargo between two countries with only one transhipment (*ibid*). Hoffmann et al. (2014) further argued that the more common direct connections, the higher the connectivity and trade potential between trading countries. The positive impact of increased common direct connections on the trade volume between countries was also discussed in other papers included in the SLR. Specifically, according to Fugazza and Hoffmann (2017), the addition of one extra common direct connection might explain approximately 5% of additional bilateral export value. According to Hoffmann et al. (2020), one extra common direct connection may result in an increase of 2.8% in exports and 2.4% in imports, respectively.

Thus, according to the reviewed literature, a comparatively high number of options to move cargo between two countries with a single transhipment may highlight an upcoming trade opportunity earlier than any other random flow between countries which connect with two or more transhipments. The reviewed literature however did not clearly propose that this may, respectively, trigger car-

¹ This point has been verified during an interview with one of the leading container shipping lines: if a country can offer an attractive volume of containers, port cost at national level will not be a reason to reject the option for a direct call. Indeed, a carrier will be selective between ports within a country (should there be competitive alternatives) or aim to make specific procurement arrangements with terminals within ports, but will not abstain from directly calling at a country as a whole because its ports are considered expensive. Ultimately, any potential savings from not calling directly at a country with a mother vessel will be diminished if a carrier ends up sending cargo to that country via transhipment.



riers to remove the transshipment leg between two particular trading countries, support them with a direct shipping connection and allow a promising bilateral flow to further flourish. Nevertheless, we believe that this is possibly another factor that may encourage a direct connection between countries and constitutes another dimension that is worth to be further explored.

5 Conclusions

We employed a Systematic Literature Review (SLR) to identify the factors that carriers may consider in their decision-making process towards the establishment of a direct connection between trading countries. The reviewed literature revealed 23 factors across 5 Themes: (1) Shipping Network, (2) Connectivity, (3) Port Selection Criteria, (4) Trade and (5) Alternative Transport Modes with some factors appearing across multiple Themes. For the majority of the identified factors, there is a strong convergence regarding their potential impact based on our interpretation. However, our analysis also revealed that for a few factors a general consensus has not been reached in the literature.

In the aftermath of COVID-19, the world witnessed an unprecedented disruption of global supply chains, prolonged bottlenecks and service shortages. Those developments underlined the increasing need for countries to reduce their dependence on specific trade partners and/or seek other sources of supply. Ongoing structural adaptations of global trade including concepts such as reshoring and nearshoring²(Notteboom and Haralambides 2020) may be increasingly considered as strategies that can allow the increase of supply chain resilience (Notteboom et al. 2021). Hence, as global trade may reshape to follow the paradigm of a decentralised and largely multipolar network, the deeper understanding of the factors that may allow a country to directly connect with targeted trade partners can be of growing importance. We have identified and reconfirmed the importance of factors that have traditionally been regarded as important for the establishment of direct connections between countries (e.g. Trade Flow, Port Infrastructure, Connectivity, etc.). It is likely however that the shape of the future shipping network may be increasingly co-defined by environmental, geopolitical, cultural, and security-related characteristics of the shipping routes. Our effort has also highlighted those relevant factors (e.g. ECA Routing, MSR Routing, Common Language, Political Stability, etc.).

The identification and understanding of the various factors can help policy makers in their efforts to promote the establishment of a direct shipping connection between trading countries. The SLR, through its identification of the 23 factors and 5 Themes, also provides a platform for researchers to conduct further analysis into the relative roles of these factors—or others—in the establishment of direct shipping

² Reshoring or backshoring refers to the “relocation to the home country” and nearshoring to the “relocation to the home region”, as opposed to the long-established concept of offshoring which refers to the “relocation to a region far away from the home one” (Merino, Di Stefano, and Fratocchi 2021).



connections between trading countries. In turn, this can aid, for example, in predicting the future evolution of container shipping networks.

Appendix

A sample of studies (20) evaluated by the modified CASP Checklist as suggested by Wang and Notteboom (2014).

Results of the Evaluation and Selection of the studies based on the Modified CASP Checklist by Wang and Notteboom (2014)

Answer Notation

Y = YES
 N = NO
 CT = CANNOT TELL

Study Notation

P = Academic paper
 R = Report (working paper/report)
 B = Book Section

Study No	Study Type	Q1 Address a clearly focused issue?	Q2 Relevance to the synthesis?	Q3 Clear research methods?	Q4 Explicit data collection?	Q5 Clear data analysis?	Q6 Rigorous data analysis?	Q7 Explicit and understandable findings?	Q8 Data analysis sufficiently support findings?	Q9 Adding knowledge or theory?	Q10 Findings important to practice?	Result Included in the synthesis ?
1	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	B	Y	Y	Y	CT	N	N	Y	Y	Y	N	Y
4	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
5	P	Y	Y	Y	CT	Y	Y	Y	Y	Y	Y	Y
6	P	Y	Y	Y	CT	Y	Y	Y	Y	Y	Y	Y
7	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
10	R	Y	Y	Y	CT	CT	CT	N	Y	Y	Y	Y
11	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
12	P	Y	Y	Y	Y	Y	Y	Y	Y	CT	CT	Y
13	P	Y	Y	Y	Y	Y	Y	Y	Y	CT	CT	Y
14	P	Y	Y	CT	Y	Y	Y	Y	Y	CT	CT	Y
15	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
16	P	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N
17	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	CT	Y
18	P	Y	Y	Y	Y	Y	Y	Y	Y	CT	CT	Y
19	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
20	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

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