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The international expansion of Chinese and Taiwanese electronics firms: the role of networking and learning

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Abstract: This paper offers empirical evidence on how Chinese and Taiwanese electronics firms have developed their global business relationships with their suppliers, clients, and competitors to develop competitive advantage based on learning (knowledge access) during their international expansion. We follow the semi-systematic sourcing approach, in form of network centrality index analysis to study relationship developments of our Chinese and Taiwanese electronics sample firms between 1997 and 2017. By using quantitative network centrality indices, we are able to provide the highest possible generalisability of our research outcomes. Consequently, we contribute to the scholarship on developing regional business networks and the internationalisation of electronics manufacturing firms from emerging economies such as China and Taiwan. We offer managerial implications on country-specific business relationships, preferred market entry modes, regional partner preferences and relationship building frequencies of Taiwanese and Chinese firms on their way to becoming dominant players in the global electronics industry.

Keywords: China; electronics industry; internationalisation; learning; knowledge; networks; Taiwan.

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1 Introduction

Firms' survival and growth in highly competitive industries are an area of interest for both scholarly research and business executives. In this context, the key role and importance of business networks have been established in earlier studies, where it has been referred that a favourable business network positioning in a regional industrial cluster is a prerequisite to gain competitive advantage as it facilitates market and technology learning from locally established firms (Del Giudice and Cillo, 2022; Hagedoorn and Duysters, 2002; Holm et al., 2015).

The industry network positioning, as a result of a firm's quantity and quality of bilateral relationships to suppliers, customers and other stakeholders, offers successful firms a platform for developing production, technological and local geographic-specific capabilities (Hult et al., 2019; Johanson and Vahlne, 2009; Vahlne and Johanson, 2017). Consequently, a firm's promising positioning in a regional industry network comes along with a high number of a firm's beneficial relationships to its business partners and thus serves as a valuable strategic asset of the firm (e.g., Gruber et al., 2010; Tjemkes et al., 2012).

Moreover, trustful relationships increase mutual learning capabilities and prevent unwanted knowledge spillovers (Narula and Santangelo, 2009; Niu, 2010). While the extant research has established the importance of business networks, several avenues associated with the value of a firm's relationships still need to be supported with empirical evidence. For example, Bembom and Schwens (2018, p. 680) called to investigate network dynamics in terms of 'knowledge and local market learning', addressing the role of networks as external resource providers. In this concern, Hult et al. (2019) suggest that future research should also consider how business network positionings foster or constrict new business opportunity discovery. Similarly, Ojala et al. (2018) pose a question about the role of resource commitment within networks which is also linked to the firm's positioning in its international business network. Hence, our paper aims to untangle the role of regional business network positioning in an interesting industrial context, namely electronics.

Despite the importance of electronics industries globally (Fung et al., 2015), current research on this industry primarily focuses on European and American companies entering Chinese and Taiwanese markets (Davies et al., 2003; Lee et al., 2012; Pan and Li, 1998). The importance and global success of emerging Chinese and Taiwanese firms, which, meanwhile often hold the leading industry positioning, is well established in the literature (Alon, 2003; Davies et al., 2003; Lee et al., 2012; Pan and Li, 1998). As a result, a couple of local economies, such as many member states of the European Union (EU), have even become seriously dependent on electronics component supply (e.g., semi-conductors, batteries) from China and Taiwan. Consequently, we currently witness electronics component delivery shortages in light of COVID-19 causing severe consequences in various industries (e.g., automotive, electronics) of the EU and their regional industry value chains (e.g., semiconductors for vehicles, electronics components for electric and mobile devices). Despite this fact, studies focusing on Chinese and Taiwanese electronics industries, although extremely dominant as they globally serve as major productions hubs, are still comparatively limited (e.g., Andersson et al., 2018; Hertenstein et al., 2015; Holtbrügge and Berning, 2018). The existing rare studies of business network configurations of Chinese and Taiwanese electronics firms approach

the topic from a micro perspective, usually through single case study methods (Chen et al., 2003; Glowik, 2020).

Nevertheless, a single case study limits developing a broader global-geographical industry perspective aiming to endeavour regional long-term competitive industry potentials (McIvor et al., 2006; Wang, 2003).

For these reasons, our paper aims to further develop the literature by applying an industry network view instead of taking a single case study perspective. The network relationship view is recommended to be used to endeavour industry-wide inter-organisational relationship partner preferences in terms of a firm's value-adding processes within an international industry cluster (Heisig et al., 2016; Huggins et al., 2012; Nascimento et al., 2021; Zhao et al., 2014).

We aim to contribute to the scholarship on learning in business networks concerning the internationalisation of emerging electronics firms from China and Taiwan as we target the following research aims.

First, in reflection to Ojala et al. (2018), our paper targets to find out whether there is a tendency of electronics firms from China and Taiwan to maintain stable relationship commitments during times of global business stability but the readiness to expand their networking activities during periods of global economic crisis? We emphasise the investigation of network positioning concerning the firm's agility to adjust their networking strategies in times of turbulent business environments (Yang and Hsian-Ming, 2012). Therefore, we ask whether Chinese and Taiwanese firms flexibly adapt to changes in the global business environment through the increase/decrease of their relationship engagements, thus using their chance to strengthen their global business network positioning?

Second, firms originating from emerging economies tend to be market knowledge resource-deficient (Gaur et al., 2014), as well as carry the legacy of liabilities of technological newness (Das and Kapil, 2016; Xie, 2017) and late arrival in international markets (Bruche, 2012). Our empirical findings highlight the international market preferences of Chinese and Taiwanese firms. Bembom and Schwens (2018) call for developing a deeper understanding concerning business network relationships as resource supply vehicles (including knowledge resources) for substituting their own resource drawbacks.

Third, our study aims to enhance the scholarly understanding by asking which technological expertise Chinese and Taiwanese electronics firms are seeking to gain (for example through learning) from Western business network actors such as from the USA and Europe, to overcome their market latecomer drawbacks (Prashantham and Young, 2011; Gaviria-Marin et al., 2018; Hussain et al., 2022)?

Forth, our paper augments the internationalisation literature by asking whether electronics firms from emerging economies such as China and Taiwan follow traditional internationalisation patterns of regional, incremental market entry (e.g., launching the business first in their direct neighbourhood countries) or whether they seek opportunities seeing the entire world as one market (Vahlne and Johanson, 2017; Quer et al., 2010)? The remaining part of the paper is organised in a way that the following section presents the literature concerning international business networks and Chinese and Taiwanese firms, followed by a discussion on our research methodology and empirical findings. The paper concludes with a presentation of implications and future research directions.

2 Literature review

2.1 *The role of networks and knowledge access*

The business network theory originating from the seminal work of Cyert and March (1963) suggests that successful internationalisation centres on the organisational ability to embed the firm in target country business relationships (Andersson, 2002; Andersson et al., 2007; Del Giudice and Cillo, 2022; Forsgren et al., 2005; Johanson and Mattsson, 1992). Firms embedded in business networks and linked to each other through long-lasting relationships develop mutual information and knowledge exchange channels. Consequently, a firm's international competitive positioning is to a significant extent dependent on its position in its international business network related to other actors such as its suppliers, clients, service providers and competitors in the regional target countries (Johanson and Mattsson, 1988; Masiero et al., 2017; Mueller, 2021). Since these actors have other relationship partners with whom their activities are connected, the focal firm is indirectly engaged in a knowledge-creation process that extends far beyond its own horizon. This process is particularly important for seeking international business opportunities (Bujak and Schott, 2021; Hult et al., 2019; Johanson and Vahlne, 2009).

