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Vietnam:
Connecting value chains for trade competitiveness

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Acknowledgments

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Abbreviations

ACIC	ASEAN Common Industrial Classification
AFTA	ASEAN Free Trade Area
ASEAN	Association of Southest Asia Nations
CP-TPP	Comprehensive Progressive Trans-Pacific Partnership
DDC	Direct value-added contribution
DOIT	Department of Industry and Trade
DPI	Department of Planning and Investment
DVA	Domestic value addition
E&E	Electronic and Electric
EAP	East Asia and Pacific
FDI	Foreign Direct Investment
FVA	Foreign value addition
GDP	Gross Domestic Product
GDVC	General Department of Vietnam Customs
GSO	General Statistics Office
GVCs	Global Value Chains
HCMC	Ho Chi Minh City
HS	Harmonized System
I/O	Input-output data
ICDs	Inland Clearance Depots
ICT	Information and communication technology
IDC	Indirect value-added contribution
ISIC	International Standard Industrial Classification
IWT	Inland waterways
LPI	Logistics Performance Index
LQ	Location quotient
MNEs	Multinational enterprises
MOC	Ministry of Construction
MOF	Ministry of Finance
MOIT	Ministry of Industry and Trade
MOST	Ministry of Science and Technology
MOT	Ministry of Transportation
MPI	Ministry of Planning and Investment
NR	National Road
NTFC	National Trade Facilitation Committee
OD model	Origin-destination model
OECD	Organization for Economic Cooperation and Development
PC	People's Committee
RCA	Revealed Comparative Advantage Index
RIM	Reimported intermediates
SDPs	Small development projects
SEDS	Socio-Economic Development Strategies
SEZs	Specialized Economic Zones
SI	Sourcing intensity
SMEs	Small and medium enterprises
T&G	Textile and Garment
TDSI	Transport Development and Strategy Institute
US-BTA	United States and Vietnam Bilateral Trade Agreement
VDR	Vietnam Development Report
VIA	Vietnam Industry Agency
VIDS	Vietnam Institute of Development Strategy
VSIC	Vietnam Standard Industrial Classification
WB	World Bank
WCO	World Customs Organization
WTO	World Trade Organization

Executive summary

Vietnam's export-led growth strategy and global integration are among the key factors behind the country's remarkable achievements in growth and poverty reduction over the last two and a half decades. During this period, Vietnam's per capita income increased nearly fourfold and poverty was reduced from around 53 percent in 1992 to 2 percent in 2016. Vietnam has become one of the most open economies in the world with a trade-to-GDP ratio of 187.52 percent in 2018. Merchandise export growth averaged more than 15 percent per annum in the last ten years; nearly five times the global export growth. The country's export basket has improved in its technological content and has diversified in both its geographic destination and its product mix.

There are nevertheless challenges that continue to confront Vietnam's export performance. Many of Vietnam's manufacturing exports have low domestic value addition, where Vietnam performs primarily assembly functions. Trade costs remain high compared to the average regional level. Domestic firms' participation in key global value chains (GVCs) is limited, and instead, export performance is largely driven by the foreign direct investment (FDI) sector, accounting for more than 70 percent of total exports. Vietnam will likely be able to maintain its high export performance even if these challenges are not addressed, but there is scope for Vietnam to benefit even more from trade.

Trade competitiveness – one key element of a productive economy – can be enhanced in three key ways, among others: (i) lowering trade costs associated with policy barriers to trade, (ii) improving the efficiency and reliability of transport infrastructure, and (iii) enhancing the integration of domestic production into GVCs as indicated in the three-pillar policy framework on trade competitiveness in Pham, Mishra, Chong et al. (2013). This report looks at the last two pillars, recommending policies to support trade competitiveness by improving the efficiency of transport infrastructure to enhance Vietnam's ability to integrate into GVCs[1].

To facilitate GVC integration, Hollweg, Smith, and Taglioni (2017) recommended a comprehensive set of policy measures: (i) domestic infrastructure upgrading and logistics regulatory environment improvement, (ii) a more private-sector financed and integrated approach to developing transport corridors, (iii) a more liberal stance on FDI, (iv) a general reduction in the costs of doing business, (v) more transparent and predictable border procedures, (vi) and better connectedness with regional sources of demand and technology-related investment.

This report scrutinizes a more specific aspect of pro-trade connectivity for GVC integration and complements the Hollweg, Smith, and Taglioni (2017) recommendations by offering a new analytical

1 This report does not cover trade cost issues, which are addressed in other World Bank papers, including Pham and Oh (2018), and Pham, Artuso et al., (2018).

approach developed according to the value-chain-based connectivity assessment under the World Bank 2013 Report. It does so by collecting and analyzing data on geographic arrangements, links and connectivity of production, and export activities along key value chains of comparative advantage for Vietnam. The principal objective is to identify policy actions to improve connective efficiency for and prioritized investment in pro-trade transport infrastructure to enhance trade competitiveness and GVC integration.

The report is organized into six chapters beginning with an introduction to trade-oriented connectivity policy. Chapter two then outlines our approach to assessing value-chain-based connectivity whereas chapters three through six focus on efficient international trade gateways, regional specialization and coordination, economic zones in relation to value chains, and implementing trade-oriented connectivity policy, respectively.

The key findings are organized into five main policy recommendations with detailed recommendations, objectives, policy actions, lead agencies, timeframe for implementation, and outputs, summarized in Table ES.1.

Policy Recommendation One: Make connectivity policy and transport investment more robustly trade oriented by integrating comprehensive value-chain connectivity assessment and trade gateways analysis.

At present, the objectives of improving trade growth competitiveness are not clearly linked with the objectives of developing connectivity policies and investment in transport infrastructure. Trade information, especially on value chains, is rarely used in policy formulation and implementation. There remains a lack of in-depth analysis on spatial structure and connective propensity along various linked segments of value chains to inform relevant policies and investment for transport infrastructure development. Related policies, transport master plans, and investment priorities should be formulated and implemented to more strongly support trade.

Chapter two provides a new four-step methodology for a comprehensive value-chain connectivity and competitiveness assessment that identifies corridors and gateways critical for key domestic export-oriented value chains. These corridors are defined based on spatial structure of input-output links, industrial concentration, and hierarchical connective propensity, linking all segments of value chains with international trade gateways. This important information could guide related policies for and investment in transport infrastructure for the most effective support to enhance trade competitiveness and improve GVC integration. The report identifies key trade corridors and gateways for ten selected value chains with national comparative advantage, good trade performance, and governmental priority, including textile and garment, leather and footwear, electronics and electrical equipment, motor vehicles, wood products, rubber, rice, coffee, and fruits and vegetables.

Subsequently, chapter three scrutinizes international trade gateways and their trade flows and structure, showing the share of total trade via air gateways has increased rapidly from 15.6 percent in 2011 to 39.5 percent in 2016, while the share of total trade via sea gateways plummeted from 78.8 percent in 2011 to 56.1 percent in 2016. This reflects the drastic shift in export structure from primary exports including crude oil and non-oil (coal, stone, sand, gravel, aluminum, copper, etc.) and resource-based exports (agriculture-based products) to high-tech exports (electronics, cell phones, incorporated circuits, etc.). This structural change—rapid increases in small but valuable products, like mobile phones, electronic components, high fashion exports, and high-value, processed agricultural products—requires the transport system and its investments supporting exports to consider a shift from logistics perspectives, based not only on trade growth but also (and more important) on structural change and developing domestic value chains.

Later, chapter six suggests formalizing the comprehensive value-chain connectivity and competitiveness assessment and trade gateway analysis into new transport and trade strategies. Authorities would need to formalize these analyses and appoint lead agency and research institutions to regularly conduct them, guide interagency coordination, and integrate their outputs and outcomes into trade policy, export-import strategy, and national and provincial socio-economic development strategies (SEDS) and master plans.

One proposed action is to incorporate the information and policy analyses on trade flows and key value chains into the transport strategy for 2030. Trade-related indicators should be factored into renewed transport strategy to better benchmark Vietnam against international practice and to monitor policy implementation. Key trade indicators would include trade cost reduction, and Vietnam's improved position in the interrelationship between efficient connectivity, measured by the quality of trade-related infrastructure, and trade development, measured by trade per capita, etc.

In conjunction, the import-export strategy for 2030 should also be renewed to incorporate trade-related infrastructure factors including transport and logistics policies. Similarly, Vietnam should consider including infrastructure-related indicators like trade-related transport capacity (road, airway, seaway and ports, railway) and logistics performance indicators into import-export strategy to promote this critical policy coordination.

In selecting ten value chains to demonstrate the four-step methodology for the value-chain-based connectivity and competitiveness analysis in chapter two, the report used existing datasets to produce empirical results. Looking forward, when scrutinizing structural changes in developing GVCs, policy makers should also account for mega trends that may disrupt GVCs, notably the acceleration of the digital transformation and associated de-globalization process. Over the medium to long term, GVCs will consolidate, with fewer countries and firms participating. Automation may result in reshoring manufacturing and therefore the comparative advantage of cheap labor enjoyed by low-and-middle-income countries (LICs) like Vietnam may be quickly eroding. In other words, infrastructure investments should not only support current economic activities (and, therefore, inevitably reinforce the current economic structure), but also be forward-looking and consider emerging trends and future developments. The proposed methodology allows for close monitoring with dynamic change in spatial structure and connective propensity of existing and emerging value chains in Vietnam.

Policy makers may face some trade-offs when using information on GVC-based connectivity for master planning given limited resources and capacity. For example, developing connective infrastructures and gateways to support electronics GVCs may come at the expense of aquaculture value chains.

This is already happening in Vietnam, when infrastructure in the Mekong River Delta does not keep pace with rapidly rising demand, while in the North, activities along some highways are relatively low.

Policy Recommendation Two: Establish an efficient mechanism for coordinating trade and transport connectivity and GVC policies proposed in Recommendation One.

It is vital to establish an effective interagency coordination mechanism to implement the recommendation for multisectoral policies and investment related to pro-trade transport infrastructure and GVC integration. This mechanism should be put under a four-pillar framework for trade facilitation and logistics and enhanced trade competitiveness as referenced in Pham and Oh (2018).

Chapter six recommends the National Committee for National Single Window, ASEAN Single Window and Trade Facilitation (below reffered to as National Trade Facilitation Committee - NTFC) should take the lead in coordinating trade, trade-related transport, and GVC policies by providing strategic direction and guidance, and supervising related multisectoral policies, particularly for delivering Policy Recommendation One. This committee was established by the Prime Minister's Decision 1899 /QD-TTg dated April 10, 2016, chaired by Deputy Prime Minister Vuong Dinh Hue, with senior representatives from 20 line ministries, primarily to comply with the WTO's Trade Facilitation Agreement (TFA). More important, this committee has been assumed to coordinate multiagency efforts to facilitate trade, reduce trade costs, and improve trade competitiveness.

In response to the World Bank's policy recommendation (Pham and Oh, 2018), the Prime Minister issued the Decision 684/QD-TTg dated June 4, 2019 to revise and supplement the Decision 1899/QD-TTg by adding the role to coordinate interagency efforts on national logistics development. This additional function makes the upgraded NTFC a perfect body to coordinate multisectoral policies on trade, traded-related transport and connectivity, and GVC development for trade competitiveness as proposed in the four-pillar framework and Policy Recommendation One. Chapter six further suggests strengthening this mechanism by recommending the committee appoint an interagency taskforce to assist managing assumed task in the above-mentioned Recommendation One.

Policy Recommendation Three: Secure firm-level data for qualified multisectoral policy analyses on trade, transport, and value chains.

Chapter six advises relevant data sets should be in place with appropriate and regularly updated statistical indicators on value chains and gateways to ensure reliable policy analysis informs connectivity policy and investment in trade-related infrastructure. Much of the information and data needed for such analyses is missing and/or difficult to collect. This is partly due to a new approach that requires complex datasets and time for statistical systems to respond, but more important due to strict regulations for disclosing raw and firm-level data. Chapter six proposes issuing relevant regulations to make firm-level trade and transport data available for the value-chain connectivity and competitiveness assessment and trade gateways analysis, as well as establishing an effective mechanism for better data collection, processing, and coordination at national and sectoral statistics levels among the General Statistics Office (GSO), the Ministry of Transport, the General Department of Customs, and others to supplement the data. Innovative methodologies using big data for real-time analysis should be explored toward this modern policy formulation process.

The analyses proposed in chapters two and three would use considerable firm-level data to address research questions and inform key findings. Disaggregated data would be combined from various sources, including: (i) input-output data for value-chain link identification, (ii) enterprise data (per industry, per province, per commodity, per industrial park, per industry, etc.) for capturing regional concentration of domestic supply chains, (iii) transportation data and origin-destination (OD) flows (both within supply-chain structure and between cluster locations and trade gateways), and (iv) border/port trade data (land gateway, seaport, and airport with the Harmonized System (HS) code of export and import volume).

Because this value-chain analysis is critical for businesses and the private sector, the report recommends building an information point with convenient access to publicly available information on value-chain links and spatial structure, including but not limited to geographic location of value-chain links, provincial specialization, international gateway statistics, etc. To be sustainable, such a multidisciplinary, cluster-development data center would require strong interagency coordination and a government-private sector partnership. Optimally, this center would be managed by a government agency, strongly motivated to use the data (which could oversee development master planning, competitiveness enhancement, and connectivity policy and investments). For coordinating data inputs, this agency would be mandated to work with the various sources of this data (GSO, customs, transport, other development partners, etc.), and empowered to manage data sharing with the private sector. Preferably, the center would be overseen by the National Trade Facilitation Committee.

Regular updates and visualization of industrial concentration indicators and commodities flows is useful for all stakeholders, policy makers, academics, researchers, and businesses alike. Chapter six recommends sharing the information on provincial specialization for all concerned parties including central and local governments, the private sector, and development partners. The information on value-chain links, spatial structure, and connectivity is important not only for policy formulation, but also for the private sector to proactively participate in domestic supply chains as a significant part of GVCs. This is especially essential in Vietnam where more than 90 percent of the domestic private sector are small firms that lack this information and have weak links to foreign invested firms.

The information on value-chain links, spatial structure, and connectivity could be made available on a cluster-mapping website following a U.S. model, with information collected and analyzed via the comprehensive value-chain connectivity assessment and trade gateways analysis, using big data in real time. It would be developed and shared publicly, for both policy makers and the private sector not only to implement Policy Recommendation One but also to fulfill Vietnam's e-government initiative.

Vietnam should consider developing a similar cluster-mapping project as in the United States, with data sources and operational organizations properly ascribed. In addition to a cluster website, online freight-flow modeling can be developed based on OD flow data. The website and online freight-flow modeling would provide dynamic, visual information for governments and businesses to understand and shape the competitive landscape for a range of industries. The website would also help local governments understand local specialization and regional comparative advantages to promote strategic investment and lay the groundwork for new industries.

Policy Recommendation Four: Consider regional specialization and inter-regional cooperation in transport infrastructure investment policy.

Chapter four shows manufacturing density and value-chain concentration have a positive interrelationship with income, exports, and employment in local areas. Regional specialization measured by location quotient (LQ) is a dynamic metric, changing over time. Some provinces change their participation in the value chain for various reasons. For example, emerging electronics value-chain expansion in Thai Nguyen Province and Bac Ninh Province resulted from the foreign-led firm Samsung's move to Vietnam. Other provinces change their specialization because of increasing competition in obtaining necessary skilled labors. The information on local specialization is important for understanding the geographic structure of value chains. The government needs this information to formulate policy in regional coordination integrating value-chain links, and for planning human capital in appropriate regions and areas accordingly.

An example of spatial structural analysis using this method of calculating LQ on the aquaculture value chain shows that, although aqua-culturing is spread across the country, this export-oriented value chain that has a spatial layout along key segments including aquaculture, capture, and export processing, is concentrated mainly in the South, especially in the Mekong Delta. The value-chain connectivity follows a specific trend of sequential transport connection, reflecting the input-output relationship of production, and especially the connection between export processing location and related national trade gateways. This report recommends integrating effective regional value-chain connectivity into regional development planning and implementation. Moreover, decisions on transport infrastructure investment should be based on a conducive environment for regional specialization and inter-regional cooperation (rather than unhealthy competition) for public investment sources.

Another example of dynamic specialization is Ha Nam Province, which currently specializes in the textile and garment, electronics, cement, auto-parts, and animal food subsectors. Between 2011 and 2016, textile and garment specialization has moved away from fabric and clothing and more toward yarns. Meanwhile, electronics emerged during this period. This specialization change would require a shift in labor force skills, and a conducive policy environment for increased competition in the labor force. Remarkably, during this same period, Ha Nam Province has become more specialized in cement production, but with fewer local inputs. This may reflect a shortage of local inputs or the provincial government's increasing awareness of environmental protection.