The extant academic literature also highlights the importance of business networks when doing business in China and Taiwan (Zhang, 2014). However, characteristics of business relationships of emerging Chinese and Taiwanese firms outside Asia are comparatively less visible in the academic literature (Blackburne and Buckley, 2017; Davies et al., 2003; Fu et al., 2013; Lee et al., 2012; Pan and Li, 1998). Hence, our paper focuses on the business network approach as a theoretical basis while focusing on Chinese and Taiwanese electronics manufacturers on their way of going abroad. A firm's favourable positioning in a relevant industry network indicates a vital factor to gain local market knowledge and thus, helps achieving competitive advantage (Andersson et al., 2018). As network relationships are a crucial determinant of new knowledge creation and sharing (Coviello and Munro, 1997; Johanson and Vahlne, 2009), the network theory has been widely applied in the recent international business expansion literature (Vahlne and Johanson, 2017; Cuypers et al., 2020).

Experiential learning from regional market actors positively affects the firm's technological and market knowledge stock (Bhatti et al., 2016). Business networks have a significant impact on a firm's global expansion, as they provide access to resources that are not promptly available internally, which is particularly the case for international latecomers such as electronics firms from China and Taiwan (Shan and Jolly, 2013; Zhang et al., 2014).

These valuable intangible knowledge resources are, for example, regional design and service expectations of the clients, competitors' product configuration including advertising, preferred payment modes, and many others (Andersson et al., 2018). According to the literature, to overcome resource limitations, market latecomers prefer cooperative market entry strategies (e.g., strategic alliances and international joint ventures) in the early stages of international expansion (Buckley et al., 2008; Park and Harris, 2014).

Therefore, within our study, we aim to understand whether Chinese and Taiwanese electronics firms have favoured cooperative or other market entry modes in their international expansion. Within the context of market entry and positioning, it is vital to

consider both the business network size as well as network centrality and relationship building dynamics of the involved firms.

2.2 *Network size*

Network size is defined as the number of actors that are directly and indirectly connected to other industry actors (Fung et al., 2015; Prell, 2012). Within a business network, there are usually subnetwork clusters, which highlight dense but separated regions in the network, meaning areas of the network where actors are more closely linked to each other than other segments of the business network (Tichy et al., 1979). Dense network structures allow for efficient *collective knowledge sharing routines and joint learning channels* (e.g., Larsson et al., 1998), as they enhance common understanding between connected actors and limit opportunism due to mutual monitoring (Vanhaverbeke et al., 2012).

In the specific context of networks, it is further essential to stress that a more extensive network enables firms to achieve more significant synergies (e.g., Patel and Conklin, 2009) and, also, offer a possibility to access and transfer tangible and intangible resources which help in gaining competitive advantage in international markets (e.g., Powell et al., 1999; Yang and Driffield, 2012). Hence, some prior scholars have explicitly stressed that network size facilitates a firms' international expansion (Oviatt and McDougall, 2005; De Noni and Apa, 2015), particularly if they lack prior experience in international markets (e.g., Coviello and Munro, 1997; Hoang and Antoncic, 2003). We expect these aspects to play a role for Chinese and Taiwanese electronics firms in their international markets.

2.3 *Network centrality and relationship dynamics*

A firm's market success depends largely on its insider positioning in the relevant business network (Gulati et al., 2000; Vahlne and Johanson, 2017; Bhatti et al., 2022). To identify the firms holding an insider positioning, one can calculate the network centrality (eigenvector) index, which is an indicator of the actor's (each of our sample firms) influence on other firms in the global electronics business network (Masiero et al., 2017). The *network centrality* scores are weighted in favour of those actors that have altered with high degree centralities. Actors connected to many firms in the business network indicate a high degree (*eigenvector*) *centrality* and are defined as business network insiders (Prell, 2012). Other business actors perceive network insiders as essential partners for exchanging market knowledge and seeking promising opportunities that provide the best prerequisites for gaining competitive advantage (Gilsing, 2005; Prell, 2012). Consequently, a central position in a business network constitutes a valuable strategic resource as it enables a firm to exercise influence over network market knowledge flows (Gruber et al., 2010; Tjemkes et al., 2012; Johanson and Vahlne, 2003, 2009).

A favourable business insider network positioning (proven against a firm's eigenvector centrality degree, which is higher than the industry average) is relevant for Chinese and Taiwanese firms, particularly because of their latecomer status in the electronics business arena (Manarungsan, 2009; Liu, 2020). Thus, a firm's international business efforts positively correlate with its centrality position in a global business network (Paruchuri, 2010).

If an actor rests between many other disconnected actors in a business network, then this actor holds a *valuable bridging position* regarding knowledge flows between business actors, which are, otherwise, disconnected (Tichy et al., 1979). Therefore, an actor indicating a high betweenness centrality index can significantly influence its business network by withholding or distorting valuable market information given to other (usually disconnected) actors in the business network. Thus, betweenness centrality reflects potential control of important resources (e.g., regional market knowledge) to gain international business opportunities (Gilsing et al., 2008; Prell, 2012).

2.4 *Chinese and Taiwanese electronics firms – the state of research*

The past three decades saw an extraordinary growth of international production networks and substantial relocations of electronics manufacturing activities away from Western countries towards emerging economies such as China and Taiwan (e.g., Buckley, 2020). Timmer et al. (2019) offer data that authenticates the validity of the Ricardian insight validity in an unbundling world. They name a process consisting of trade functional specialisation wherein international production networks participants carry out various jobs. These advancements can be labelled as a process of catch-up and convergence, possibly emerging economies leapfrogging, illustrated by ever-growing manufacturing hubs growth in regions such as Shenzhen, Tianjin, and Shanghai (Chaminade and Vang, 2008; Lorenzen and Mudambi, 2013). China benefited from the World Trade Organization accession in 2001 and rapidly participated in globally integrated value chain networks (Baldwin and Freeman, 2022). The Taiwanese electronics industry plays a vital role in this sector globally, with Taiwan holding the leading global market shares of many electronics products, e.g., semi-conductors, with promising business opportunities for the future in light of Industry 4.0.

Table 1 Chinese and Taiwanese electronics firms – the current state of research

<i>Article</i>	<i>Country</i>	<i>Industry/sample</i>	<i>Focus</i>
Bhaumik et al. (2016)	China	Electronics	Sources of competitive advantage (country-specific advantages vs. traditional firm-specific advantage)
Wang et al. (2021)	Taiwan	Electronics	The impact of interlocking directorates on dynamic corporate performance
Liu et al. (2016)	China	Electronics	The impact of inward foreign investments on industry productivity (spillover effect)
Feng et al. (2019)	Taiwan	Buyers in Taiwanese electronics industry	Innovation competence, local network embeddedness and joint innovation
Fu et al. (2013)	China (Pearl River Delta)	Electronics	The role of informal Guanxi network in interactive learning and its impact on innovation outcomes
Pecht et al. (1999)	China	Electronics	Goes back to historical origins of the Chinese electronics industry (1930s and 1940s) and first Chinese cooperate ventures overcoming its latecomer positioning

Table 1 Chinese and Taiwanese electronics firms – the current state of research (continued)

<i>Article</i>	<i>Country</i>	<i>Industry/sample</i>	<i>Focus</i>
Pecht (2006)	China	Electronics	Industry overview, historical developments, and institutional frameworks
Chen et al. (2003)	China	Electronics	A case study of the business activities of the Dutch Philips company in China
Shih and Wickramasekera (2011)	Taiwan	Electrical and electronic SMEs	The role of management characteristics and attitudes, perceived benefits, barriers, and costs in export decisions
Sim and Pandian (2003)	Taiwan and Singapore	MNEs in textile and electronics	Internationalisation characteristics and strategies, motivations, internationalisation patterns and sources of competitive advantage
Luo and Lemański (2016)	China	Electronics	Motives, location, entry-mode choices for foreign direct investments
Shan and Jolly (2013)	China	Electronics	Positive impact of technological innovation capabilities and networking capability on firm performance
Yang and He (2017)	China	Electronics industry	Structural and selective recoupling within regional production networks in China
Zhang et al. (2014)	China	Electronic and telecommunication manufacturing industry	Impact of localisation and urbanisation economies impacts on firm's R&D efforts
Ho et al. (2017)	China/ Taiwan	Electronics	Factors influencing narrowing of the productivity gap (ownership structure, R&D activity)

Despite their importance in the global arena, while Chinese and Taiwanese electronics firms received some research attention, the insights into their global international position's role in achieving and sustaining competitive advantage remain limited. Previous research in the field of Chinese and Taiwanese electronics industries can be divided into two major research streams – first, early stream focusing on motivations and internationalisation strategies, and second, emerging research on the role of network positioning (see Table 1).

Early internationalisation studies identified factors driving exports by Taiwanese firms. These factors include the exploitation of economies of scale, diversification of markets, reducing the dependence on the domestic market, and managerial characteristics (Shih and Wickramasekera, 2011; Wang et al., 2014), with authors calling for the exploration of the role of network access as an important entry barrier for non-exporting firms. The case study by Sim and Pandian (2003) considered motives for internationalisation and corresponding strategies of Taiwanese firms. The authors state that some of the firms expanded to North America and Europe to gain a strategic positioning (e.g., developing brand loyalty) in the regional markets. International business motivations and investment strategies of Chinese firms were investigated by

Luo and Lemański (2016). Another study by Yang and He (2017) describes trends in terms of export evolution and product relocation from the Western hemisphere towards the Chinese market. Zhang et al. (2014) focused on the impact of urbanisation and localisation (e.g., regional supplier density, local industrial diversity) on the firms' research and development efforts. However, their study was limited to the local Chinese market.

Expanding the focus to a larger international business network, Bhaumik et al. (2016) identify sources of competitive advantage for Chinese electronics firms such as those derived from country-specific advantages and economies of scale rather than technology. However, the role of regional business network positionings in facilitating competitive advantages is not appropriately discussed. By looking at the inward foreign direct investments (FDIs) and their spillover effects on the productivity of the electronics industry in China, Liu et al. (2016) suggest that the collaboration with foreign partners and foreign equity participation results in technological transfer and consequently increases local productivity. Unfortunately, their discussion does not explore how firms with different network positioning benefit from the spillover effect, nor does it mention the impact of latecomer status. While the study by Wang et al. (2021) focusing on Taiwanese electronics firms investigates the role of networks (centrality, structural holes, and the number of connections) on firm performance, it uses the interlocking directorates as a proxy for the network position of the firm and relies solely on secondary data (FSC's annual reports). We address these methodological shortcomings and expand this research focus by obtaining data from several sources (e.g., annual reports, industry surveys, and industry expert interviews).

As Feng et al. (2019) did not look directly at the competitive advantage but joint innovation, the latter could be considered as a source of competitive advantage and a determinant of firm performance. Their study focused on buyers in Taiwanese electronics firms and the impact of perceived exploitative and explorative innovation competence on the relationship between perceived network embeddedness and joint innovation. However, the focus on Taiwanese buyers and their local (geographically limited) business networks does not consider that these firms operate in a world with globalised value-added activities. Therefore, the authors proposed further research "including buyers from other countries or other industries, which is needed to support the findings of this study and improve its external validity" [Feng et al., (2019), p.359].

An earlier study of Chinese firms in the electronics industry by Shan and Jolly (2013) links innovation-related network capability to production innovation and firm performance. However, it does not consider the impact of network positioning or network structure. Similarly, a study by Ho et al. (2017) looks at the role of the innovation effort in narrowing the productivity gap between Chinese and Taiwanese electronics firms. While their study shows that the Chinese firms were successful at integrating within the regional Asian production network, the discussion of the role of their network position within this network and collaboration with western firms is missing. Their research covers a period between 2001 and 2007; thus, it does not consider more recent developments and China's integration into global business networks. Focusing on the Chinese market, a study by Fu et al. (2013) considered the importance of informal Guanxi networks and intensity of interactive learning on product innovation but focused on local networks and did not explore the importance of network positioning.

From our point of view, advancing the research on the electronics firms originating from both countries, China and Taiwan, is essential for multiple reasons. Even though

China and Taiwan are politically separated, both countries have a shared history and are regionally seen in Asia as ‘one manufacturing place’ (separated from Japan or South Korea), especially in the electronics industry; an industry which has contributed significantly to economic prosperity in China and Taiwan (e.g., An et al., 2015; Liu, 2020). Just to mention one prominent example, the Taiwanese firm HonHai (Foxconn) runs one of the largest component supply logistics, research and manufacturing capacities in China (Foxconn, 2020). The electronics sector indicates one of the most critical industries in China and Taiwan for other local industries (e.g., automotive, telecommunication). The electronics industry also serves as a springboard for other firms (e.g., component suppliers, logistic providers) which seek to internationalise, for example in course of building the Digital Silk Road (Visvizi et al., 2020).

Chinese and Taiwanese electronics firms are relative technological latecomers to this industry, compared to firms from the USA (e.g., Apple, Dell), South Korea (Samsung, LG Electronics), and Japan (e.g., Sony, Panasonic, Toshiba) (Amsden and Chu, 2003; Mathews, 2006; Yang et al., 2009). Hence, knowledge accumulation through relationship learning from regional market incumbents is even more important for Chinese and Taiwanese electronics latecomer firms (e.g., Fang et al., 2011; Liu, 2012). As a result, analysis of the specific country and regional positioning in a global electronics business network becomes very important in this context; an aspect that previous studies have not explicitly addressed.

3 Research methodology

3.1 Research design and sample selection

We follow the semi-systematic sourcing approach, which is designed for topics that consider diverse disciplines of interest as we address our research on global electronics business networks and the role of Chinese and Taiwanese electronics firms (Snyder, 2019). In the next step we define essential criteria for selecting sample firms following the recommendation by Burgelman (2011). First, the firm’s national background had to be either Chinese or Taiwanese. Second, the sample company must have started international business activities. Finally, the firms in our sample are involved in the electronics business, which means value-added activities such as research and manufacturing of integrated circuit chips, semiconductors, electronics appliances, mobile communications, display devices, and batteries (Backer and Miroudot, 2013). Our sample of ‘Chinese and Taiwanese electronics firms’ are selected based on their market shares and electronics product range which are superior compared to its competitors (Bacani, 2005; Chen, 2015).

To secure the highest possible representativeness, our sample is verified by the literature addressing important Chinese and Taiwanese electronics players (Yang and He, 2017) as well as by market surveys and industry reports proving our sample firms’ leading market positionings in terms of their product range and market shares, etc. (Netimperative, 2018; HIS, 2021).