Changes in provincial specialization can create opportunities for lagging regions like poor and remote provinces. This report shows the garment segment of the textile and garment value chain has shifted from Red River Delta provinces (Hai Duong, Bac Ninh, Ha Nam) to a lagging province (Tuyen Quang) between 2011 and 2016. The shift in provincial specialization needs to be reviewed more closely in separate focused studies.

This report recommends developing and implementing a National Action Plan for Inter-regional Linkages and Coordination, built on an in-depth assessment of static and dynamic provincial specialization and an analysis of inter-regional links and connectivity, and based on spatial structure and developing key value chains. Among other things, the Action Plan should direct public investment accordingly and avoid unnecessary regional competition for inefficient and fragmented public investment by each province.

Policy Recommendation Five: Industrial and economic zones should support the development of domestic supply chains for better GVC integration.

Chapter five uses value-chain analysis to differentiate between industrial agglomeration and concentration through value chains versus economic concentration in economic zones. The characteristics and spatial structure of industrial parks and economic zones are far different than those of value chains. Industrial and economic zones are organized in specific areas designed for multiple sectors, and sometimes apply preferential policies for firms located within them. Instead, the spatial structure of a value chain usually spans larger geographic areas with many more actors, and preferential policies are not usually applied to entire value chains.

The difference in the spatial structure and the policy disparity inside and outside industrial and economic zones can prevent or constrain links across the entire value chain, as international experience shows (Zeng, 2010). Establishing the needed interactions between various segments of value chains, physically and institutionally, is one challenge for economic zones models. Furthermore, zones are often located near big cities or important transport corridors, especially in the final corridor connecting the export processing point to the international trade gateway.

This report emphasizes the necessity of rethinking and modernizing industrial and economic zones to make them best support domestic value-chain links and connectivity. Policies should be enacted so industrial and economic zones are developed to promote better GVC integration. Zone policies also need to be revised and supplemented to promote cluster development. Cluster links, while they may not fully reflect the entire value chain, include important value-chain link(s) that require spatial and policy priorities to facilitate input-output links of the broader chain. Policies should also address the impacts of urbanization and spontaneous zone development along main transport corridors. Chapter five provides international examples from China and other countries of developing cluster-based economic zones and facilitating localized cluster growth.

This report provides several policy recommendations and actions. First, we recommend restructuring industrial and economic zones so they best support value-chain-based connectivity and competitiveness. This would require forming an industrial and economic zones development plan accounting for comparative advantages of each province and region, and integrating them into national, regional, and provincial master plans. In addition, industrial and economic zones regulations should be revised to drive better GVC integration.

Second, in the longer term, the government should prioritize leveraging industrial and economic zones to attract FDI and accelerate industrial and trade growth. To achieve this, an FDI promotion plan should identify appropriate types of FDI to be attracted with sectoral priority. Furthermore, the government should design an industrial and trade strategy and development plan considering regional comparative advantages, value-chain development, and upgrading Vietnam's position in GVCs. This strategy would then be integrated into national, regional, and provincial master plans.

Last but not least, Vietnam should identify existing industrial and economic zones that are not fully occupied and promote them as "greenhouses" for potential industrial clusters based on the host province's advantages and industrial agglomeration (LQ index), and reflect this direction in national, regional, and provincial master plans.

TABLE ES.1. **Policy priorities for value chain connectivity and trade competitiveness**

Objective	Policy action	Lead agency	Time	Outputs
1. Policy Recommendation One: Make connectivity policy and transport investment more robustly trade oriented by integrating comprehensive value-chain connectivity assessment and trade gateways analysis.				
1.1. Renew the transport strategy for 2030 to include links between transport and development of trade and key value-chains.	Incorporate trade-related indicators in transport strategy, including but not limited to (i) reducing trade costs ("doing business", etc.); (ii) improving Vietnam's position in the interrelationship between efficient connectivity (measured by the quality of trade-related infrastructure Logistics Performance Index (LPI)) and trade development (measured by trade per capita).	MOT, MOIT, MPI	2020-2021	- A new transport strategy - Inputs for ten-year social and economic development strategy (SEDS) 2021-2030
1.2. Renew the import-export strategy for 2030 to include trade-related infrastructure factors (transport and logistics).	Incorporate infrastructure-related indicators in import-export strategy, including but not limited to (i) trade-related transport capacity (road, airway, seaway and ports, railway), (ii) trade-related logistics (LPI).	MOIT, MPI, MOT	2020-2021	- A new import-export strategy - Inputs for ten-year SEDS 2021-2030
1.3 Formalize a comprehensive value-chain connectivity assessment and trade gateways analysis that collects and analyzes data on geographic arrangements of production and export activities along key value chains of comparative advantage for Vietnam, and key international gateways into transport and trade strategies.	- Issue an instruction to formalize a comprehensive value-chain connectivity assessment and trade gateways analysis by appointing lead agency and research institutions to regularly conduct these studies, and guide interagency coordination. - Integrate value-chain connectivity assessments into trade policy and export-import strategy. - Integrate value-chain connectivity assessments into regional and provincial socio-economic development strategy and master plans.	MPI (VIDS), MOT (TDSI), MOIT (VIA), MARD	Annually or every two years	- Regular value-chain-based connectivity and competitiveness analysis. - Value-chain-based connectivity analysis to be integrated in trade policy and export-import strategy. - Value-chain-based connectivity analysis to be a component in regional and provincial SEDS (ten year) and master plans (five year)

Objective	Policy action	Lead agency	Time	Outputs
2. Policy Recommendation Two: Establish an efficient mechanism for coordinating trade and transport connectivity and GVC policies proposed in Recommendation One.				
2.1. Establish an effective mechanism for implementing Policy Recommendation One.	- Consolidate the current National Trade Facilitation, Logistics and National Single Window Committee (NTFC) to coordinate trade, trade-related transport, and GVC policies, to provide strategic direction and guidance, and to supervise related multisectoral policies. - Appoint a special taskforce or secretary to assist the NTFC in managing multisectoral policy coordination for trade, trade-related transport, and GVCs.	NTFC, MOIT, MARD, MPI, MOT	2020-2021	- A consolidated NTFC - Relevant NTFC decisions
2.2. Establish an interagency taskforce under the NTFC to implement actions under Policy Recommendation One.	- Issue a decision for establishing the special taskforce or secretary. - Formalize the development and implementation of a firm-level data system to support multisectoral policy analyses on trade, trade-related transport, and GVCs.	NTFC, MOIT, MARD, MOT, GSO, Customs	2020-2021	A taskforce under NTFC oversight
3. Policy Recommendation Three: Secure firm-level data for qualified multisectoral policy analyses on trade, transport, and value chains.				
3.1. Develop a relevant dataset with appropriate and regularly updated statistical indicators on value chains to ensure reliable policy analysis and appropriate investment in trade-related transport infrastructure.	Promulgate regulations to make data available for a value-chain-based connectivity and competitiveness analysis, including (i) adding missing indicators in enterprise surveys and census (OD freight flows information, etc.), (ii) adding missing indicators in customs data (trade volume, OD information, etc.), (iii) adding freight flows data, and (iv) exploring innovative methods using big data for real-time analysis.	GSO, Customs, MOIT, MARD, MOT (TDSI)	2020-2021	PM's decision making a dataset available for a value-chain-based connectivity and competitiveness analysis
3.2. Share publicly the information on value-chain links, spatial structure, and connectivity, especially for the private sector to proactively participate in GVCs.	Develop and maintain a Vietnamese cluster-mapping website like the U.S. model, and collect and analyze information under the value-chain-based connectivity and competitiveness analysis.	GSO, Customs, MOIT, MARD, MOT	2020-2021	- A cluster-mapping website

Objective	Policy action	Lead agency	Time	Outputs
3.3. Establish a digital traceability system for key value chains to enable relevant stakeholders to collect and analyze value-chain data and improve the performance of the supply chains.	- Develop a pilot project for a digital traceability system. - Regulate enterprises' responsibility in goods' origin traceability.	MOF (GDVC), MOC, MOST, MOIT, MARD, business associations of key value chains	2021-2023	- A demonstrated digital traceability system - Regulations on enterprises' responsibility in goods' origin traceability
4. Policy Recommendation Four: Consider regional specialization and inter-regional cooperation in transport infrastructure investment policy.				
4.1. Develop and implement a National Action Plan for Inter-regional Links and Coordination taking into account spatial structure and development of key value chains.	Develop an in-depth assessment on static and dynamic provincial specialization and an analysis on inter-regional links and connectivity that integrates spatial structure and development of key value chains as foundation for the National Action Plan for Inter-regional Links and Coordination.	MPI, NTFC taskforce, DPIs	2020-2021	- National Action Plan for Inter-regional Links and Coordination - Inputs for regional and provincial master plans - Inputs for ten-year SEDS
4.2. Direct public investment based on the National Action Plan for Inter-regional Links and Coordination.	Prioritize and integrate development of some high-value agriculture processing chains and manufacturing chains into the National Action Plan for Inter-regional Links and Coordination to avoid inefficient and fragmented public investment by each province.	MPI, MOIT, MARD, MOF, NTFC taskforce, PCs	2020-2021	Inputs for regional and provincial master plans
5. Policy Recommendation Five: Industrial and economic zones should support the development of domestic supply chains for better GVC integration.				
5.1. Restructure industrial and economic zones so they best support value-chain-based connectivity and competitiveness.	- Formulate an industrial and economic zones development plan accounting for comparative advantages of each province and region, and integrating them into national, regional, and provincial master plans to best support value-chain-based connectivity and competitiveness. - Revise industrial and economic zones regulations to drive better GVC integration.	MPI, DPIs	2020-2021	- Industrial and economic zones development plan - Inputs for national, regional, and provincial master plans

Objective	Policy action	Lead agency	Time	Outputs
5.2. Prioritize leveraging industrial and economic zones for FDI attraction to accelerate industrial and trade growth.	- Develop an FDI promotion plan to identify appropriate types of FDI to be attracted with sectoral priority. - Design an industrial and trade strategy and development plan considering regional comparative advantages, value chain development, and Vietnam's improvement in GVCs and integrate it into national, regional, and provincial master plans.	MPI, DPIs, MOIT, MARD	2020-2021	- FDI promotion plan - Industrial and trade strategy - Inputs for national, regional, and provincial master plans
5.3. Select existing industrial and economic zones as "greenhouses" for potential industrial clusters based on provincial industrial agglomeration (denoted by LQ index).	Identify industrial and economic zones that are not fully occupied and promote them as "greenhouses" for industrial clusters based on the host province's advantages and industrial agglomeration, and reflect this direction in national, regional, and provincial master plans.	MPI, DPIs, MOIT, DOITs	2020-2021	- List of industrial and economic zones and their potential industrial clusters - Inputs for national, regional, and provincial master plans that consider emerging industrial clusters.

CHAPTER 1

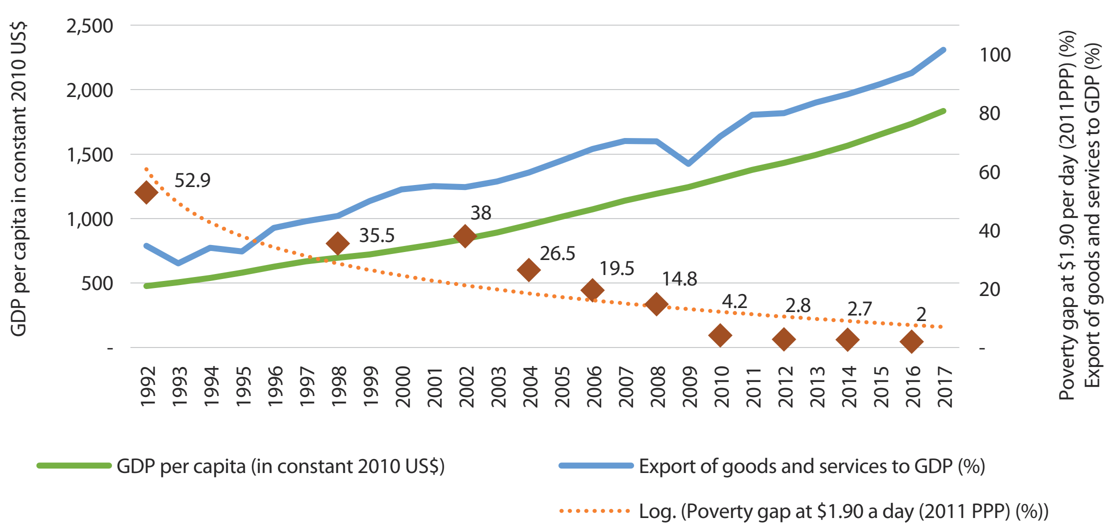
Toward trade-oriented connectivity policy

This chapter recommends making connectivity policies and transport investments more robustly trade-oriented and integrating comprehensive value-chain analyses.

Transport and connectivity policies, master plans, and investment priorities should be formulated and implemented to support trade more strongly. At present, the objectives of improving trade growth and competitiveness are not clearly linked with the objectives of developing connectivity policies and transport infrastructure investment.

Global empirical evidence shows trade promotes growth. And by promoting growth, trade openness can be an important driver of poverty reduction. The export-led growth strategy adopted by a number of countries in the East Asia region provides powerful examples, including Vietnam's. Trade has played a particularly remarkable role in economic growth and poverty reduction over the past three decades. Figure 1.1 illustrates the link between trade (denoted by export-to-GDP ratio), the growth trend (reflected by GDP per capita), and poverty reduction (represented by poverty gap at US$ 1.90 a day) for an extended period, from 1992 to 2017 in Vietnam.

FIGURE 1.1. **Export-led growth and poverty reduction (1992-2017)**



Source: World Development Indicators (WDI).

In the last nearly three decades Vietnam has become one of the most open trade countries in the world. The export-to-GDP ratio has steadily increased from 34.7 percent in 1992 to more than 100 percent in 2017, excluding the 2009-2011 drop during the global financial crisis. Imports have increased alongside exports, and trade openness, measured by the ratio of trade to GDP, reached nearly 200 percent in 2017. Vietnam's spectacular achievement has resulted largely from trade liberalization underpinned by their removal of trade and nontariff barriers committed in a number of regional trade agreements, like the Association of Southeast Asian Nations (ASEAN) Free Trade Area (AFTA) in 1996, the Bilateral Trade Agreement between the United States and Vietnam (US-BTA) in 2000, the World Trade Organization (WTO) in 2006, and the Comprehensive Progressive Trans-Pacific Partnership (CP-TPP) in 2017.

As a result of this remarkable trade performance, Vietnam's GDP per capita measured by constant price in 2010 US$ has increased from less than US$ 500 in 1992 to more than US$ 1,800 in 2017, nearly four-fold during this period.

Similarly, Vietnam is a leading example of how trade can contribute to significant poverty reduction. The poverty rate of Vietnam has decreased remarkably during the same period. At the threshold poverty line of US$ 1.90 a day, the poverty headcount as percentage of Vietnam's total population has decreased from nearly 52.9 percent in 1992 to 2.0 percent in 2017.

Vietnam's trade grew alongside its deepening global integration and participation in GVCs, as discussed in Hollweg, Smith and Taglioni (2017). Since 1995, Vietnam has shown higher integration as a buyer and a seller in a number of GVCs. An improved business environment for attracting qualified foreign direct investments (FDI) has enabled Vietnam to upgrade in GVCs. Vietnam grew its domestic value addition embodied in its increase in gross exports by 16.6 percent annually between 1995 and 2011 – just below what had been achieved by China. This combined integration and upgrading has created better jobs, supported economic growth, and reduced poverty.

Despite remarkable achievement during the past two-and-half decades, challenges remain. First, many of Vietnam's higher-value manufacturing exports have high value content but low domestic value addition. Second, Vietnam is facing a situation in which export performance is largely driven by the FDI sector, which contributes up to 70 percent of total exports, while domestic firms contribute only 30 percent of total exports. The dual-track economy has resulted from weak value-chain links and the limitation of domestic firms' participation in key GVCs. In addition, there is low productivity growth and weak competitiveness in the domestic private sector, especially small and medium enterprises (SMEs). Third, Vietnam's exports are strong on quantity but weak on quality. Although a leader in export quantities of several agricultural commodities, they are often low quality, hence sell at low unit prices. Last but not least, Vietnam's trade costs are higher than the ASEAN average in logistics and compliance costs, with complicated on-border and behind-the-border regulations according to annual Doing Business report of the World Bank (2019).