Based on the above selection criteria, our sample consists of industry leading Chinese and Taiwanese firms, namely, *Acer*, *AsusTek*, *BenQCorp*, *Haier*, *Hisense*, *HonHai* (Foxconn), *Huawei*, *Konka*, *Lenovo*, *Qisda*, *Sichuan Changhong*, and *TCL China*. As we apply network analysis methods and corresponding terminologies, our Chinese and

Taiwanese sample firms are categorised as ‘egos’ and their relationships to other firms as ‘alters’ (e.g., suppliers, customers, joint venture partners, other stakeholders). An ego is defined as the focal actor of interest, whereas alters are actors to whom an ego is connected in a business network (Prell, 2012).

3.2 Data collection and network analysis

We tracked the relationship developments of our Chinese and Taiwanese electronics sample firms between 1997 and 2017 (Wahyuni, 2012). For each of our sample firm we went through corresponding annual reports, press releases, industry announcements etc. aiming to figure out and record newly established relationship engagements (e.g., proven by a press release that a new joint venture was established) with another firm (e.g., supplier, customer, other stakeholders). We consider formally established relationships (e.g., international joint venture, license agreement, contract manufacturing agreements) when officially published and, thus, available to the public but did not target informal relationships (e.g., lobbying to politicians or governments) in our study.

Although we are aware that informal relationships are important as well in course of gaining competitive advantages, we intend to secure highest study representativeness and transparency, as we believe can be only secured at the highest possible level when corresponding data are officially published.

In the course of data collection, we identified the year and the country of the first international market entry, as well as preferred market entry modes and international target market preferences concerning our Chinese and Taiwanese sample. All data are recorded in an Excel datasheet. We used firm data published in English, Mandarin, and German, which reflect the involved project members’ linguistic capabilities to gain the most possible access to relevant information.

For validation purposes, non-standardised, informative interviews with seven electronics industry experts were conducted during the International Funkausstellung (IFA) 2014 and 2017 in Berlin (Eisenhardt and Graebner, 2007). These interviews were possible because one of our authors relies on a long-lasting electronics business experience and maintained personal industry relationships, which made it much easier to get connected to other industry experts from the electronics industry. These experts either worked in the past or currently work at IHS Markit, Changhong, TCL China, LG Electronics and Samsung. Interviews conducted face-to-face aimed to verify some of the secondary data we had reason to question (e.g., less specific formulated firm press release concerning the establishment reasons of a joint venture). In other words, interviews aimed to go beyond official press information and annual reports, which always must consider shareholder interests when published.

Following to the data collection, we recorded the frequencies of contractual ties per sample firm and per year. Based on our final dataset, we then conducted eigenvector analysis, betweenness centrality calculation, and Markov-clustering technique (Dobrovolny and Fuentes, 2008). We use eigenvector and betweenness analysis to quantify each sample firm’s electronics industry network positioning (Prell, 2012). For calculating eigenvector centrality, data are undirected (symmetric). Our quantitative network research design to explore a firm’s network positioning follows the proven concept recommended by Wassermann and Faust (1994).

Betweenness centrality is calculated on undirected relationship variables, but each variable is binary (ties are coded as either 1 s or 0 s) (Prell, 2012). All ties are coded

either as 1 or 0 are inscribed in an adjacency matrix. Eigenvector centrality is concerned with an actor's positioning in a network and functions as an indicator of an actor's hierarchical power and influence on other actors of the network (Ibarra, 1993). An actor's degree of eigenvector centrality is calculated by counting the number of immediate contacts an actor has in the network (Prell, 2012).

Comparing the firms' eigenvector centrality delivers empirical evidence whether a firm is located outside the business network (e.g., does not maintain any or very few relationships to other firms) or holds network insider positioning (comparatively high number of relationships correlates with high eigenvector centrality degrees). Betweenness centrality calculates how many times an actor (firm) sits on the geodesic (e.g., the shortest path) linking other actors (firms) together. If an actor rests between many, otherwise disconnected actors in the network, then this actor holds a valuable bridging position (also called 'broker' positioning). This actor can greatly influence the network by choosing to withhold or distort valuable regional market knowledge (Prell, 2012, Wassermann and Faust, 1994).

In addition, we operate Markov clustering analysis aiming to identify dense sub-clusters (cliques) characterised by intense bilateral relationships within electronics industry networks of Chinese and Taiwanese firms. Cluster analysis allows us to figure out partner preferences of our sample firms in course of their international expansion. For running quantifiable network analysis in terms of eigenvector, betweenness and Markov cluster findings we use UCINET software (Borgatti et al., 2002; Halinen et al., 2013; López-Duarte and Vidal-Suárez, 2010). The correlation analysis of normalised eigenvector and normalised betweenness centrality, relationship mode, and global target regions is done using SPSS (Brosius, 2013).

For the period 1997 to 2017, we identified 512 bilateral relationship ties for our 12 Chinese and Taiwanese sample firms. Out of 512 connections, 306 firm ties could be clearly attributed based on data source evidence (e.g., annual report, industry press release) 138 cells are coded as 0 s (no direct tie), whereas 193 direct bilateral ties are coded as 1 s, meaning there is a contractual tie between the sample firm and another network actor (e.g., supplier, customer). Consequently, our research provides robust empirical evidence on the international experience, preferred relationship modes, relationship building frequencies, and electronics business network positioning as well as international partner preferences as discussed in the following sections.

4 Empirical findings and discussion

4.1 Internationalisation experience and learning

Our research delivers evidence that Chinese and Taiwanese electronics firms started establishing their international business networks during the 1980s (e.g., Acer, Haier, and HonHai). The majority of Chinese and Taiwanese firms in our sample selected the USA, Germany, South Africa, and the Czech Republic as their initial target regions in the course of their international expansion. Interestingly, the Czech Republic, although relatively small, belongs to the preferred business target regions of Chinese and Taiwanese electronics firms due to its well-developed infrastructure and its geographical location adjacent with Germany, Austria, Poland, and Slovakia.

Our research delivers evidence that Chinese and Taiwanese sample firms do not follow linear internationalisation paths, e.g., entering direct neighboring countries first and gradually expand towards more distant markets (Johanson and Vahlne, 1977). Instead, Chinese and Taiwanese firms serve as ‘market opportunity seekers’ and initiate relationships with partners regardless of their geographical distance. As illustrated in Table 2, Chinese and Taiwanese firms indicate a clear internationalisation preference, namely towards the USA, during times when they have launched their first international business activities.

Table 2 Sample constitution of Chinese and Taiwanese electronics manufacturing firms

<i>Sample firm</i>	<i>Established</i>	<i>Origin</i>	<i>Main business</i>	<i>The initial year of internationalisation</i>	<i>Initial market entry strategy</i>	<i>Initial target country</i>
Acer	1976	Taiwan	Computer/IT	1984	Foreign direct investment	USA
AsusTek	1989	Taiwan	Computer/IT	2006	Joint venture	Czech Republic
BenQ Corp	1984	Taiwan	Consumer electronics/IT	1998	Foreign direct investment	China
Haier	1984	China	Consumer electronics	1984	Joint venture	Germany
Hisense	1969	China	Consumer electronics	1993	Foreign direct investment	South Africa
HonHai (Foxconn)	1974	Taiwan	Consumer electronics	1988	Foreign direct investment	China
Huawei	1987	China	Communication	2003	Joint venture	USA
Konka	1980	China	Consumer electronics	1999	Joint Venture	India
Lenovo	1984	China	Computer/IT	1997	License	USA
Qisda	1984	Taiwan	Consumer electronics	1992	Foreign direct investment	USA
Sharp*	1952	Japan	Consumer electronics	1952	Joint venture	USA
Sichuan Changhong	1958	China	Consumer electronics	2002	Joint Venture	USA
TCL China	1981	China	Consumer electronics	2002	Foreign direct investment	Germany

Notes: *Sharp (Japan) is listed separately because, meanwhile, Sharp belongs to HonHai. Through the acquisition of Sharp, HonHai got access to valuable and long lasting business relationships established over decades.