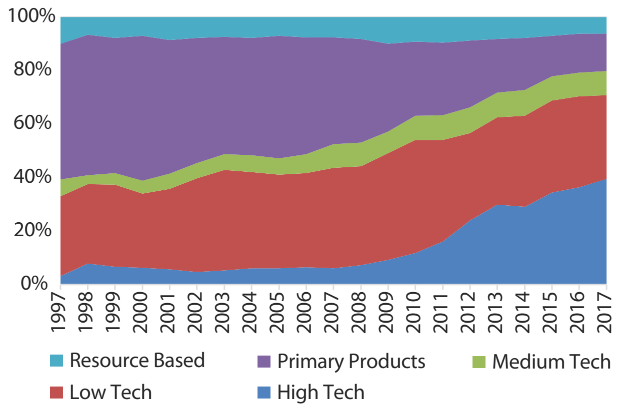
These four challenges have contributed to Vietnam's weak trade competitiveness. Trade competitiveness – one key element of a productive economy – can be enhanced in three key ways, among others: (i) lowering trade costs associated with policy barriers to trade, (ii) improving the efficiency and reliability of transport infrastructure, and (iii) enhancing the integration of domestic production into GVCs as indicated in the four-pillar policy framework on trade competitiveness in Pham, Mishra, Chong et al. (2013). This report looks at the last two pillars, recommending policies to support trade competitiveness by improving the efficiency of transport infrastructure to enhance the country's ability to integrate into GVCs[2].

Scrutinizing the export growth from trade-related connectivity perspectives, Vietnam's export structure has changed dramatically in terms of technology embodied in export and product-based export.

2 This report does not cover trade-costs issues, which are addressed in other World Bank papers, including Pham and Oh (2018), and Pham, Artuso et al. (2018).

Figure 1.2 shows significant structural change in technology embodied in export between 1997 and 2017 based on the five international classifications of technology level of exports: low tech, medium tech, high tech, primary products, and resource based[3]. The share of low-tech exports, medium-tech exports, and resource-based products has not changed significantly during this period. However, the proportion of primary products including crude oil and non-oil (coal, stone, sand, gravel, aluminum, copper etc.) declined markedly, mainly due to a decline in crude oil export, and export-control policy limiting minerals and raw material exports. Furthermore, there has been a dramatic shift from primary and resource-based products (agriculture-based products) to high-tech exports (electronics, cell phones, incorporated circuits, etc.). This trend is closely associated with significant investment projects of some leading multinational firms including Samsung Group and Intel Corporation, who selected Vietnam as a production base for mobile phone and tablet products for export worldwide.

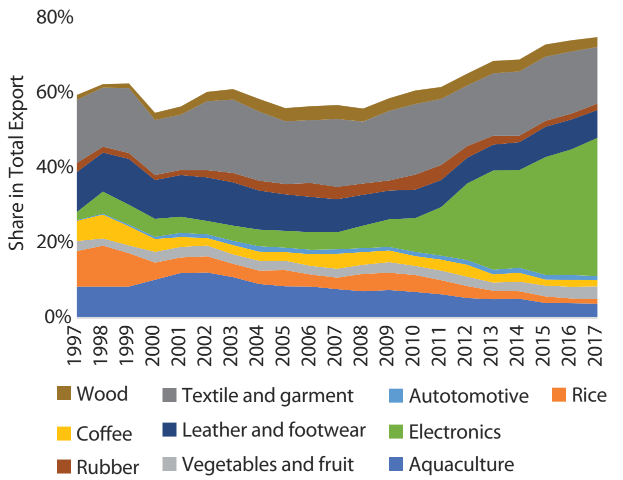
FIGURE 1.2. **Structural change in technology embodied in export (1997-2017)**



Source: UNComtrade.

Figure 1.3 shows the share of key exports (the ten selected value chains discussed in chapter two) has changed over time.

FIGURE 1.3. **Structural change in total export by value chain (1997-2017)**



Source: UNComtrade.

Despite increasing in absolute values, the share of agricultural exports (aquaculture, rice, vegetables and fruit, and coffee) decreased, from over 20 percent in 1997 to about 10 percent in 2017. Meanwhile, other traditional exports from labor-intensive value chains like leather and footwear and textile and garment have maintained their share in total exports (around 10 percent from leather and footwear and about 20 percent from textile and garment). The share of these ten value chains in total exports has increased from 60 percent to 75 percent in this period, confirming their increasing importance in the economy in general and exports in particular. The FDI sector plays a crucial role in these value chains' export, accounting for 60 percent of total textile and garment exports, 70 percent of total leather and footwear exports, and 100 percent of electronics exports.

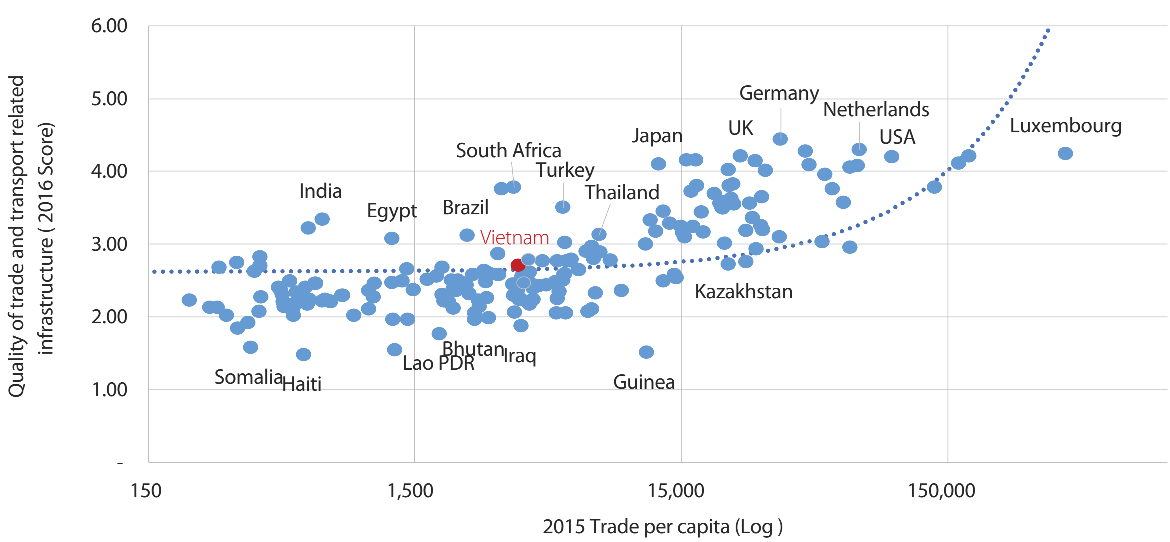
3 UNComtrade.

There are two important implications concerning this structural change. First, Vietnam is at the low end of GVCs, performing primarily assembly functions with limited value addition, and weak links from FDI firms to the domestic private sector. Second, since exports matter for connectivity, a change in product-based export structure should be considered when prioritizing better connectivity and logistics for higher-value product export. A transport system which promotes exports should account for this shift in logistics perspectives, especially for prioritized investment in appropriate trade gateways.

Clearly, Vietnam is in a transition to diversify and move up the chain to higher, value-added functions, and to support backward integration of domestic, input-supplying firms. Policies for export-led growth and enhanced competitiveness in general and for improved connectivity specifically will need to become more value-chain based, moving toward higher-value products. A value-chain-based approach will allow a comprehensive consideration to promote trade competitiveness, including policies to facilitate GVC integration.

Along with asset protection, seamlessly connecting factors across or within borders is one of two fundamental needs of the private sector to participate in GVCs and is a key driver of international competitiveness. Lead firms must be able to move component parts quickly, reliably, and cheaply between different points in the production network and assembly facilities. However, the logistics needs vary depending on the composition of exports (Hollweg, Smith, Taglioni, 2017). For example, in agri-processing, logistics are needed to move higher value-added goods for export and/or domestic processing, and competitiveness depends a lot on the quality of domestic infrastructure. In apparel, logistics are needed to reduce lead times for assembly activities. In information and communication technology (ICT), which relies on lightweight or digital inputs, logistics in soft and hard infrastructure are necessary.

FIGURE 1.4. **Quality of trade-related infrastructure versus trade per capita**



Source: LPI, WDI, and calculation by authors.

Efficient connectivity is essential for trade development as shown in Figure 1.4, which illustrates the interrelationship globally between efficient connectivity, measured by the quality of trade and transport-related infrastructure,[4] and trade development, measured by trade per capita. Vietnam's score on quality of trade-related infrastructure as measured by the logistics performance index (LPI) in 2016 was 2.7, roughly equal to the average global level (2.75) but below the East Asia and Pacific (EAP) level (3.02) when including the high-income countries. It was, however, higher than the average EAP level (2.58) when excluding the high-income countries. From this global landscape, Vietnam's quality of trade and transport-related infrastructure apparently has not been able to keep pace with the EAP's trade growth and development. Vietnam typically performs well on connectivity metrics, but EAP is an increasingly competitive environment, and Vietnam will need to upgrade its performance quickly and comprehensively (Hollweg, Smith, Taglioni, 2017). Vietnam's trade competitiveness potential is constrained by the lack of policy aimed toward promoting trade-oriented connectivity.

This study looks at the spatial dimension of Vietnam's domestic participation in value chains, to identify key value-chain sectors, as well as policy recommendations that can support domestic links to emerge within these sectors with a spatial consideration[5].

4 Quality of trade-related infrastructure is one key indicator surveyed by the World Bank under the Logistics Performance Index (LPI) for 160 countries.

5 Given the breadth of issues covered and the limited resources, this report focuses on domestic connectivity only. Another study on external trade linkages and connectivity, including within ASEAN or CLMV, is planned.

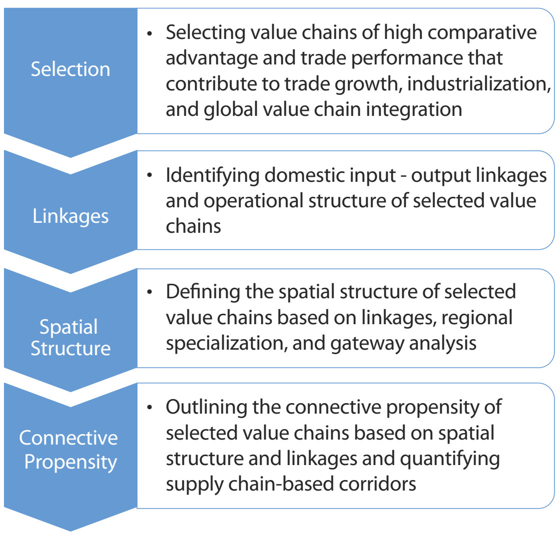
CHAPTER 2

A new approach for value-chain-based connectivity

This chapter proposes a new approach for value-chain-based connectivity and competitiveness that collects and analyzes data on geographic arrangements of production and export activities along key value chains of comparative advantage for Vietnam.

Currently, trade information, especially on value chains, is rarely used in formulating connectivity policy and transport investment in Vietnam. There remains a lack of in-depth analyses on spatial structure and connective propensity along various linked segments of value chains to inform respective policy and investment. The principal objective is to identify policy actions to improve connective efficiency for investment into pro-trade transport infrastructure in order to enhance trade competitiveness and GVC integration.

FIGURE 2.1. **Methodological overview**



Source: Built on Pham, Mishra, Cheong et al., 2013.

The proposed value-chain-based connectivity assessment is built on Pham, Mishra, Cheong et al.'s methodological approach in their review of Vietnam's trade competitiveness (2013). Following this approach, there are four integral steps, summarized in Figure 2.1. Hierarchical structure of a value chain is defined by input-output links, and spatial industrial concentration of all segments is measured by location quotients (LQs) within the value chain. This report adopts the concept of local cluster (Porter, Michael E., 2000 and http://www.clustermapping.us), but focuses on the domestic production part of value chains including companies, and suppliers among other cluster's stakeholders.[6] Value-chain connective propensity follows the sequential links of all value chains segments to international trade gateways based on product mix and the structure of export-oriented domestic production. Value-chain connective propensity is important information that could guide transport infrastructure policies and related investment for the most effective support to enhance trade competitiveness and GVC integration.

2.1. Selecting key value chains

The *first step* in this methodological approach is to analytically identify and select key value chains where Vietnam is already competitive. The three criteria for selecting key value chains are: (i) high trade performance and high importance in the economy, (ii) high comparative advantage, and (iii) governmental priority.

The idea is, if Vietnam's performance in these value chains is improved, there is potential to enhance national competitiveness and promote Vietnam's continued participation in GVCs.

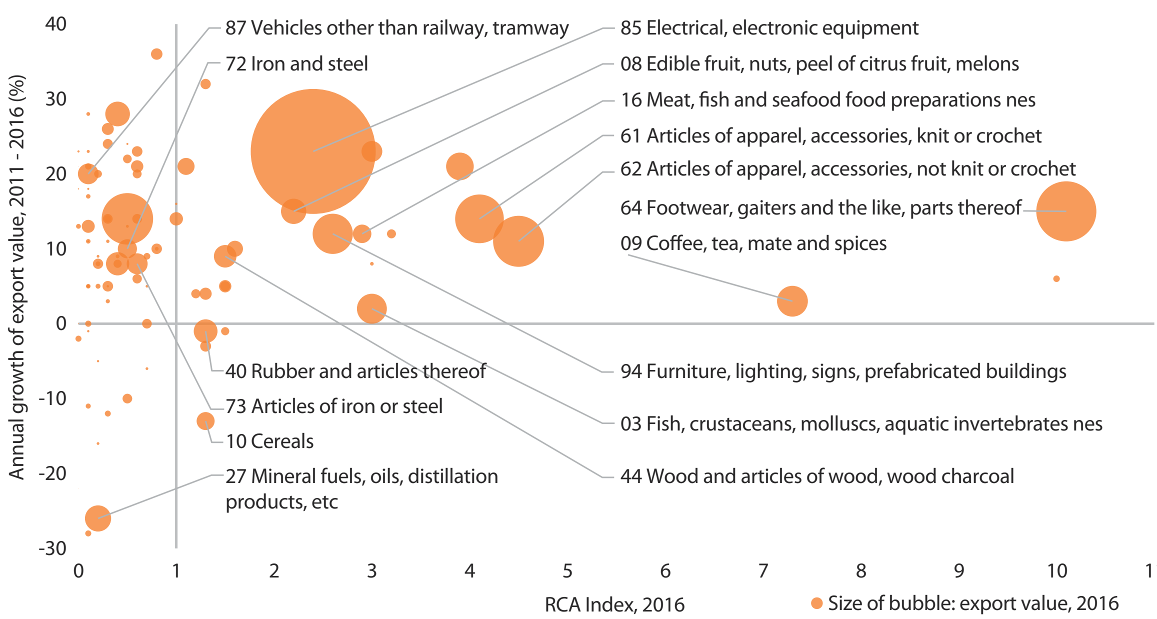
Value-chain trade performance is measured by (i) the sector's share in total exports and imports nationally and globally, (ii) the average annual growth rate of the sector's exports and imports

6 See the distinction between value chain, supply chain, and industrial cluster in Box 2.1 below.

nationally, and (iii) and the sector's net trade balance nationally. In addition, domestic value addition, estimated by OECD-WTO in "Trade in value-added database" (https://stats.oecd.org/index.aspx?queryid=75537), is also considered when reviewing the value-chain trade performance.

Value-chain comparative advantage is measured by the revealed comparative advantage index (RCA)[7] and Lafay index. The RCA index indicates relative advantage of a certain product as evidenced by a country's trade flows in that product relative to global trade flows in that product. It is calculated as the ratio of the product's national export share to the product's global export share. For an RCA > 1 (the country has a comparative advantage in exporting the product and for an RCA < 1, a disadvantage. The Lafay index reveals comparative advantage of an industry. If the index has a value of more than zero, the country being reviewed has a comparative advantage on global competitors in exporting the industry's products. (An index value of less than zero shows a country does not have a comparative advantage). Since it takes account of exports and imports, it is suitable for some export-oriented industries that have high imports. Figure 2.2 shows Vietnam's key products by trade performance and RCA.

FIGURE 2.2. **Value Chain Selection Based on Revealed Comparative Advantage (RCA) and Trade Performance**



Source: Trade Map, 2016.

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7 The revealed comparative advantage of commodity i of country j in a given period t is calculated as:

$$RCA = \frac{\frac{x_{ij}}{x_{tj}}}{\frac{X_{iw}}{X_{tw}}}$$

where x_{ij} is the export value of commodity *i* of country *j*, x_{tj}: total export value of country *j*, X_{iw}: export value of commodity *i* of the world, and *Xtw*: total export value of the world.

The *Government priorities* can be found in Prime Minister's Decision No.879/QD-TTg dated June 9, 2014 approving Vietnam's industrial development strategy through 2025, with a vision toward 2035 (Table 1.1), and Prime Minister's Decision No.32/QD-TTg dated January 13, 2015, approving an integrated program to develop and upgrade value chains and clusters that are considered to be of competitive advantage.

TABLE 2.1. **Industrial priorities through 2025 with a vision toward 2035**

Industrial priority	Through 2025	Toward 2035
Agri-processing	- Fisheries and aquatic processing - Wood processing	
Light manufacturing (garments and footwear)	- Auxiliary materials	- Fashion - Luxury products
Electronics and telecommunications	- Computers - Telephones and components	
Mechanicals	- Agricultural machinery	- Shipbuilding - Nonferrous metal
Chemicals	- Basic chemicals - Plastic and rubber products - Petrochemicals	- New materials - Pharma-chemicals
Energy	- New and renewable (wind, solar, biomass)	- Renewable (geothermal, wave, nuclear)

Fourteen value chains met these three criteria: textile and garment, leather and footwear, electronics, automotive vehicles, wood products, rice, aquaculture, coffee, rubber, fruit and vegetable and, cement, iron and steel, and oil and gas. We selected ten of those (aquaculture, textile and garment, leather and footwear, electronics, wood products, motor vehicles, rubber, rice, coffee, fruit and vegetable) for analysis because they are agricultural and manufacturing value chains with high RCA and increasing share in total exports (more than 70 percent of total exports in 2017).

This final selection has nothing to do with traditional industrial policy perspectives. Instead, it is to ensure, while covering these "backbone" value chains of the economy, the analytical result could build on sufficient evidence to support policy recommendations to promote the connectivity associated with these competitive sectors. As an example, the aquaculture value chain is analyzed later in the chapter, using the four-step approach (summarized in Figure 2.1). Detailed analyses for other selected value chains can be found in Annexes 1-9.

2.2. Identifying value-chain links

The *second step* is to determine the production structure to identify the domestic links of the ten selected value chains by analyzing domestic input-output (I/O) data. This study limits its focus to the domestic "production" links of the value chains rather than the entire value chain, which would also include service-related and external links. The domestic links are identified following four stages: (i) determine first-tier supplying sectors (a sector's backward links) using data from Vietnam's I/O tables from Enterprise Censuses 2011 and 2016; (ii) repeat the exercise in the first step multiple times to compute second-, third- or lower-tier supplying sectors; (iii) diagram the value-chain links; and (iv) refine links and diagrams based on expert views and sectoral data.

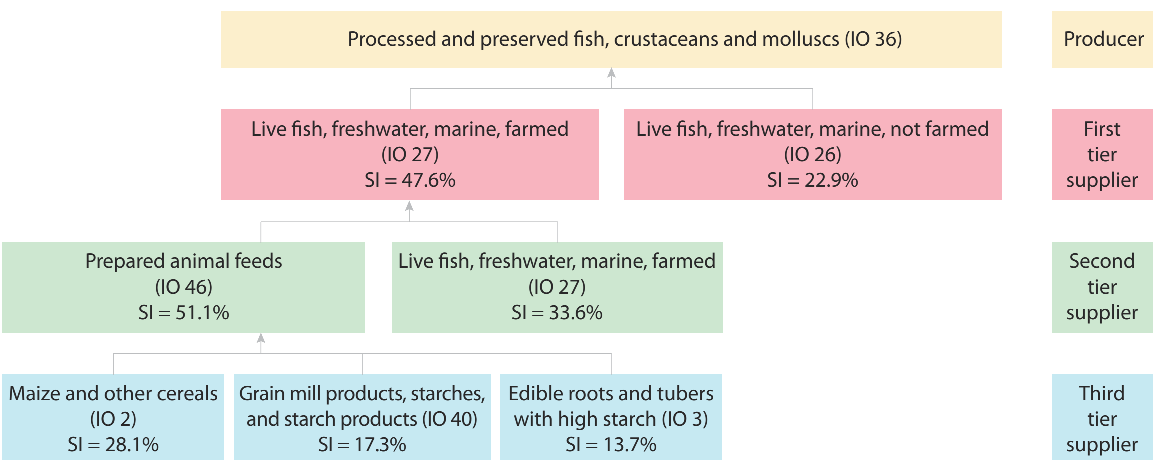
Stage one, determining first-tier supplying sectors, is based on a sector's sourcing intensity, computed as the share of inputs from a supplying sector as percent of total intermediate inputs. We consider both imported and domestically purchased inputs, since both are combined in the I/O data for 2011 and 2016. Lastly, we only consider nonservices and noncapital inputs. In most cases, we apply a sourcing intensity threshold of 2%. That is, we only consider non-services and noncapital inputs that represent at least 2% of total inputs. Sourcing intensity (SI) is defined as follows:

$$SI_{s,i} = \left(\frac{\textit{purchase of input s by sector i}}{\textit{total intermediate inputs used by sector i}} \right) * 100\%$$

where *i* is a key value-chain sector, and *s* is a sector supplying inputs to the key value-chain sector.

The second stage repeats the first stage for various layers of backward links. That is, it considers the sectors that supply inputs to sector s. Since SIs of lower-tier sectors can vary across value chains, we selected the most important supplying sectors ad-hoc, focusing on the most critical in the value chain. In other words, once the most important first-tier supplying sectors are identified, this process is repeated for the most critical inputs, all the way back to the third-tier supplier. The third stage is to develop a diagram of value-chain links for each of the value-chain sectors as well as the first-, second-, and third-tier supplying sectors. Figure 2.3 shows the diagram from the aquaculture value chain for 2016.

FIGURE 2.3. **Aquaculture value-chain links, inputs-outputs table 2016**



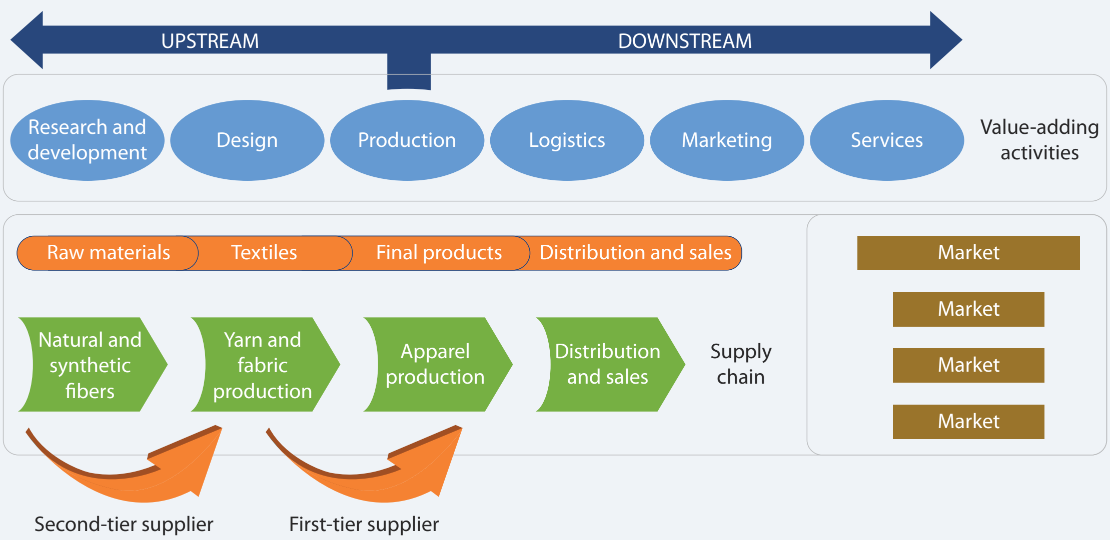
Source: Authors.

Box 2.1. Distinction between value chain, supply chain, and industrial cluster

It is important to distinguish between the terms "value chain" and "supply chain", which are often used interchangeably, as well as "industrial cluster". A supply chain refers only to input-output links of productive activities in a product chain. A value chain embraces the full range of value-adding activities in a supply chain, and supplementary services including research and development, design, input sourcing, processing, marketing, distribution, and customer support.

Figure 1 (Box 2.1) shows an example distinguishing an apparel value chain (in blue) from its supply chain (in green). The difference between the value chain and supply chain is that a supply chain focuses on a physical transformation and transportation of raw materials (or inputs) to final products, whilst a value chain focuses on activities that add economic value to products but are not necessarily manufacturing or logistics related.

FIGURE 1 (BOX 2.1). **Apparel value chain versus supply chain**



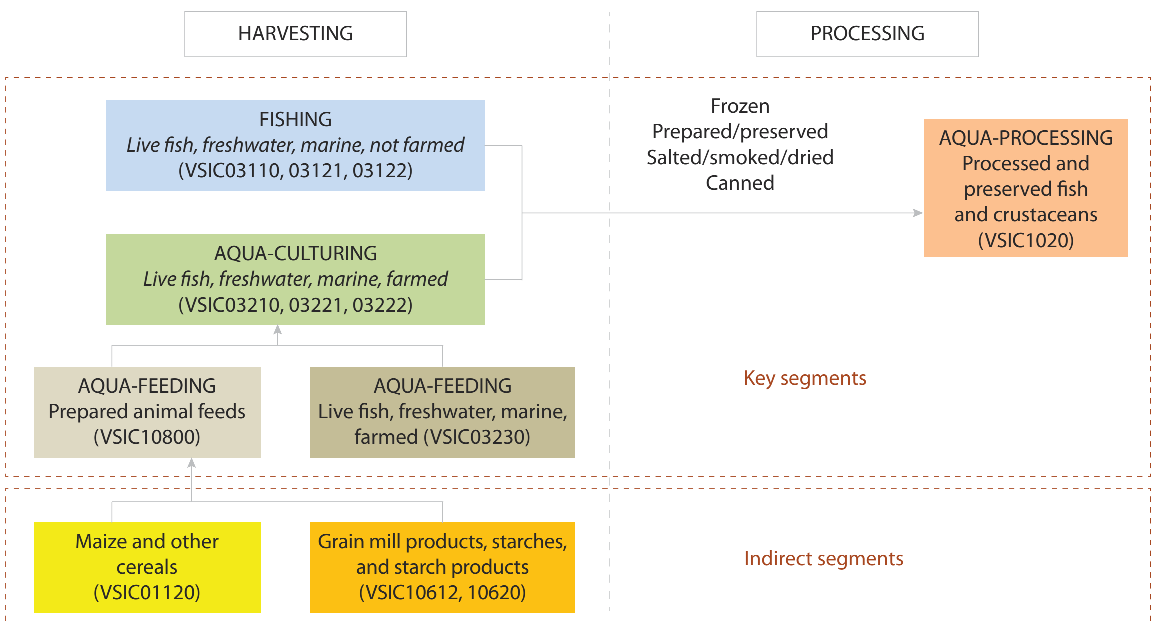
Source: Modified from Staritz and Fredrick (2014) and Fredrick (2010).

Industrial clusters, by contrast, refer to the geographic and sectoral components of economic activity. They are defined as "regional concentrations of economic activities in related industries connected through local linkages and spill-overs" (Ketels, 2017). Clusters are not the same as sectors because they recognize the geographic location of production and also consider groups of sectors that are related through links and spillovers. Clusters can further be differentiated from agglomerations which tend to focus on geographic locations of economic activity in the context of related sectors. This report uses the concept of industrial cluster to refer to the spatial structure of related industrial supply chains of domestic production.

The information from the I/O analysis is refined in the fourth stage in combination with external information from existing value-chain maps or clusters. This allows us to create value-chain specific concordance tables that link the sectors of the I/O tables to the Vietnam Standard Industrial Classification (VSIC) codes. These concordance tables are value chain specific because an I/O sector can be linked to multiple VSIC codes hence the I/O tables are more aggregated than the VSIC codes (138 sectors vs. 734 sectors). Since VSIC is based on the International Standard Industrial Classification (ISIC), the selection of VSIC sectors has been supported by the accompanying United Nations document (2008) and insights from industry experts. VSIC is crucial to ensure an accurate reference for value-chain structure and a reliable source of analytical data. This study uses the five-digit VSIC 2018, developed by the General Statistics Office (GSO) based on the four-digit International Standard Industrial Classification (ISIC Rev.4, 2006). (See Annex 1.3 Terminology).

Figure 2.4 shows the refined aquaculture value-chain links with the VSIC codes of related commodities in the value chain.

FIGURE 2.4. **Refined links: aquaculture value chain**



Source: Authors.

Box 2.2. Industrial classification and harmonized commodity coding system

The Harmonized Commodity Description and Coding System, also known as the Harmonized System (HS) of tariff nomenclature is an internationally standardized system of names and numbers to classify traded products. It came into effect in 1988 and has since been developed and maintained by the World Customs Organization (WCO), an independent intergovernmental organization based in Brussels, Belgium, with over 200 member-countries. The HS is regularly updated by the World Customs Organization (WCO) to accommodate new products and remove outdated/obsolete products. The fourth edition, HS 2007 (which is a substantial revision from previous versions), came into effect on January 1, 2007, and on January 1, 2012 the fifth edition, HS 2012, came into effect. In HS code, the first two digits designate the HS chapter (HS2), the second two digits designate the HS heading (HS4), and the third two digits designate the HS subheading (HS6).

The ten selected value chains in this report will be identified by the two- or four-digit Vietnam Standard Industrial Classification (VISC), and converted to a Harmonized System (HS2, HS4, and HS6) level when analyzing the related value chains' trade data. Vietnam Standard Industrial Classification 2018 (VISC 2018) was developed by the General Statistics Office (GSO) based on the International Standard Industrial Classification of All Economic Activities (ISIC) adopted by the United Nations Statistics Committee in March 2006 (ISIC Rev.4, at four digits) and the ASEAN Common Industrial Classification (ACIC, at three digits). The ISIC and other relevant classification systems provide a set of activity categories for collecting and reporting statistics. They provide a comprehensive framework for collecting, reporting, and analyzing economic data for decision-making and policy making. The classification structure represents a standard format to organize detailed information about the state of an economy according to economic principles and perceptions. These economic activities are subdivided in a hierarchical, four-level structure of mutually exclusive categories, facilitating data collection, presentation and analysis at detailed levels of the economy in an internationally comparable, standardized way. To adapt ISIC in Vietnam, the GSO has developed the VSIC 2018 up to five digits, which has been promulgated by Prime Minister's Decision No 27/2018/QD-TTg dated July 6, 2018. VSIC includes five levels: level one includes 21 sections hierarchically designated by alphabetical order from A to U, level two includes 88 divisions, each assigned a two-digit code according to the corresponding section, level three includes 242 groups, each assigned a three-digit code according to the corresponding division, level four includes 486 classes, each assigned a four-digit code according to the corresponding group, and level five includes 734 subclasses, each assigned a five-digit code according to the corresponding class.

VSIC/ISIC classifies economic activities and is used mainly for statistical purposes like analyzing national accounts, demography of enterprises, employment, and others. The HS classifies products according to its composition, form, or function, and is used mainly for trade-related work like analyzing import/export and tariff statistics, or trade negotiations. Both VSIC/ISIC and HS are useful for research: the former is more commonly used for research focusing on local economic activities/products (like industrial agglomeration, clusters, local value chains), while the latter is more commonly used for research focusing on trade-related products/activities (such as global value chain of export-oriented products, competitiveness).

Source: Authors, based on government regulations on VSIC.

2.3. Defining the spatial structure of value chains

The *third step* is to determine the spatial structure of value chains using the analytical results on I/O links of the domestic value chains from the previous step. In other words, the main purpose of this step is to determine geographic distribution and industrial concentration of selected chains, including their backward segments of the value chain. There was a way defining industry spaces as representation of technological relatedness (Hausman, Tran, Butos, 2017). However, this approach does not take into account backward and forward linkages across supply chains. From another perspective, cluster mapping was an initial step for developing a cluster initiative (Shakya, Mallika, the World Bank, 2009). While this approach introduced various tools for cluster mapping, including value chain analysis, it does not specify steps taken.

This methodology defines spatial structure of value chains in two stages: (i) identifying regional specialization and value-chain locations by calculating location quotients (LQs) of all selected value chains and their segments, and (ii) mapping the spatial structure of value chains and their segments.

LQs were calculated for each segment of the selected value chains and reflect the economic concentration of activities. They are a statistical indicator measuring the deviation of a series of specific economic activities in a region from the overall economy. Data from Vietnam's Enterprise Censuses for 2011 and 2016 were used to calculate the key value chains' LQs at the district and provincial level, based on three parameters: labor, employment and turnover, and revenue. Employment LQs are calculated as a value-chain segment's regional employment share divided by the its national employment share.

$$LQ_{Employment} = \frac{e_i/e}{E_i/E}$$

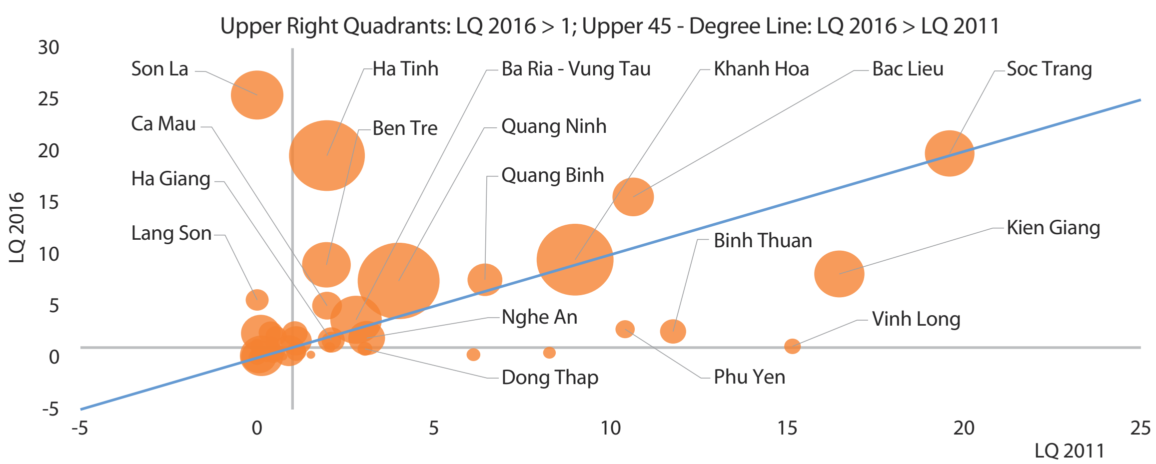
Where $LQ_{Employment}$ is LQ measured by employment, e_i is the number of employees in the value-chain segment *i* at a locality, *e* is the total number of employees in a locality, E_i is the number of employees in the value-chain segment *i* of country, and *E* is the number of employees in a country.