4.2 Relationship modes

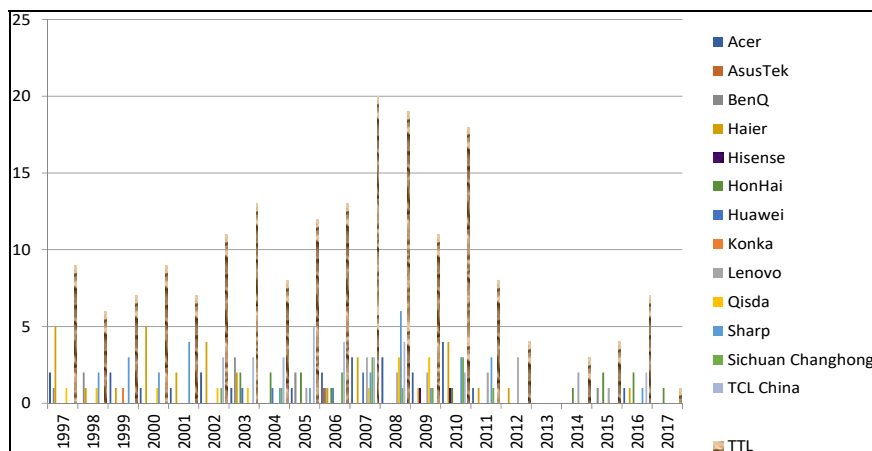
At the initial stage in course of their international expansion, Taiwanese and Chinese preferred international joint ventures (with local partners) and FDI's first and foremost in the USA, followed by Germany, Czech Republic, India and South Africa (compare Table 2). Frequency analysis for the period of 1997 until 2017 based on the study of 193

bilateral relationships (compare Table 3) delivers empirical evidence that Chinese and Taiwanese electronics firms favoured cooperative market entry modes with a preference for international joint ventures (94) and strategic alliances (38), that means a total 132 cooperative relationship modes (out of 193). Our research confirms earlier findings by Buckley et al. (2008) that Chinese firms favour cooperative market entry strategies. Ranked as second are FDIIs (55), among which acquisition (38) is the most prevalent, followed by equity participation (13) and mergers (4). The least popular relationship mode involved contractual arrangements (26), namely original contract manufacturing (13) and licensing (3) (Cooper and Ross, 2007). Table 3 provides an overview of the market entry mode frequencies of our Chinese and Taiwanese sample for the period 1997–2017.

Table 3 Relationship institutionalisation, relationship mode, and number of newly established ties of Chinese and Taiwanese electronics manufacturing firms for the time period 1997–2017

<i>Relationship institutionalisation</i>	<i>Relationship mode</i>	<i>Number of newly established ties</i>
Cooperative	International joint ventures	94
	International strategic alliances	28
Foreign direct investment	Acquisition	38
	Equity participation	4
	Merger	13
Contractual modes	Original equipment manufacturing (OEM)	13
	Licensing	3
<i>TTL</i>		<i>193</i>

Figure 1 Number of newly established relationships of each sample firm agreed in each year (long bar indicates the total number of relationships agreed per each year) for the time period 1997–2017 (see online version for colours)



Note: In 2016, HonHai (Taiwan) acquired Sharp (Japan).

Table 4 Frequency analysis of newly established ties of Chinese and Taiwanese electronics manufacturing firms in terms of regional preferences and relationship establishment objective for the time period 1997–2017

Sample firm	Europe			Middle East + Asia + Oceania			Americas			Africa		TTL	
	Northern/Central		Middle East	Asia + Oceania		North America		South America		Manu	Sales/ R&D		
	Manu	Sales/ R&D	Manu	Sales/ R&D	Manu	Sales/ R&D	Manu	Sales/ R&D					
Acer	3	2	0	1	8	5	1	3	1	1	0	0	25
Asus	1	0	0	0	0	0	0	0	2	0	0	0	3
BenQ	2	12	0	2	0	23	0	3	0	2	0	0	44
Haier	1	10	2	4	7	11	1	1	0	0	4	2	43
Hisense	2	1	1	0	0	1	0	1	1	0	2	1	10
HonHai	3	0	1	0	11	0	0	0	5	0	0	0	20
Huawei	0	4	0	0	0	1	0	1	0	0	0	0	6
Konka	0	0	0	0	2	0	0	0	1	0	0	0	3
Lenovo	1	1	0	0	2	2	1	1	1	0	0	0	9
Qisda	0	0	0	0	4	0	1	0	1	0	0	0	6
Sharp (acquired by HonHai)	7	10	0	1	38	34	2	2	1	0	0	0	95
Sichuan Chang-Hong	1	2	1	2	1	4	0	0	0	0	0	0	11
TCL China	1	8	0	0	10	8	0	1	2	1	0	0	31
TTL	22	50	5	10	83	89	6	13	15	4	6	3	306

4.3 *Relationship frequencies*

The relationship-building frequencies of Chinese and Taiwanese electronics firms do not follow a linear process. Over the last two decades, the number of relationship engagements has not continuously increased; it instead follows a wave pattern. As illustrated in Figure 1, the number of relationship engagements hit a record high during the global financial crisis (2008–2010) and declined after 2011. Since 2011, returning to the level as before the global financial crisis, tie establishment frequencies have remained at a magnitude of four to seven newly established contractual relationships each year.

Chinese and Taiwanese electronics firms prefer western partners when looking for sales and distribution channels as well as for research and development (R&D) reasons. The majority of ties (50) of our sample were established with European firms, with a focus on research and development (R&D), and gaining access to supply and distribution channels (Seaman et al., 2017). Not surprisingly, manufacturing network grids with major suppliers are mainly located in Asia (83) with Europe in a distant second place (22). Concerning the American continent, our Chinese and Taiwanese sample concentrates its manufacturing in South America (15) whereas, sales and research relationship partner firms are located in North America. Africa is behind all other continents with six manufacturing establishments and three sales and research units running by our sample firms. A profound overview of the international activities, segmented by manufacturing, sales/R&D of our Chinese and Taiwanese electronics firm sample is presented in Table 4.

4.4 *Electronics business network positioning*

Eigenvector analysis allows us to endeavour which firms hold the most promising business network (insider) positioning and which companies are geographical and technological less integrated in the global electronics business network. Quantitative eigenvector analysis for this study is calculated based on 167 firms, which include suppliers, customers, and competitors of our Chinese and Taiwanese electronics sample and their business network. The highest normalised eigenvector indices are held by HonHai (70.112), followed by Acer (55.058) – both are of Taiwanese origin.

That means, HonHai holds the most favourable electronics network insider positioning globally (which indicates a valuable knowledge hub) followed by Acer. In other words, through fine-grained knowledge relationship channels, both Taiwanese firms, have best prerequisites for searching global business opportunities. For example, in 2016, through an investment of USD3.81 billion, HonHai Precision Industry acquired 66.07% of shares and became Sharp's parent company and thus gained access to the extensive business network of the Japanese market incumbent (Chung and Low, 2016). This helped HonHai develop its business portfolio from a narrowly focused original equipment manufacturer, mainly for Apple, to a powerful electronics business network actor (Yiwei, 2014). Further network actors holding large eigenvector indices are Lenovo (21.702) and Haier (20.821) – both from China – and the Taiwanese Premier Image Corporation (20.038).