An LQ >1 indicates the value-chain segment has a greater regional employment share than the total value-chain segment has in national employment. An LQ 2016 > 1 reflects the current extent of relative provincial specialization. When LQ 2016 > LQ 2011, it shows positive change in relative provincial specialization expanded between 2011 and 2016 (and vice versa).

Defining spatial structure, or value-chain mapping, can be generated from understanding geographic distribution of various segments in the value chain. The locational distribution of value-chain segments, in turn, is defined by scrutinizing regional specialization for respective segments. For example, the aqua-culturing segment is sub-segmented into the fishing segment and aqua-processing segment. Two other subsectors of the aqua-culturing segment (aqua-breeding and aqua-feeding) are also scrutinized.

Figure 2.5 illustrates *locational distribution of aqua-culturing segments*. Aqua-culturing activities are spread-out all over the country. However, from statistics on international trade gateways, aqua-culturing activities in the North and Central Vietnam are mainly for domestic consumption, whereas in the South they are mainly for export.

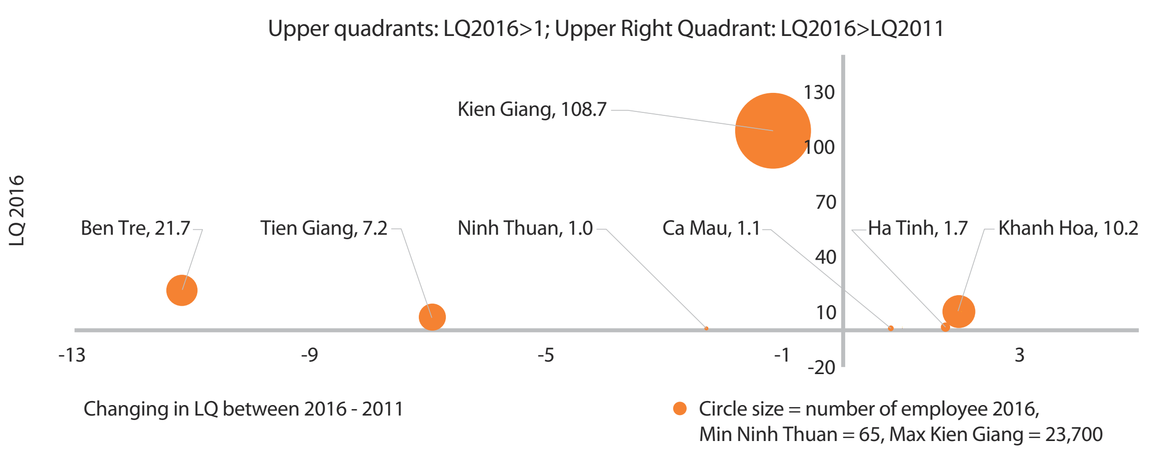
FIGURE 2.5. **Locational distribution of the aqua-culturing segment**



Source: Enterprise Census 2011 and 2016, and calculation by authors.

Figure 2.6 illustrates *provincial specialization in fishing activities*. Fishing is concentrated in a few provinces in the South, including Khanh Hoa, Kien Giang, and Ben Tre. Although Khanh Hoa Province remains specialized in fishing (LQ2016 > LQ2011), other provinces such as Kien Giang, Ben Tre, and Tien Giang have reduced their specialization in fishing.

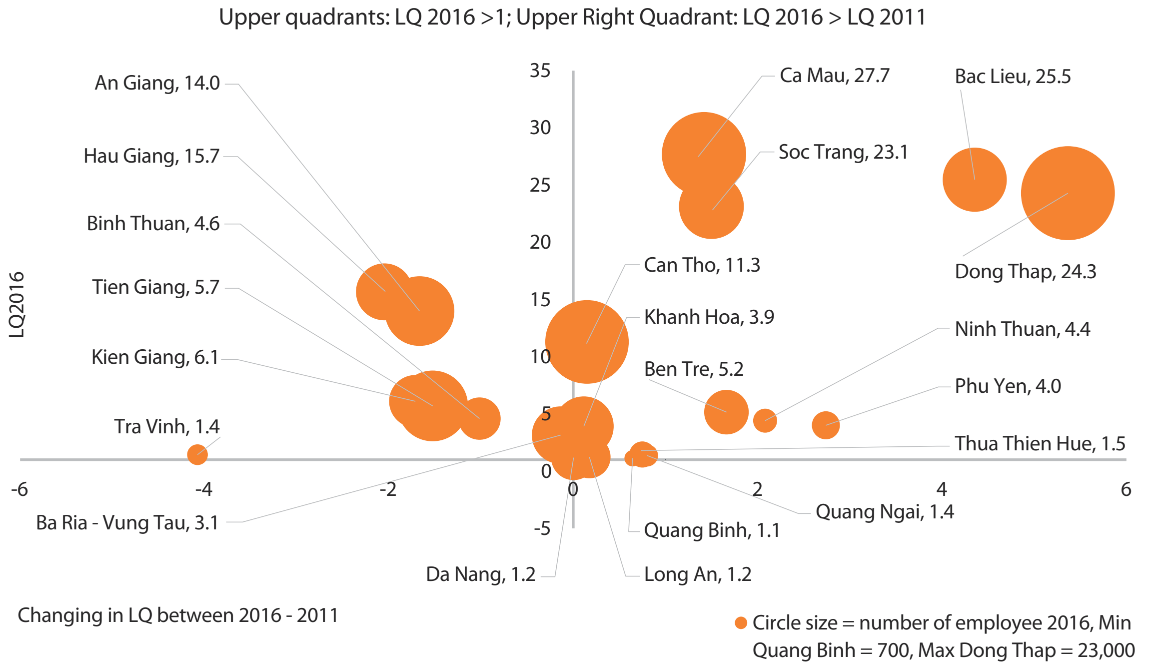
FIGURE 2.6. **Locational distribution of the fishing segment**



Source: Enterprise Census 2011 and 2016, and calculation by authors.

The *Aqua-processing segment* is located mostly in the Mekong Delta Region as shown in Figure 2.7. Key localities have enhanced their specialization in aqua-processing including Ca Mau, Soc Trang, Bac Lieu, and Dong Thap provinces. Provinces that have reduced their aqua-processing specialization are Hau Giang, An Giang, Can Tho, Tien Giang, and Kien Giang.

FIGURE 2.7. **Locational distribution of the aqua-processing segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Table 2.2 shows calculated LQs identifying geographic locations of the aquaculture value chain and its various segments.

TABLE 2.2. **Spatial Structure of the Aquaculture Value Chain**

Province	LQ 2016 >1	Diff btw LQ 2016 and LQ 2011	Province	LQ 2016 >1	Diff btw LQ 2016 and LQ 2011	Province	LQ 2016 >1	Diff btw LQ 2016 and LQ 2011
Aqua-feeding			Aqua-culturing			Fishing		
Hoa Binh	1.08	0.52	Tuyen Quang	1.30	1.30	Ha Tinh	1.73	1.73
Vinh Phuc	1.58	-0.56	Lai Chau	1.38	1.38	Khanh Hoa	10.19	1.96
Hai Duong	1.89	0.43	Son La	25.46	25.46	Ninh Thuan	1.04	-2.31
Hung Yen	4.28	-1.22	Yen Bai	1.03	-1.02	Tien Giang	7.18	-6.95
Ha Nam	2.93	-0.16	Lang Son	5.61	5.61	Ben Tre	21.74	-11.18
Quang Nam	1.38	0.42	Quang Nam	7.46	3.46	Kien Giang	108.66	-1.19
Binh Dinh	1.55	1.01	Bac Giang	2.38	2.28	Ca Mau	1.08	0.81
Binh Thuan	1.60	-0.49	Nam Dinh	1.66	0.55	Aqua-processing		
Tay Ninh	1.05	0.77	Nghe An	1.92	-1.18	Quang Binh	1.13	0.64
Binh Duong	1.08	0.18	Ha Tinh	19.60	17.62	T.Thien - Hue	1.46	0.75
Dong Nai	5.84	-0.29	Quang Binh	7.57	1.13	Da Nang	1.18	0.00
Long An	4.47	-0.46	Quang Tri	1.49	1.07	Quang Ngai	1.37	0.80
Tien Giang	2.07	-0.38	Phu Yen	2.78	-7.63	Phu Yen	4.01	2.74
Vinh Long	1.57	-0.92	Khanh Hoa	9.52	0.52	Khanh Hoa	3.92	0.11
Dong Thap	9.76	-4.55	Binh Thuan	2.56	-9.20	Ninh Thuan	4.41	2.08
An Giang	1.39	1.02	Dak Lak	2.39	1.33	Binh Thuan	4.59	-1.02
Kien Giang	1.20	-0.11	Lam Dong	1.65	-0.44	B.Ria - Vung Tau	3.15	-0.14
Can Tho	2.05	-1.76	B.Ria-Vung Tau	3.69	0.90	Long An	1.23	0.17
Hau Giang	3.15	1.15	Ben Tre	9.02	7.06	Tien Giang	5.70	-1.52
Aqua-breeding			Tra Vinh	2.14	1.60	Ben Tre	5.16	1.66
Nghe An	1.87	-0.83	Vinh Long	1.12	-14.02	Tra Vinh	1.44	-4.08
Ha Tinh	3.70	3.70	An Giang	2.45	2.06	Dong Thap	24.29	5.37
Binh Dinh	4.09	-1.95	Kien Giang	8.13	-8.34	An Giang	13.99	-1.67
Phu Yen	2.82	2.44	Can Tho	1.74	-0.36	Kien Giang	6.10	-1.71
Khanh Hoa	1.62	-0.55	Soc Trang	19.81	0.22	Can Tho	11.29	0.15
Ninh Thuan	152.10	35.20	Bac Lieu	15.59	4.95	Hau Giang	15.67	-2.05
Binh Thuan	39.68	2.98	Ca Mau	5.06	3.08	Soc Trang	23.13	1.50
Ben Tre	6.94	5.62				Bac Lieu	25.47	4.35
Can Tho	2.11	2.11				Ca Mau	27.69	1.42
Bac Lieu	96.52	-14.52						
Ca Mau	20.30	7.07						

Source: Enterprise Census (2011 and 2016), calculation by authors.

The spatial structure of the aquaculture value chain is illustrated in Map 2.1 based on analyses of the locational distribution of its five respective value-chain segments.

1. Aqua-feeding: a small-scale segment concentrated in the South, in Dong Nai, Long An, and Dong Thap provinces.

2. Aqua-breeding: a small-scale segment concentrated in the South, in Ninh Thuan, Binh Thuan, and Ca Mau provinces.

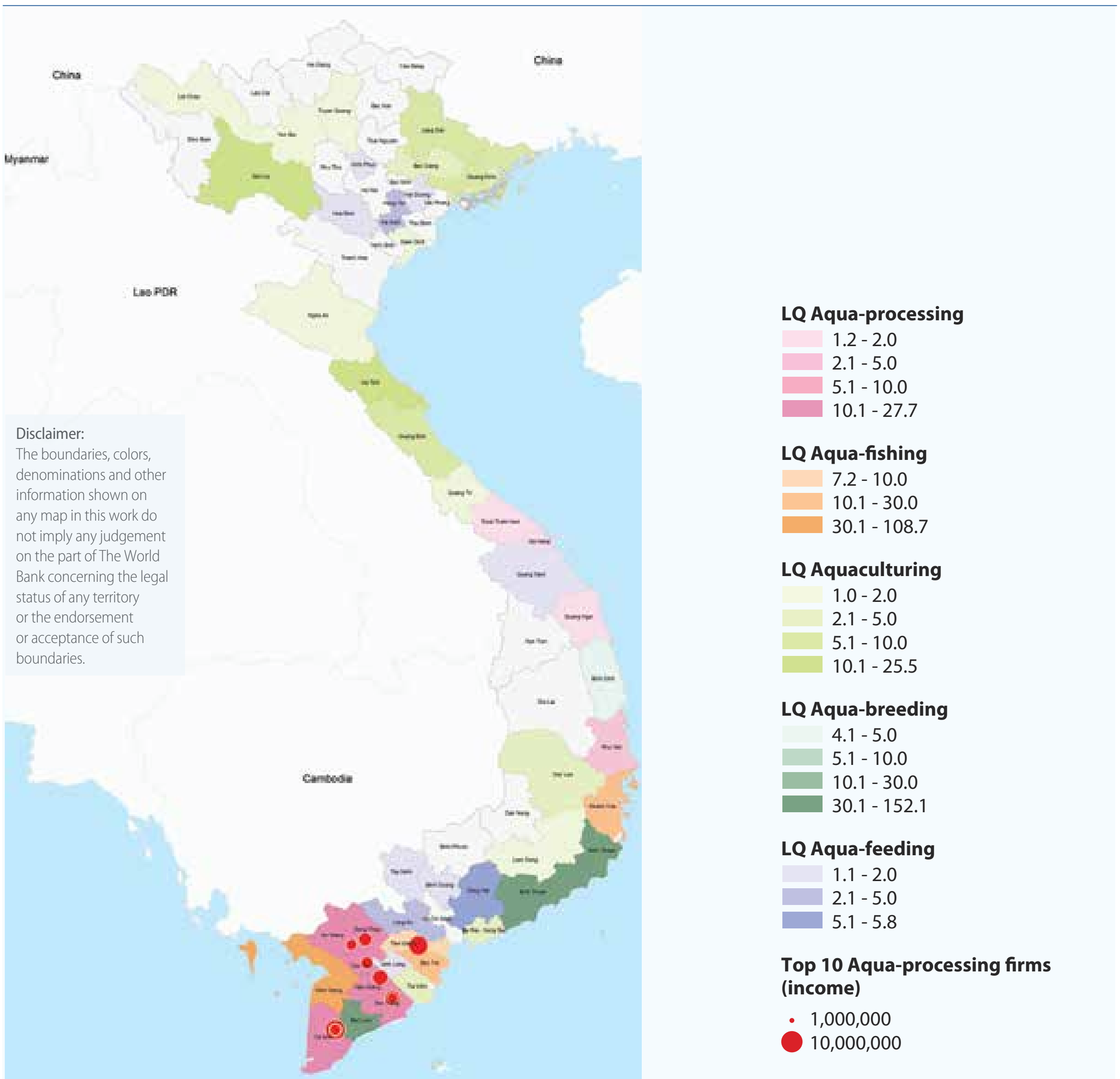
3. Aqua-culturing: spread-out across the country though aqua-culturing activities in the North and Central Vietnam are mainly for domestic consumption, and in the South for export.

4. Fishing: concentrated in few localities in the South (Khanh Hoa, Kien Giang, and Ben Tre provinces).

5. Aqua-processing: concentrated mostly in the Mekong Delta Region. Processed products are mostly exported through Ho Chi Minh City (HCMC) seaports.

Although the aqua-culturing segment is spread across the country, the export-oriented value chain that has a spatial layout along key segments including aquaculture, capture, and export processing, is concentrated mainly in the South, especially in the Mekong Delta.

MAP 2.1. **Spatial structure of the aquaculture value chain**



Source: I/O Table (2011 and 2016) and Enterprise Census (2011 and 2016), calculation by authors.

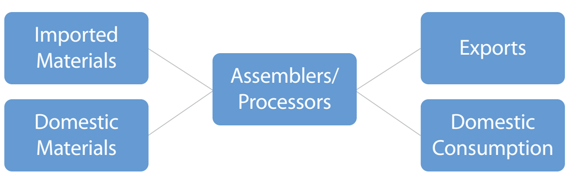
2.4. Value-chain-based connective propensity and key corridors

The objective of the *fourth step* is to use the results of the geographic analysis from the third step to analyze the structure of domestic production chains in the context of regional specialization. In other words, this analysis helps identify the connection of different production-chain segments by connectivity of regional specialization links. The provincial specialization degree was determined not only by the LQs of all selected chains in that province, but also by the change in the LQ measured in two points in time. A specialization map for each production chain for all provinces helps define the connective propensity of production chains based on regional specialization links.

The methodology of the connective propensity analysis is based on the LQ index and the value-chain spatial structure. To define the connective propensity of a value chain we relied on the following four hypotheses:

1. Localities having a productive concentration for value chain segments with LQ > 1 defined as linked nodes to attract and generate connections emerged throughout the domestic part of value chain.
2. Localities having productive concentration with LQ2016 > LQ2011, are becoming more specialized in the segments and/or value chain, and therefore may potentially generate stronger connectivity in the future (and vice versa).
3. The connective propensity of a value chain is the trend of related commodities flowing from and to international gateways and along various productive points of a domestic value chain as shown in the connective model in Figure 2.8. A connective propensity is defined based on spatial locations of productive segments of the domestic value chain and the structure of value-chain links. It begins with materials imported via a gateway, connected by various intermediate points for supplying and processing raw materials, concluding with finished products exported via gateways or consumed domestically.
4. Transport distance is assumed to define priority of movement of goods and transport corridor formation.

FIGURE 2.8. **Connective model for a value chain**



Source: Authors.

Import and export gateways are at the end nodes in this model. For all identified value chains, trade gateways (air, sea, inland waterways, rail, and road) are imports origins and exports destinations, whereas, location of cluster segments (suppliers, processors) are the internal export origin and import destination. The information on trade gateways[8] for all forms of transport is important for value-chain-based connectivity.

8 A comprehensive gateways analysis is done in chapter three.

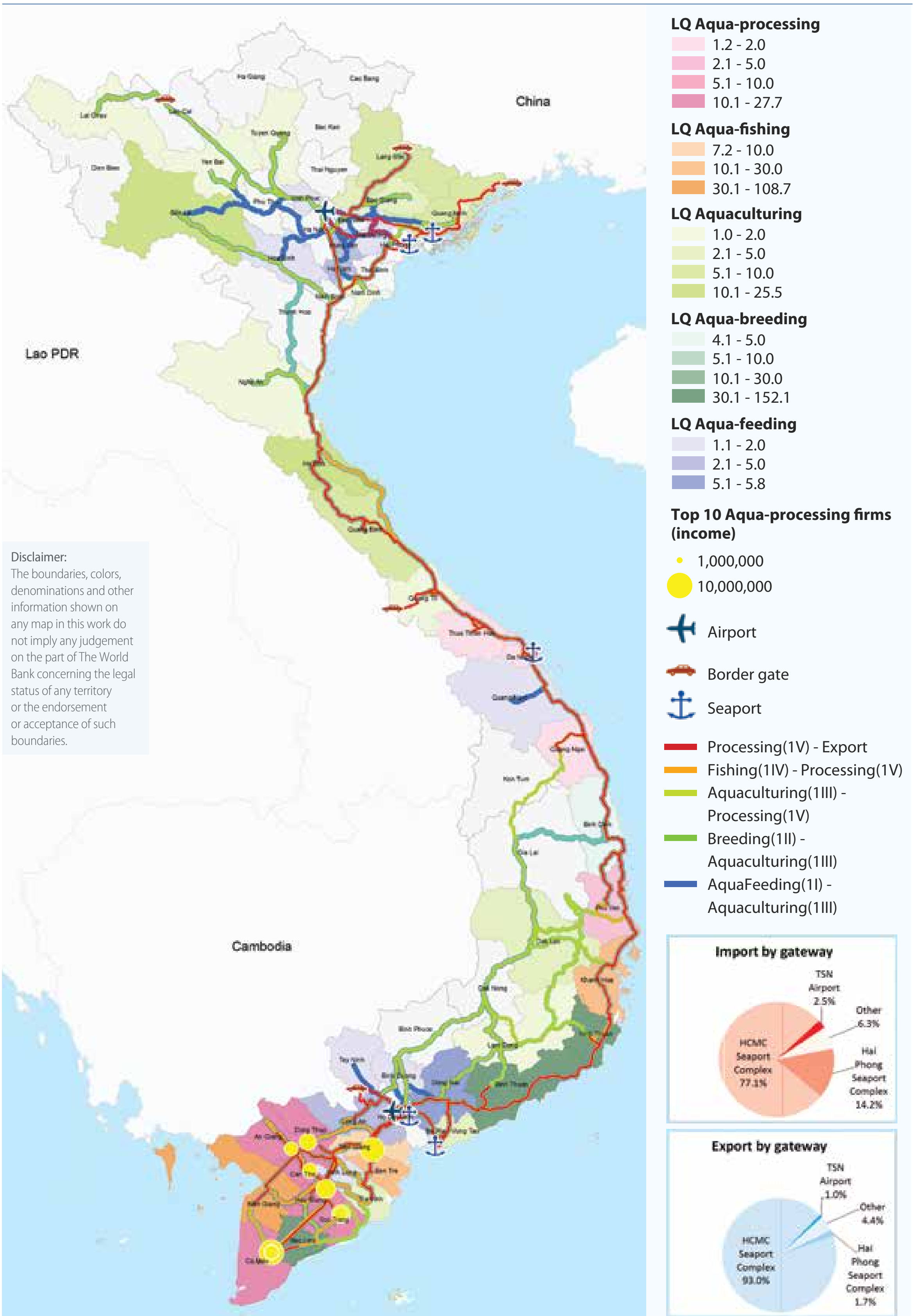
Table 2.3 and Map 2.2 depict the connective propensity and key corridors of the aquaculture value chain.

TABLE 2.3. **Key corridors of the aquaculture value chain**

Origin	Destination	Main corridor
Aqua-feeding	Aqua-culturing	Quan Lo – Phung Hiep expressway, HCMC - Trung Luong – My Thuan expressway, Ben Luc – Long Thanh expressway, NR1, NR91, NR80, NR54, NR62, NR63, Ringroad No4 HCMC, NR22, NR13 (Vinh Binh – Binh Duong – Binh Phuoc), Ringroad No3 HCMC, NR51, NR56, NR20, NR55, Cau Gie – Ninh Binh expressway, Noi Bai – Bac Ninh expressway, Noi Bai – Lao Cai expressway (through Vinh Phuc), NR21, NR32B, AH13, NR18, NR5
Breeding	Aqua-culturing	HCMC - Trung Luong – My Thuan expressway, NR91, NR80, NR54, NR62, NR63, NR60, NR57, Ringroad No4 HCMC, NR22, NR13 (Vinh Binh – Binh Duong – Binh Phuoc), NR14, AH17, Ringroad No3 HCMC, NR51, NR56, NR20, NR55, NR28B, NR7, NR1, NR19, Noi Bai – Lao Cai expressway
Aqua-culturing	Processing	Quan Lo – Phung Hiep expressway, HCMC - Trung Luong – My Thuan expressway, Ben Luc – Long Thanh expressway, NR1 (Phu Yen - HCMC – Ca Mau), NR91, NR80, NR54, NR62, NR63, NR60, NR57, Ringroad No4 HCMC, NR22, NR13 (Vinh Binh – Binh Duong – Binh Phuoc), Ringroad No3 HCMC, NR51, NR56, NR20, NR55, NR28B, NR7, NR1, AH13, Noi Bai – Lao Cai expressway, NR26, NR29, NR10, NR18, Ha Noi – Bac Giang expressway, NR12B
Fishing	Processing	Quan Lo – Phung Hiep expressway, HCMC - Trung Luong – My Thuan expressway, NR80, NR63, NR62, NR54, NR1 (HCMC – Ca Mau), NR51, Ringroad No4 HCMC, NR20, NR56, NR1 (Ninh Thuan – Dong Nai), NR27, NR28
Processing	Export	Quan Lo – Phung Hiep expressway, HCMC - Trung Luong – My Thuan expressway, Ben Luc – Long Thanh expressway, NR80, NR91, NR91C, NR1, NR22, NR51, NR19C, NR24B, NR9

Source: Enterprise Census (2016), and estimates by authors.

MAP 2.2. **Connective propensity of the aquaculture value chain**



Source: I/O Table (2012 and 2016) and Enterprise Census (2011 and 2016), calculation by authors.

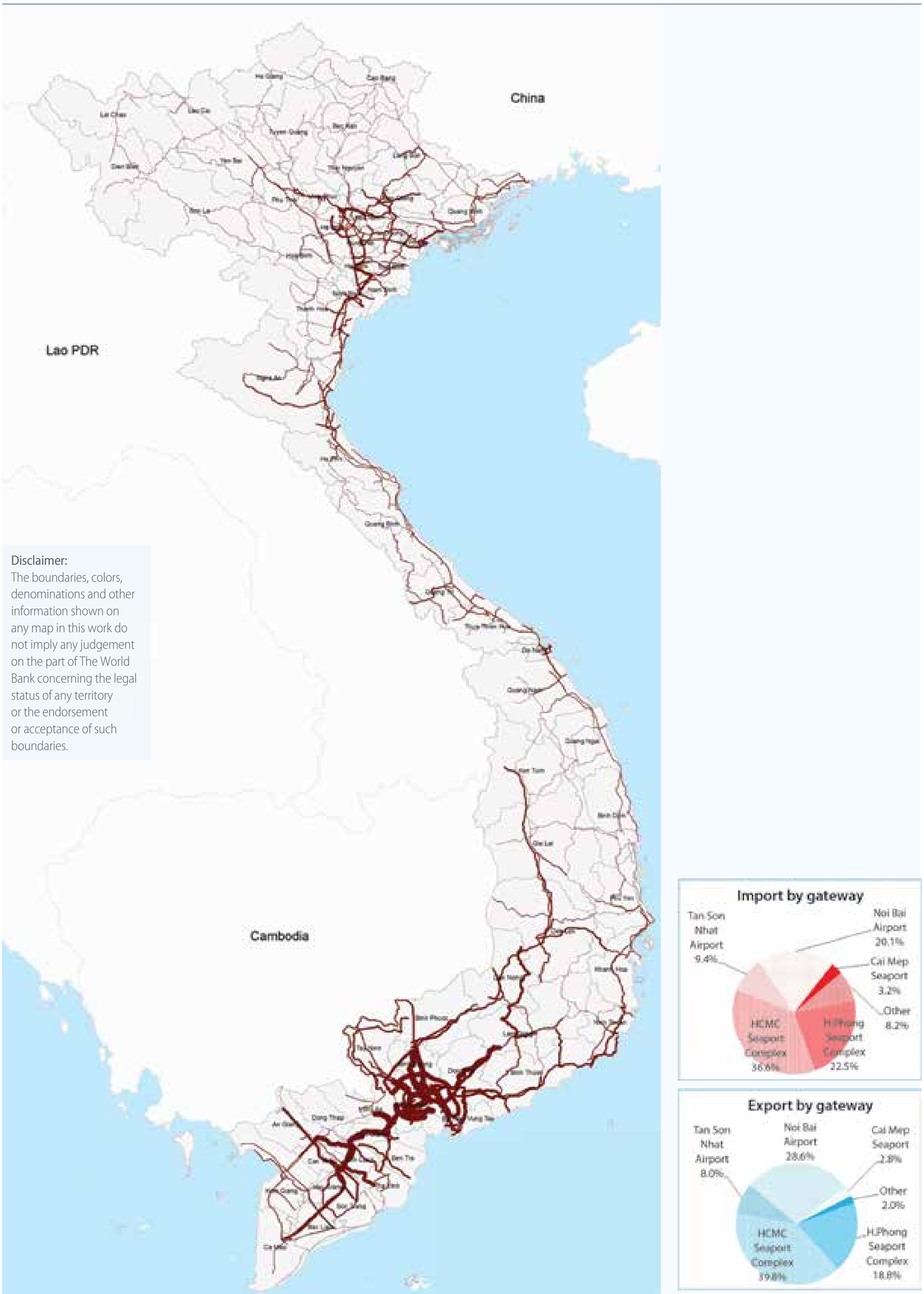
This connective propensity analysis concludes with a model of the value-chain link as a result of the previous study, to simulate freight flows according to the origin-destination (OD) model along the spatial organization of value chains and connect chains to international gateways. The results of the mapping allowed us to identify trade corridors organized to promote value-chain links, and to evaluate supporting logistics services to improve their overall efficiency and competitiveness. It is necessary to develop a model of disaggregated freight flows for traffic between the main freight centers in Vietnam (at district level if possible, including cluster locations) and the trade gateways. Freight-flow models, however, will require freight-volume data for transportation I/O within a value chain, and between processing location and trade gateway. Given the lack of readily accessible relevant freight-volume data needed, available HS trade data should be converted into equivalent freight-volume data, using proven techniques for converting export and import commodity values with appropriate assumptions. The key challenge is the lack of provincial I/O tables to define links, and OD flows per commodity within the value chains of each selected clusters.

2.5. Critical consolidated transport network for ten selected value chains

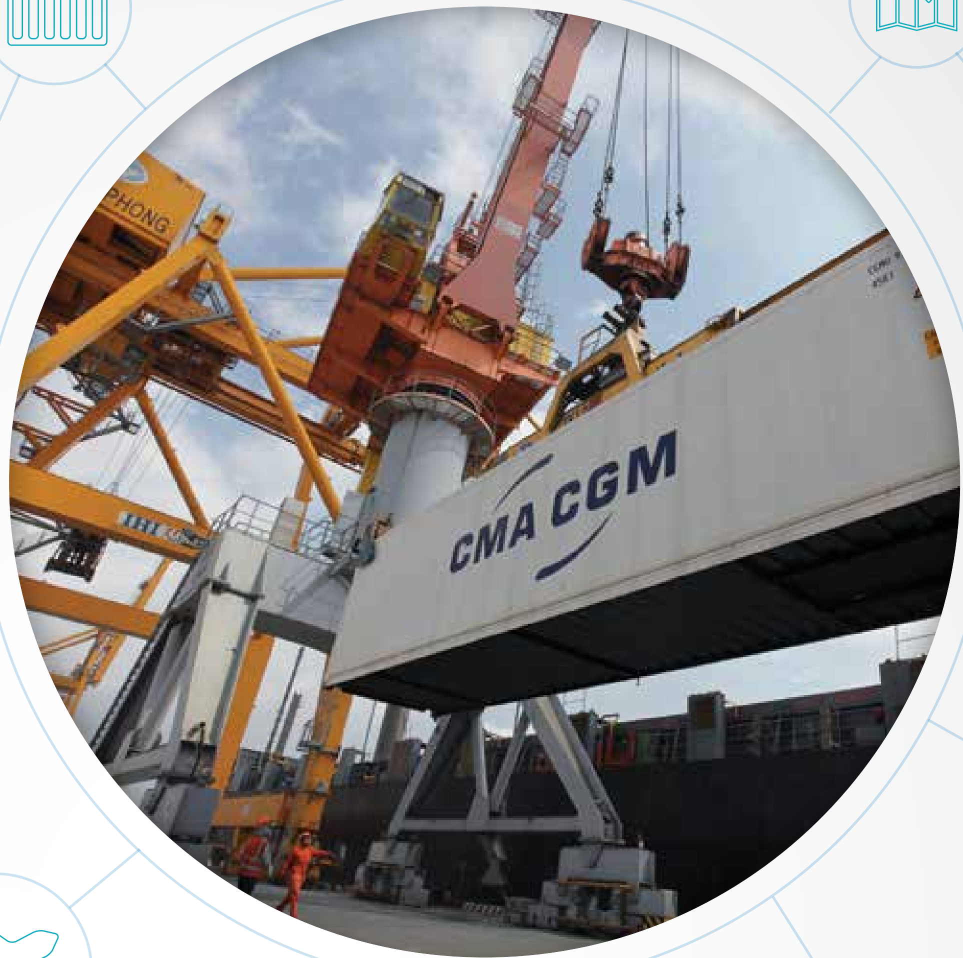
Map 2.3 shows the consolidation of connective propensity, transport network, and critical corridors for the ten selected value chains. The transport link's thickness represents its significance to value-chain links and freight flows of final exported and imported products as well as all backward links and intermediate products of the domestic supply chains. Key corridors are found (i) around the largest economic centers—Hanoi and HCMC—connecting nearby provinces that participate in the value chains, (ii) between the Mekong Delta Region and HCMC, (iii) between Hanoi and northern Chinese borders, (iv) along the north-south coastal line, and (v) between the central highlands and the south. Ensuring quality infrastructure and necessary logistics services along these corridors would help lower the trade and transport costs associated with these value chains, which are crucial for Vietnam's export competitiveness.

On one hand, transport and logistics networks should be master-planned and new transport investments should be based at least partially on changes in the structure of trade flows and value chains. On the other hand, they have the reverse relationship because infrastructure development of existing transport networks, needs on trade and cluster development could be created. In any case, value-chain connectivity information and analysis are crucial for optimizing the efficiency of transport networks and transport infrastructure investment. The relationship between transportation infrastructure and trade-related activities are elaborated further in the Vietnam Development Report 2019 (VDR) "Connecting Vietnam for Growth and Shared Prosperity".