Table 5 lists the top 50 firms based on their eigenvector height. Figure 2 serves as an illustration of the complexity of the electronics industry network and corresponding important nodes based on our Chinese and Taiwanese electronics sample.

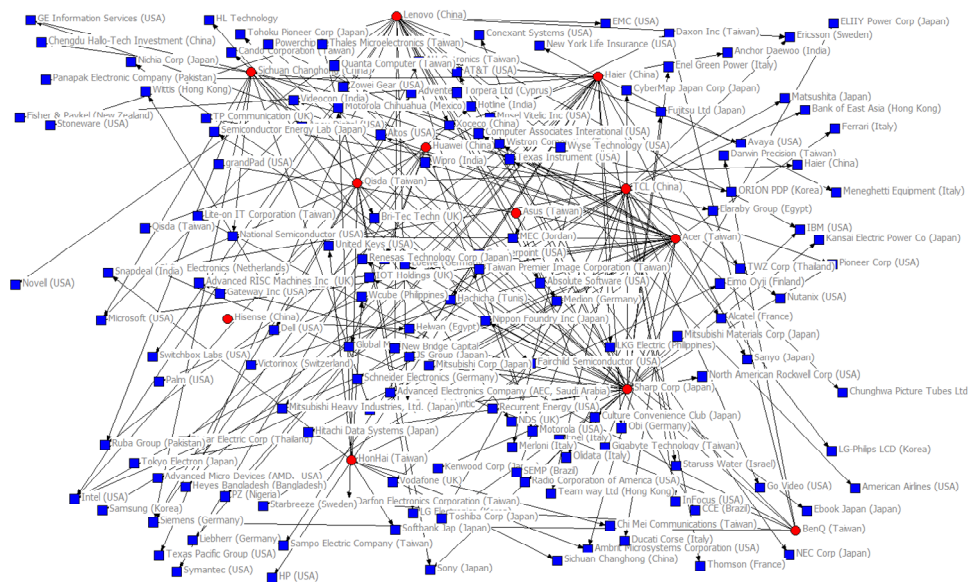
Table 5 Network analysis parameter results of our Chinese and Taiwanese sample (egos) and their alters based on their firm relationships analysed for the period 1997–2017

<i>No.</i>	<i>Firm name</i>	<i>Eigenvector</i>	<i>Betweenness</i>
1	Acer (Taiwan)	55.058	20.596
2	HonHai (Taiwan) including Sharp	46.864	8.865
3	Schneider Electric (Germany)	35.712	0
4	Intel (USA)	33.129	9.031
5	HonHai (Taiwan) excluding Sharp	23.248	2.069
6	Pioneer Corp (USA)	22.948	301
7	Global Marine (UK)	22.191	421
8	Lenovo (China)	21.702	306
9	Haier (China)	20.821	245
10	Taiwan Premier Image Corporation (Taiwan)	20.038	313
11	Semiconductor Energy Lab (Japan)	17.929	45
12	TCL (China)	17.664	246
13	Qisda (Taiwan)	17.402	3.673
14	Philips Electronics (Netherlands)	16.839	344
15	Microsoft (USA)	16.793	45
16	Fisher & Paykel (New Zealand)	15.398	0
17	Powerchip Semiconductor (Taiwan)	15.109	44
18	Quanta Computer (Taiwan)	15.109	44
19	Sichuan Changhong (China)	14.894	109
20	GE Information Services (USA)	14.153	434
21	AT&T (USA)	13.601	38
22	Palm (USA)	13.388	48
23	Toshiba Corp (Japan)	13.203	3
24	Hitachi Data Systems (Japan)	12.276	301
25	Advanced Micro Devices (AMD, USA)	11.875	503
26	MEC (Jordan)	11.752	96
27	Mitsubishi Materials Corp (Japan)	11.599	95
28	EMC (USA)	11.316	28
29	Absolute Software (USA)	11.164	2
30	Ambrit Microsystems Corporation (USA)	10.862	103
31	Hisense (China)	10.521	241
32	Olidata (Italy)	10.484	471
33	ELIY Power Corp (Japan)	9.964	13
34	North American Rockwell Corp (USA)	9.964	13
35	Avaya (USA)	9.681	25
36	General Atlantic (USA)	9.681	25
37	Snapdeal (India)	9.491	4

Table 5 Network analysis parameter results of our Chinese and Taiwanese sample (egos) and their alters based on their firm relationships analysed for the period 1997–2017 (continued)

No.	Firm name	Eigenvector	Betweenness
38	AU Optronics (Taiwan)	9.354	2
39	Helwan (Egypt)	9.081	9
40	Culture Convenience Club (Japan)	9.065	1
41	Radio Corporation of America (USA)	9.065	1
42	Tohoku Pioneer Corp (Japan)	9.065	1
43	Tokyo Electron (Japan)	9.065	1
44	Sony (Japan)	8.991	1
45	Medion (Germany)	8.781	1
46	NEC Corp (Japan)	8.781	1
47	New Bridge Capital (Hong Kong)	8.781	1
48	ORION PDP (Korea)	8.748	4
49	Siemens (Germany)	8.677	5
50	IBM (USA)	8.608	1.145

Figure 2 Business network grid and important topographical nodes/sub-cluster of Chinese and Taiwanese electronics manufacturing firms (status December 2017) (see online version for colours)



Normalised Freeman betweenness centralities (compare Table 5) reveal that Acer from Taiwan (20.596) holds the strongest bridging (brokerage) position in terms of resource (market and technological knowledge) exchange within the global electronics business network (Burt, 1992). Chinese firms such as Lenovo (306) and Haier (245) are listed with noticeable betweenness centrality indices but far away from their Taiwanese competitors

(compare Table 5). In other words, Chinese firms indicate much lesser powerful market and technology knowledge brokerage (bridging) positionings in the global electronics industry.

In contradiction, Taiwanese firms are in better ‘brokerage’ positionings, meaning to pass through or withhold valuable knowledge within the global electronics industry networks than firms from China.

The business cluster analysis delivers evidence which firms are mutually connected in dense relationships groups and, thus, make use of efficient mutual knowledge transfer and shared geographical market positionings (Fritsch and Kauffeld-Monz, 2008). Our analysis identifies important global electronics industry clusters. For example, there is a significant cluster ‘A’ driven by leading Taiwanese electronics firms (e.g., Acer) with intense and multifaceted relationships to US-software (e.g., Microsoft) and hardware (e.g., AMD) specialists. The business cluster ‘C’, for example, is controlled by Chinese electronics firms (e.g., Hisense, Sichuan Changhong, TCL) with strong relationships to other actors in the USA (e.g., Absolut Software, RCA, EMC etc.).

Table 5 provides an overview of the identified electronics industry clusters (A–L) according to our survey targeting leading Chinese and Taiwanese electronics firms. The table delivers information concerning each cluster firm member, its country of origin, each firm’s eigenvector and betweenness centrality index (compare Table 5).

4.5 Regional market modes

Correlation analysis provides robust empirical evidence that Chinese and Taiwanese firms that already have established manufacturing sites in Asia/Oceania, at the same time, indicate a high momentum of FDI activities in Europe (0.875**). Based on our sample survey results we claim that Chinese and Taiwanese electronics firms, which favour joint ventures and strategic alliances (cooperative market entry modes), at the same time, indicate a high degree of FDIs in Europe (0.727**). Table 6 provides an overview of further correlations, according to our sample, between market entry modes and geographic target markets.