MAP 2.3. **Connective propensity of ten export-oriented value chains**



Multi-source: I/O Table (2012 and 2016) and Enterprise Census (2011 and 2016), calculation by authors.



CHAPTER 3

Efficient international trade gateways

This chapter recommends transport infrastructure investment, especially for developing international trade gateways, take into account not only increasing cargo transportation needs, but also changes in the structure of imports and exports.

Because connectivity matters for export competitiveness, changes in the product-based export structure should be considered when prioritizing better connectivity and logistics for more competitive exports. A transport system that supports exports should account for this shift from a logistics perspective, especially in terms of investment into appropriate types of trade gateways. Therefore, the efficiency improvement of the international trade gateway structure and performance should take into account not only trade growth but also (and more important) structural changes and the continued development of domestic value chains.

3.1. Overview of trade gateways

A trade gateway (also known as a border gate) is the first destination of imported goods and the final departure point of exported goods. Therefore, gateways play an important role in foreign trade activities both in terms of cost and reliability of traded goods, and the performance and development of domestic value chains.

There is a distinction between a customs clearance point and a trade gateway. Customs statistics show there are 478 customs clearance points including at borders and at Inland Clearance Depots (ICDs) or other inland clearance points. However, the number of international gateways is much less. Among Vietnam's 48 major international gateways located in 31 provinces and cities, there are four main types: land (20), air (8), sea (16) and other (two rail and two inland waterways (IWT)). Although airports and seaports have broader international connections, the land gateways are to China, Laos and Cambodia. Among other major international gateways, there is one rail gateway to China and two IWT gateways to Cambodia. Table 3.1 represents Vietnam's main international gateways.

TABLE 3.1. **Vietnam's main gateways**

Location	Name	Transport mode				Connection
		Sea	Air	Land	Other	
Ha Noi	Noi Bai Airport		X			Multi-national
Hai Phong	Cat Bi Airport		X			Multi-national
	Hai Phong Seaport Complex	X				Multi-national
Quang Ninh	Van Don Airport		X			Multi-national
	Mong Cai			X		China
	Cai Lan Seaport	X				Multi-national
Lang Son	Huu Nghi			X		China
	Dong Dang				Rail	China
Cao Bang	Ta Lung			X		China
Ha Giang	Thanh Thuy			X		China
Lao Cai	Lao Cai			X	Rail	China
Dien Bien	Tay Trang			X		Lao PDR
Son La	Chieng Khuong			X		Lao PDR
Ninh Binh	Ninh Phuc Seaport	X				Multi-national
Thanh Hoa	Na Meo			X		Lao PDR
	Nghi Son Seaport	X				Multi-national

TABLE 3.1. **Vietnam's main gateways (cont.)**

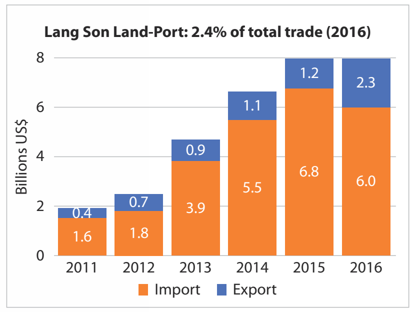
Location	Name	Transport mode				Connection
		Sea	Air	Land	Other	
Nghe An	Vinh Airport		X			Multi-national
	Nam Can			X		Lao PDR
	Cua Lo Seaport	X				Multi-national
Ha Tinh	Cau Treo			X		Lao PDR
	Vung Ang Seaport	X				Multi-national
Quang Binh	Cha Lo			X		Lao PDR
Quang Tri	Lao Bao			X		Lao PDR
Hue	Phu Bai Airport		X			Multi-national
	Chan May Seaport	X				Multi-national
Da Nang	Da Nang Airport		X			Multi-national
	Tien Sa Seaport	X				Multi-national
Quang Nam	Ky Ha Seaport	X				Multi-national
Quang Ngai	Dung Quat Seaport	X				Multi-national
Kon Tum	Bo Y			X		Lao PDR
Gia Lai	Le Thanh			X		Cambodia
Binh Dinh	Quy Nhon Seaport	X				Multi-national
Khanh Hoa	Nha Trang Seaport complex	X				Multi-national
	Cam Ranh Airport		X			Multi-national
Binh Phuoc	Hoa Lu			X		Cambodia
Tay Ninh	Xa Mat			X		Cambodia
	Moc Bai			X		Cambodia
Ba Ria - Vung Tau	Phu My Seaport	X				Multi-national
	Vung Tau Seaport Complex	X				Multi-national
Ho Chi Minh City	Saigon Seaport Complex	X				Multi-national
	Tan Son Nhat Airport		X			Multi-national
Long An	Binh Hiep			X		Cambodia
Dong Thap	Dinh Ba			X		Cambodia
	Thuong Phuoc				IWT	Cambodia
An Giang	Vinh Xuong				IWT	Cambodia
	Tinh Bien			X		Cambodia
Can Tho	Can Tho Seaport	X				Multi-national
Kien Giang	Ha Tien			X		Cambodia

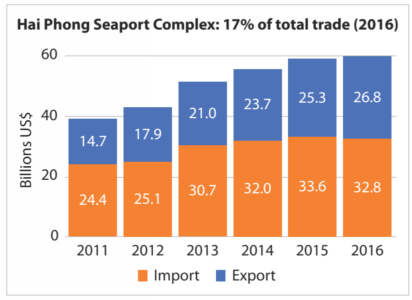
Source: Authors, combined sources of Vietnam Customs and Wikipedia.

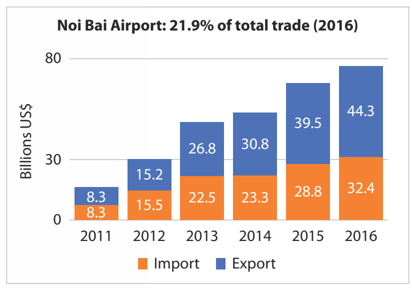
Despite that there are 48 main international gateways, as in Map 3.1, just 12 international gateway complexes accounted for more than 85.6 percent of Vietnam's trade value in 2016. These 12 gateways are the two largest airports, Noi Bai in Hanoi and Tan Son Nhat in Ho Chi Minh City (HCMC), the five most important seaports (complexes in HCMC, Hai Phong, and Vung Tau, Cai Lan in Quang Ninh, and Tien Sa in Da Nang), and five land-gate complexes in Lang Son, Quang Ninh, Lao Cai, Quang Binh-Quang Tri, and Tay Ninh. Among the land gateways, the complexes of Lang Son, Quang Ninh, and Lao Cai are the main gateways to China, the Quang Binh-Quang Tri complex is the key gateway to Lao PDR, and the Tay Ninh complex is the main gateway to Cambodia.

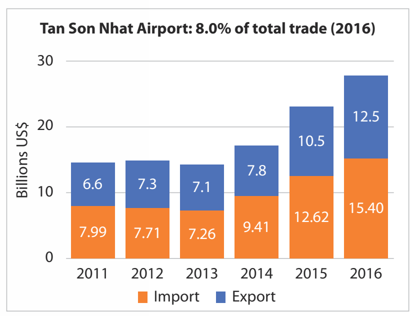
MAP 3.1. **Main trade gateways**

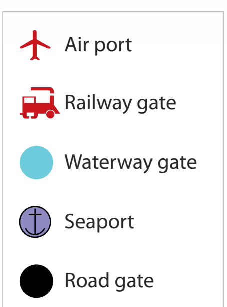
Disclaimer:
The boundaries, colors, denominations and other information shown on any map in this work do not imply any judgement on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

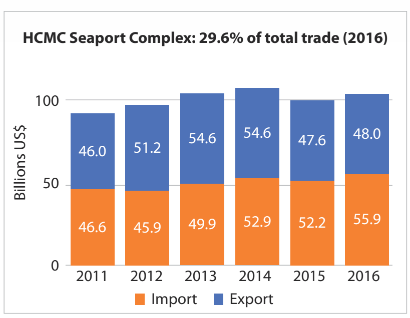


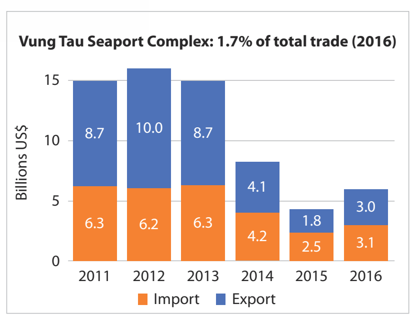












Source: Customs data, calculation by authors.

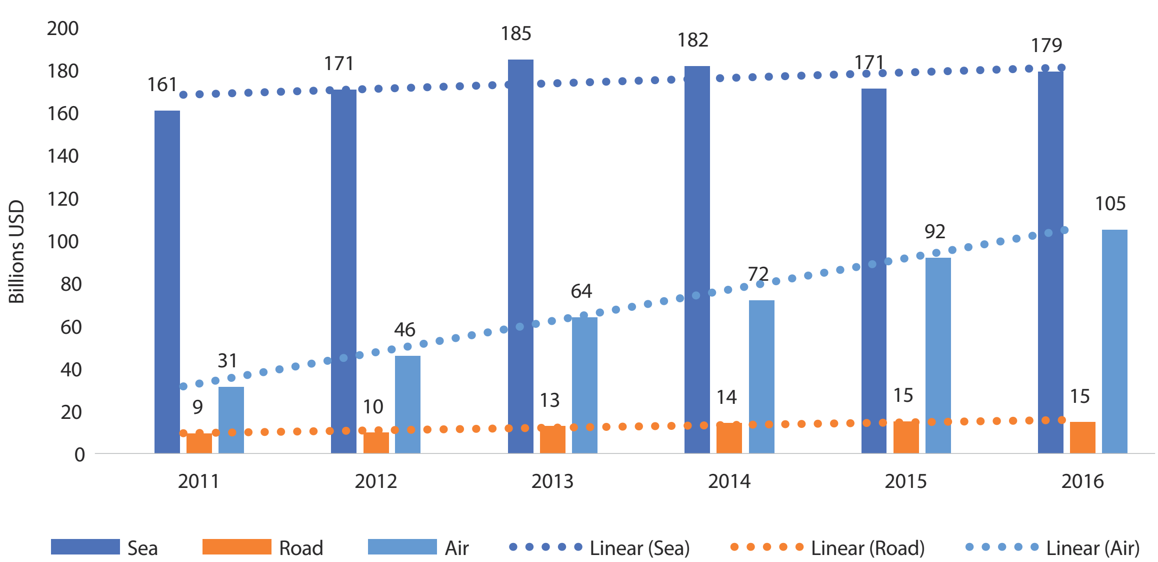
When viewing the geographic distribution of international gateways in proximity to economic regions, Noi Bai Airport in Hanoi, Hai Phong Seaport Complex, Cai Lan Seaport, and land border-gate complexes in Lang Son, Quang Ninh, Lao Cai are international gateways in the Northern and Red River Delta Regions. Tien Sa Seaport in Da Nang and Quang Binh-Quang Tri land gateways are key international gateways in the Central Region. Tan Son Nhat Airport in HCMC, Saigon Seaport Complex, Vung Tau Seaport Complex, and Tay Ninh land gateway are the most important international gateways in the Southeast and Mekong Delta Regions.

Among the above-mentioned 12 gateways that represent all regions and transport modes, the actual flows of goods across borders are concentrated in only six gateways, which are also highlighted in the Map 3.1 with graphs showing shares of the value of export and import going through these gateways in 2016. These six most significant gateways accounted for 80.5 percent of the total trade value in 2016 and include HCMC Seaport Complex, Hai Phong Seaport Complex, Vung Tau Seaport Complex, Lang Son land gateway, Noi Bai Airport, and Tan Son Nhat Airport.

3.2. Trade by gateway type

Vietnam's trade value has increased rapidly over time, with trade through all gateways increasing, though not uniformly across all types. Figure 3.1 shows this increasing trend between 2011 and 2016 and reflects the change in the domestic value-chain structure where trade value has increases unevenly across different gateway types. The rapid increase in trade flows through air compared to other gateways shows stronger growth in production, export, and import of small but valuable products like mobile phones, electronic components, high fashion exports, and high-value, processed agricultural products. Box 3.1 presents the case of Samsung Vietnam, which has significantly changed the electronics value-chain structure and the development of Vietnam's air trade.

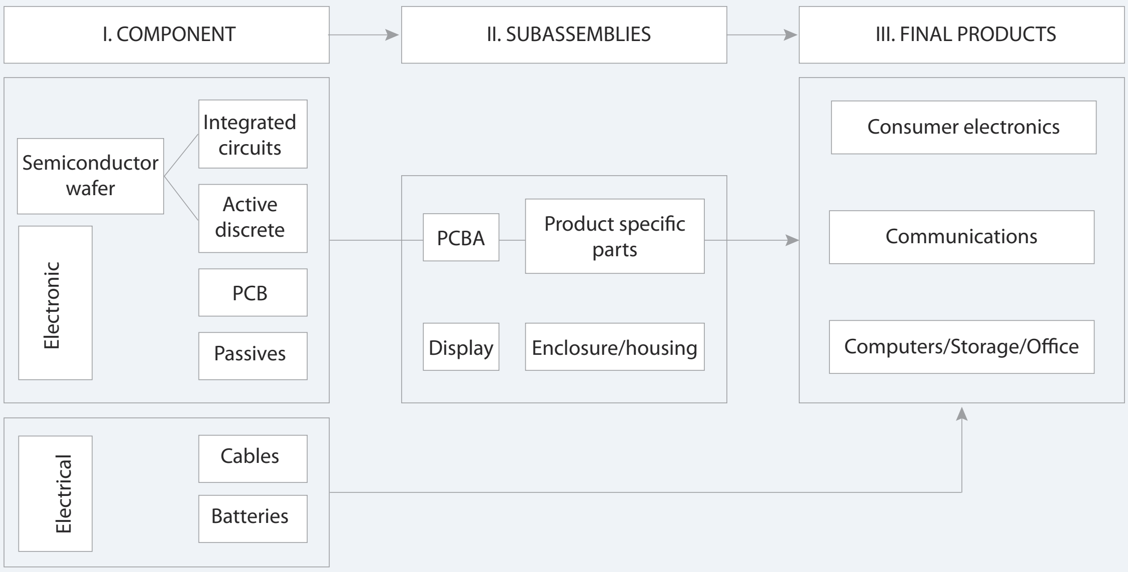
FIGURE 3.1. **Trade value by gateway type (2011-2016)**



Source: Customs data, calculation by authors.

Box 3.1. Electronics Value Chain and Samsung Vietnam

Electronic products are often categorized into three groups: computers, communications, and consumer electronics (3C). In electronic value chains, 3C are the final products that have been assembled from a number of components and parts, such as semiconductors, integrated circuits, printed circuit boards (PCB), etc. Electronics, especially cellphone parts, are usually small and light, and more likely to be high value, thus easy to transport by air. These characteristics enable electronics GVCs to spread across countries and continents to optimize comparative advantages and country specialization, and build supply chains around air transportation and logistics.



Samsung started their business in Vietnam in 1996 with a small joint venture named Samsung Vina (with the total investment of 36.5 US$ million) that ultimately turned 100 percent FDI after Samsung bought all the shares from its partner in 2013. In 2008, Samsung made a big move with a new project producing smartphones in Bac Ninh (with the total investment of 670 US$ million) and since then has expanded their production in Vietnam, opening several new factories. Samsung now has six factories in three provinces (Bac Ninh, Thai Nguyen, and Ho Chi Minh City), and an R&D center in Ha Noi with a total registered investment capital of 17 US$ billion.

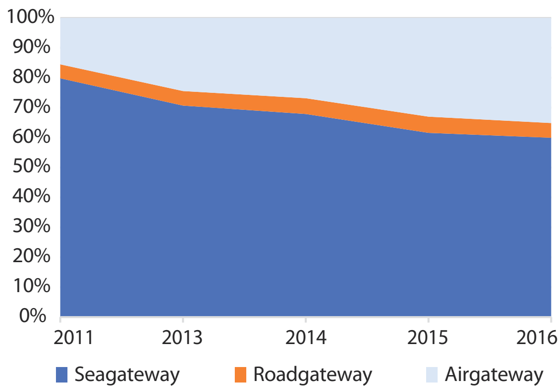
A decade after starting the first project on smartphones, Samsung has cultivated its supply chain in Vietnam with 35 suppliers in 2018, up from four in 2014, and is expected to expand to 50 by 2020. Although the local supply chain has expanded, Samsung still relies on imported parts mostly delivered from China through Huu Nghi land gateway, or from other countries via Dinh Vu seaport, but most importantly from the Noi Bai airport. Samsung Vietnam makes the majority of its global smartphones output in Vietnam, including its latest flagship device, which is exported all over the world via Noi Bai airport. This is one of main reasons Vietnam's smartphone export has increased significantly, from nothing to 20 percent of total exports over the last decade, and trade value via air gateway has increased rapidly, from 15.6 percent in 2011 to 39.5 percent in 2016.