Table 6 International business cluster analysis of Chinese and Taiwanese electronics firms

<i>Cluster group</i>	<i>Cluster member and country of origin</i>	<i>Cluster characteristics</i>
A	Acer (Taiwan), HonHai (Taiwan), Advanced Micro Devices (AMD) (USA), Advanced Electronics Company (AEC) (Saudi Arabia), Altos (USA), Ambric Microsystems Corporation (USA), Computer Associates International (USA), Counterpoint (USA), Ducati Corse (Italy), Ferrari (Italy), Gateway Inc (USA), GE Information Services (USA), GrandPad (USA), Hitachi Data Systems (Japan), Intel (USA), Microsoft (USA), National Semiconductor (USA), Olidata (Italy), Powerchip Semiconductor (Taiwan), Quanta Computer (Taiwan), Starbreeze (Sweden), Texas Instruments (USA), Victorinox (Switzerland), Vodafone (UK), Wipro (India), and Wistron Corp (Taiwan)	<ul style="list-style-type: none"> • Driven by leading Taiwanese electronics firms and Taiwanese suppliers • Intense and multifaceted relationships to firms in the USA (e.g., hardware and software specialists) • Further ties to Western firms (e.g., UK, Italy)

Table 6 International business cluster analysis of Chinese and Taiwanese electronics firms (continued)

<i>Cluster group</i>	<i>Cluster member and country of origin</i>	<i>Cluster characteristics</i>
B	Asus (Taiwan) and Gigabyte Technology (Taiwan)	<ul style="list-style-type: none"> • Bilateral Taiwanese firm relationship • No significant relationships to other firms ('stand-alone')
C	BenQ (Taiwan) and Huawei (China)	<ul style="list-style-type: none"> • Bilateral Taiwanese firm relationship, no significant relationships to other firms ('stand-alone')
D	Haier (China) and Lenovo (China)	<ul style="list-style-type: none"> • Bilateral Chinese firm relationships, no significant relationships to other firms ('stand-alone')
E	Hisense (China), Sichuan Changhong (China), TCL (China), 3com (USA), Absolute Software (USA), Advanced Risk Machine Inc. (UK), Alcatel (France), American Airlines (USA), Anchor Daewoo (India), Apex Digital (USA), AT&T (USA), AU Optronics (Taiwan), Avaya (USA), Bank of Esat Asia (Hong Kong), Bri-Tec Techn (UK), CCE (Brazil), Chengdu Hallo-Tech Investment (China), Chi Mei Communication (Taiwan), Chungwa Pictures Tubes Ltd., Conexant Systems (USA), Culture Convenience Club (Japan), CyberMap Japan Corp (Japan), Dell (USA), Distar Electric Corp (Thailand), Ebook (Japan), Elaraby Group (Egypt), ELIHY Power (Japan), EMC (USA), Enel (Italy), Enel Green Power (Italy), Eimo Oyji (Finland), Ericsson (Sweden), Fairchild Semiconductor (USA), Fujitsu Ltd (Japan), General Atlantic (USA), Go Video (USA), Helwan (Egypt), HL Technology (Germany), Hotline (India), InFocus (USA), IOT Holdings (UK), Kansai Electric Power Co. (Japan), Kenwood Corp (Japan), LG Electronics (South Korea), LG Philips LCD (South Korea), Lixil Corp (Japan), Loewe (Germany), Matsushita (Japan), Mitsubishi Corp (Japan), Mitsubishi Materials Corp (Japan), Mose Vitelic Inc (USA), NDS (UK), Nichia Corp (Japan), Nippon Foundry Inc. (Japan), North American Rockwell Corp (USA), Orion PDP (Korea), Palm (USA), Radio Corp of America (USA), Raydium Semiconductor (Taiwan), Recurement Energy (USA), Renesas Technology Corp (Japan), Samsung (South Korea), Semp (Brazil), and Torpera Ltd (Cyprus)	<ul style="list-style-type: none"> • Largest electronics network cluster of the survey • Driven by Chinese electronics firms with strong relationships to the USA (hardware and software specialists) • Multifaceted links to various firms of the Western geographic hemisphere (e.g., UK, Germany), and far east (e.g., South Korea and Japan) • Cluster consist of very powerful firms with specialised expertise (e.g., LG Electronics in case of displays) which are located all around the world

Table 6 International business cluster analysis of Chinese and Taiwanese electronics firms (continued)

<i>Cluster group</i>	<i>Cluster member and country of origin</i>	<i>Cluster characteristics</i>
F	Konka (China) and Qisda (Taiwan)	<ul style="list-style-type: none"> • Chinese-Taiwanese cluster without significant links to other electronics industry actors ('stand-alone')
G	Adventech (Canada), Cando Corporation (Taiwan), Darfon Electronics Corporation (Taiwan), Darwin Precision (Taiwan), Daxon Inc (Taiwan), Lite-on IT Corporation (Taiwan), Philips Electronics (Netherlands), Siemens (Germany), and Zowei Gear (USA)	<ul style="list-style-type: none"> • Taiwanese electronics cluster with various relationships to Western firms in the Netherlands, Germany and the USA
H	Fisher & Paykel (New Zealand), Hachicha (Tunisia), Heyes (Bangladesh), JS Group (Japan), LKG Electric (Philippines), Liebherr (Germany), MEC (Jordan), Meneghetti Equipment (Italy), Merloni (Italy), Mitsubishi Heavy Industries, Ltd. (Japan), New York Life Insurance (USA), Obi (Germany), Panapak Electronic Comp (Pakistan), PZ (Nigeria), Ruba Group (Pakistan), Sampo Electric Company (Taiwan), Sanyo (Japan), Staruss Water (Israel), and TWZ Corp (Thailand)	<ul style="list-style-type: none"> • 'International cluster' with geographical footprints in Africa, Asia, Europe, and America where only one Taiwanese represent is listed (Sampo Electric) • Some cluster participating firms are doing business in non-related businesses compared to electronics (e.g., New York Life Insurance, US or Obi in Germany)
I	Global Marine (UK), HP (USA), Motorola Chihuahua (Mexico), Snapdeal (India), Softbank (Japan), Taiwan Premier Image Corporation (Taiwan), United Keys (USA), and Wcube (Philippines)	<ul style="list-style-type: none"> • Relatively small 'Taiwanese-International' but geographically widespread cluster (America, Asia and Europe)
J	Medion (Germany), NEC Corp (Japan), New Bridge Capital (Hong Kong), Novell (USA), Nutanix (USA), Stoneware (USA), Switchbox Labs (USA), Texas Pacific Group (USA), Wyse Technology (USA), and Xococo (China)	<ul style="list-style-type: none"> • Relatively small cluster driven by US-firms and only one Chinese representative • Further links to Germany and Japan
K	Pioneer Corp (USA), Sony (Japan), and Thales Microelectronics (Taiwan)	<ul style="list-style-type: none"> • Small, international cluster with powerful actors from Asia and the USA

Table 6 International business cluster analysis of Chinese and Taiwanese electronics firms (continued)

<i>Cluster group</i>	<i>Cluster member and country of origin</i>	<i>Cluster characteristics</i>
L	Schneider Electric (Germany), Semiconductor Energy Lab (Japan), Tohoku Pioneer Corp (Japan), Tokyo Electron (Japan), and Toshiba Corp (Japan)	• Cluster driven by Japanese electronics firms with a link to Germany
M	Team Way Ltd (Hong Kong), Thomson (France), TP Communication (UK), and Videocon (India)	• Small cluster with participants from China, France, UK and India

Further analysis reveals that mainly Taiwanese firms such as HonHai and Acer maintain various ties to Western firms such as Intel, Pioneer Corporation, and Microsoft. Related to our sample, particularly US firms are important business partners of Taiwanese firm, proven by their high eigenvector parameters which also reflect their long-lasting market incumbent positionings in the electronics industry. Additionally, we found that electronics firms from Japan (e.g., Toshiba), South Korea (e.g., Samsung, LG), the Netherlands (Philips), and Germany (Schneider), according to eigenvector analysis, are important contractual partner related to our Chinese and Taiwanese sample (Gilsing, 2005; Prell, 2012). In other words, Chinese and Taiwanese firms, during 1997 and 2017, have sought to establish promising relationships to ‘regional market and technological industry specialists’ in the US, Europe, Japan and South Korea in order to advance their local market knowledge and technological industry expertise. Intense global relationship building helped them to overcome their industry latecomer drawbacks.

Table 7 Correlation analysis of market entry modes and different target markets of Chinese and Taiwanese electronics firms

	<i>FDI Europe</i>	<i>FDI Asia + Oceania</i>	<i>FDI America</i>	<i>FDI Africa</i>	<i>Contracting</i>	<i>Cooperation</i>	<i>Merger and acquisition</i>
FDI Europe	1	0.875**	0.526	0.213	0.097	0.727**	0.231
FDI Asia + Oceania	0.875**	1	0.527	0.049	0.192	0.763**	0.178
FDI America	0.526	0.527	1	-0.204	0.598*	0.269	0.471
FDI Africa	0.213	0.049	-0.204	1	-0.287	0.295	0.381
Contracting	0.097	0.192	0.598*	-0.287	1	0.216	0.301
Cooperation	0.727**	0.763**	0.269	0.295	0.216	1	0.413
Merger and acquisition	0.231	0.178	0.471	0.381	0.301	0.413	1

5 Conclusions

Our findings provide evidence that Chinese and Taiwanese electronics firms have amplified their international business network size over the last two decades. A key research outcome relates to the fact that our sample firms do not follow traditional internationalisation patterns of incremental market entry, entering the direct neighbouring

country first and then expand to geographical and cultural more distant markets (Johanson and Vahlne, 1977; Vahlne and Johanson, 2017). Instead, they are '*market opportunity seekers*' and enter new business relationships, when perceived as promising, with other actors regardless of their geographical or perceived cultural distance (Avloniti and Filippaios, 2014; Del Giudice et al., 2020). We reveal differences between Chinese and Taiwanese firms in terms of their electronics industry network positioning. We claim that promising network positions of Taiwanese firms, which started internationalising earlier than Chinese former state-owned firms, enabled them to better access market knowledge and to facilitate gaining and maintaining sustainable competitive advantage. Hence, learning and market knowledge emerge as the key competitive aspects of Taiwanese firms. We offer empirical evidence that Taiwanese firms hold the most substantial knowledge bridging power together with their network alters originating from the USA.

At the same time, it needs to be noted, that high betweenness degrees of the US firms indicate that there are able to profoundly influence Chinese and Taiwanese electronics business networks by choosing to withhold or distort valuable knowledge resources. According to our study results, Chinese and Taiwanese firms prefer cooperative relationship modes in course of expanding their global business network followed by FDIs.

Bembom and Schwens (2018) call for developing a deeper understanding concerning network relationships as resource supply vehicles for substituting own resource drawbacks. Having that said, we claim that the collaboration of our sample firms with other business network actors, mainly originated in the USA, followed by firms in Europe, Japan and South Korea helped them in overcoming market latecomer drawbacks (compare also Kiss and Danis, 2008; Niu, 2010; Prashantham and Young, 2011; Xie, 2017). A favourable network insider positioning is especially important for electronics firms as they are confronted with fast-developing (maturing) knowledge for both software and hardware components, as they are both integral of the final product.

Yang and Hsian-Ming (2012) emphasise the investigation of network positioning concerning the firm's agility to adjust their networking strategies in times of turbulent business environments. We prove that our sample firms from China and Taiwan indeed adapt their activities within the global business network to react to changing conditions. As we verify against the background of the global financial crisis, Chinese and Taiwanese electronics firms have intensified their networking activities against the background of the recent financial crisis (compare Figure 1). Our sample companies obviously perceived the crisis as an opportunity for expanding their international business (López-Duarte and Vidal-Suárez, 2010). Western policymakers shall take this as a signal regarding the COVID-19 impact to their local economies, especially when their countries are connected to the one-belt-one-road initiative (Ly, 2020).

Ojala et al. (2018) emphasise the role of commitment to networks among business platform providers. Our sample firms indicate long-term commitments by focusing mainly on collaboration, but the same firms were ready to expand their business networks significantly in turbulent times, for example, through acquisitions. Our study contributes to the network theory as, in reflection to Ojala et al. (2018), we clearly witnessed a tendency of our sample to maintain stable commitments during times of global business stability but the readiness to expand the network at the time of crisis, which also depicts openness to continuous learning.

As we recently witnessed, due to COVID-19, electronics components delivery shortages from China and Taiwan with a major impact on various industry value chains (e.g., automotive, information technology, machinery, etc.) our research sheds light on the electronics industry relationship configurations to better understand this phenomenon. The emerging challenges faced by global value chains due to pandemic, provide a new perspective preparedness. We believe that the dependence of western firms on Chinese and Taiwanese electronics component suppliers was considerably underestimated in the past. Thus, our research helps business practitioners to prepare better in order to avoid the current shortage dilemma for the future. We deliver evidence on the industry network positioning (verified by the eigenvector) of Chinese and Taiwanese electronics firms, their preferred market entry mode their belonging to a specific industry cluster as well as their geographical target market preferences. For the managerial audience, our empirical evidence concerning network insider versus outsider positionings (verified by centrality and betweenness indices, cluster analysis) and its impact on a firm's competitive advantage in its current and future markets, serve as important key take away. Firms originating from other emerging markets can learn from Chinese and Taiwanese firms by trying to become network insider in global value chain networks, as that would help in their later internationalisation endeavours. We provide valuable insights into the electronics industry network positioning of emerging Chinese and Taiwanese firms. We deliver implications to whom they are connected to access the market and technology knowledge resources. We demonstrate that Chinese and Taiwanese firms flexibly adapt to sudden changes in the global environment through the increase of their relationship engagements, thus using their chance to strengthen their global business network positioning particularly in turbulent times.

6 Limitations and future research

Our research delivers empirical evidence on how Chinese and Taiwanese firms have developed their relationship over two decades. We collected the sample data to the best of our knowledge.

However, network research is complex, and global relationship configurations (including the knowledge focused ones) tend to change over time, which may result in missing some important contractual relationships in our analysis. Further limitations of our research address the fact that we have considered only formal relationships which are institutionalised through contractual agreements, officially communicated in the firm's annual reports, press releases, and industry surveys. We are aware that informal (social) relationships of the operating management to suppliers, clients, policymakers, lobbyists, and other stakeholders vitally influence a firm's international business success as well. Studies of informal relations tend to be difficult but these are not out of consideration for continued future research, for example, through an in-depth case study and anonymous field interviews.

We propose further research related to other technologically advanced industries (e.g., digital medical devices, electric cars) were emerging firms from China and Taiwan seeks to gain global competitive industry insider positionings. Moreover, we suggest similar business network studies against the background of turbulent market surroundings. Since the global COVID-19 pandemics are shaking up global economies, it

is worth conducting research on whether and how, for example, Chinese and Taiwanese firms use their chance to expand their international business networks during post-COVID-19.

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