Samsung Vietnam has developed a unique supply chain and logistics system to ensure the shortest delivery time for its just-in-time production in Vietnam. In Noi Bai Airport, there is a separate warehouse area and customs clearance line for Samsung to ensure their imports and exports go smoothly. Samsung's investment has caused structural changes in logistics in the North, with the rapid growth of air cargo and transportation that requires a change in corresponding connective policy and logistics investment.

Source: Authors.

As a result, although trade through sea and land gateways maintained a certain growth rate, they did not reach the rate of air gateways in the same period. Figure 3.2 shows that the share of trade via air has increased rapidly from 15.6 percent in 2011 to 39.5 percent in 2016, the share of trade via land has decreased slightly from 5.7 percent in 2011 to 4.3 percent in 2016, and the share of trade via sea fell dramatically from 78.8 percent in 2011 to 56.1 percent in 2016.

FIGURE 3.2. **Share of trade value by gateway type (2011-2016)**



Source: Customs data, calculation by authors.

As we will discuss later, the change in trade gateways used reflects a change in the domestic value-chain structure. Analyzing the product mix of exports and imports through different gateways and their change over time provides a better understanding of this structural change. Figures 3.3-A and 3.3-B demonstrate the structure of imported products through sea gateways for 2011 and 2016, respectively. Generally, sea gateways carry a variety of durable and high-volume imports, like machinery and mechanical equipment (HS84), electronics and electrical equipment (HS85), mineral fuels and oils (HS27), iron and steel (HS72), plastic products (HS39), vehicles (HS87), cotton (HS52), etc. Moreover, this product mix has not changed much overtime.

Comparing the top four products imported via sea gateways between 2011 and 2016, the share of mineral fuels and oils (HS27) has declined sharply from 11.8 percent to 2.6 percent. While imports of machinery and mechanical equipment (HS84) have increased from 12.4 percent to 14.6 percent, imports of electronics and electrical equipment (HS585) have decreased from 13.5 percent to 10.4 percent, and imports of plastic products (HS39) have risen from 6.3 percent to 8.8 percent.

FIGURE 3.3. **Products imported through sea gateways (2011 and 2016)**

Figure 3.3.A: ***Products imported through sea gateways (2011)***

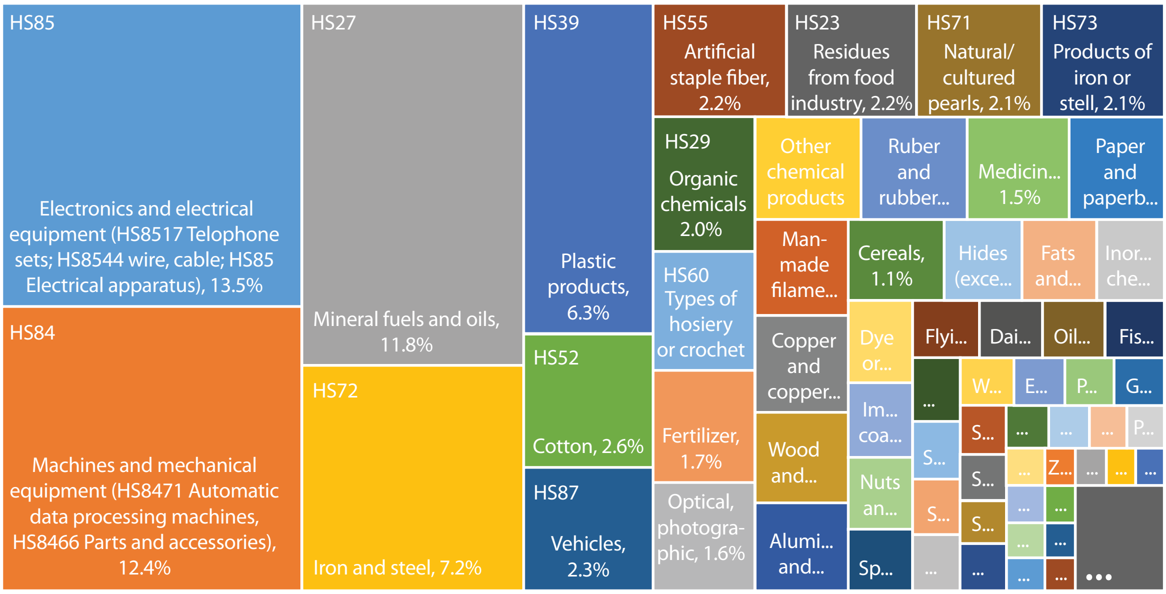
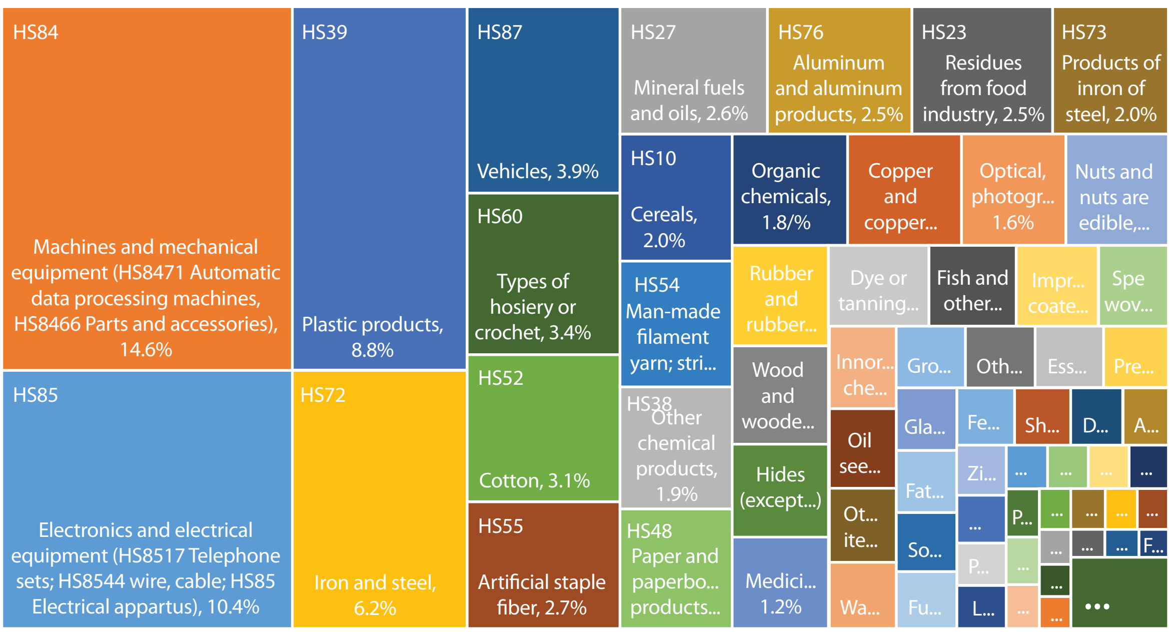


Figure 3.3.B: ***Products imported through sea gateways (2016)***



Source: Customs data, calculation by authors.

Similar to imports, sea gateways carry a variety of durable and high-volume exports. The product mix looks like that of imports including machinery and mechanical equipment (HS84), electronics and electrical equipment (HS85), mineral fuels and oils (HS27), iron and steel (HS72), plastic products (HS39), vehicles (HS87), cotton (HS52), etc. This structure has remained unchanged over time. Figure 3.4-A and 3.4-B show the top 15 products exported via sea gateways for 2011 (accounting for 77.8 percent of total sea exports) and 2016 (accounting for 73.2 percent of total sea exports). Clearly mineral fuel and oil exports (HS27) dropped out of the top 15 exported products, from the second biggest item in 2011 (11.8 percent) to 2.6 percent in 2016.

FIGURE 3.4. **Top 15 products exported through sea gateways (2011 and 2016)**

Figure 3.4.A: ***Top 15 products exported through sea gateways (2011)***

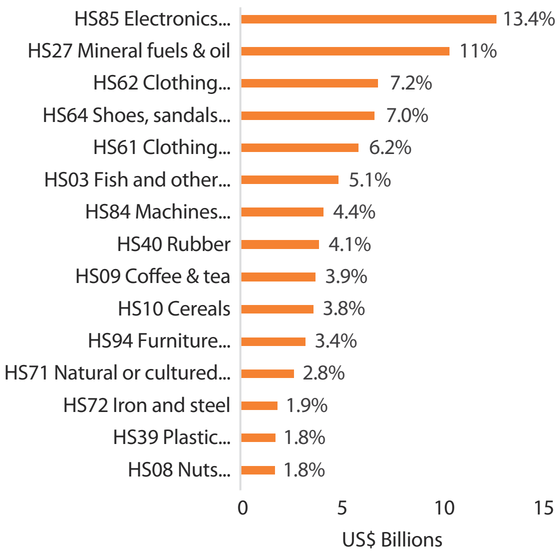
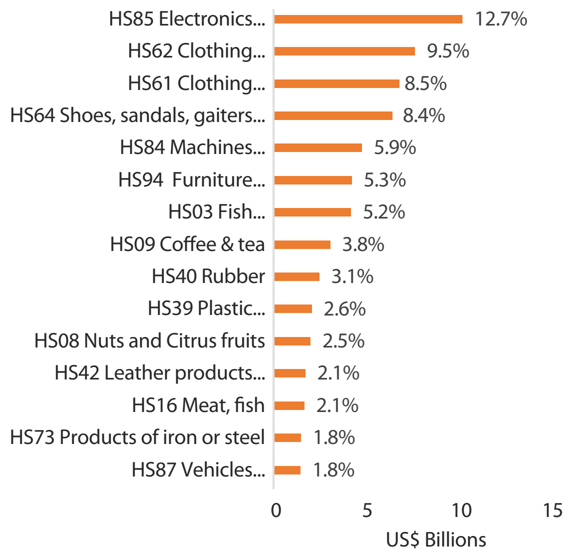


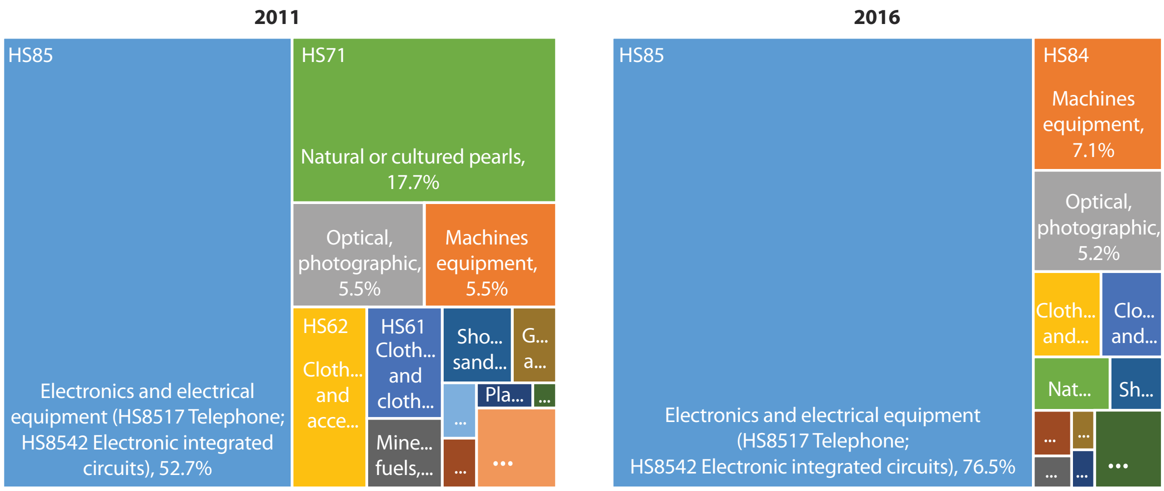
Figure 3.4.B: ***Top 15 products exported through sea gateways (2016)***



Source: Customs data, calculation by authors.

Compared to sea gateways, air gateways export fewer products with higher values, like electronics and electrical equipment (HS8517 – telephones, HS 8542 – electronic integrated circuits), natural and cultured pearls (HS71), optical, photographic (HS90), and machine equipment (HS84), etc. Figure 3.5 compares the structure of products exported through air gateways between 2011 and 2016. The share of exported electronics and electrical equipment increased considerably from 52.7 percent in 2011 to 76.5 percent in 2016. In contrast, the share of exported natural and cultured pearls dropped from 17.7 percent in 2011 to 1.6 percent in 2016.

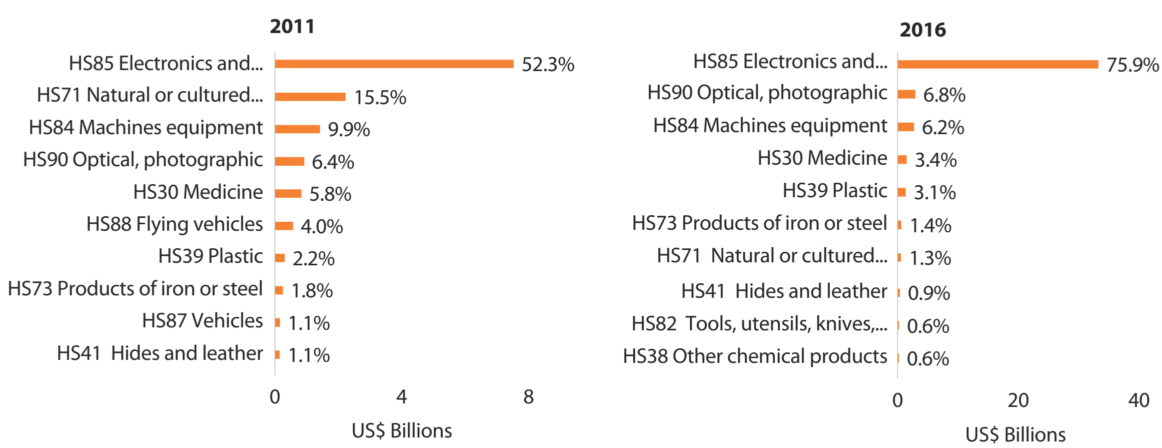
FIGURE 3.5. **Products exported through air gateways**



Source: Customs data, calculation by authors.

Figure 3.6 shows the structure of top ten products imported through air gateways between 2011 and 2016. Similar to exports, the share of electronics and electrical equipment imports increased from 52.3 percent in 2011 to a dominant share of 75.9 percent in 2016. The share of all other imported products therefore reduced considerably.

FIGURE 3.6. **Products imported through air gateways**



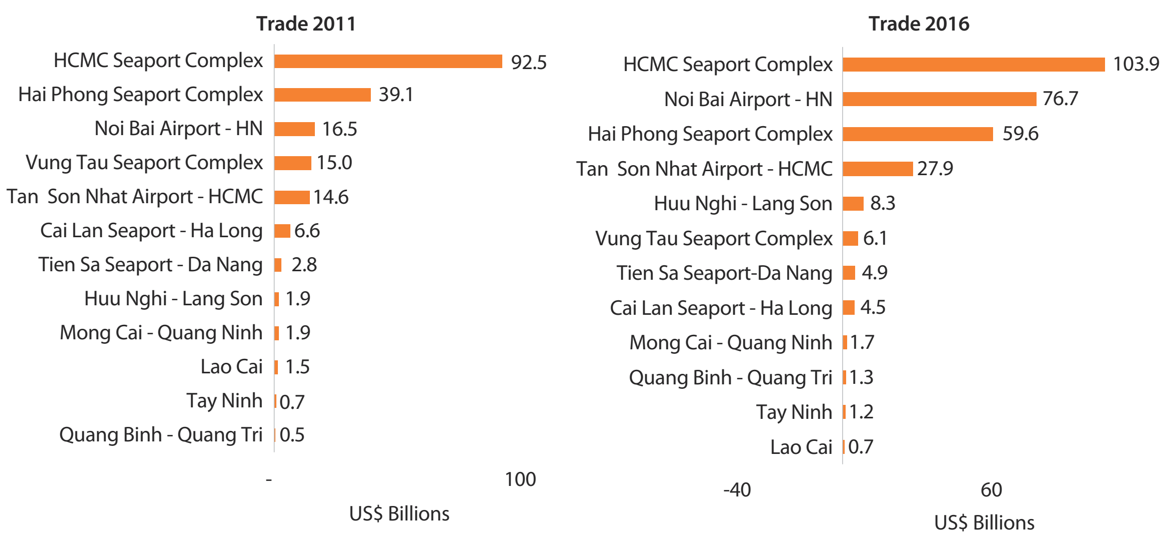
Source: Customs data, calculation by authors.

From a trade and transport perspective these are different but equally important: while high-value electronics are increasingly important in people's lives, they generate much smaller volumes in weight per cubic meter (m3) than other value chains. As such, they need less infrastructure per dollar of trade and a different type. The same applies in ports: a container of electronics may have 100 times the value of a container of plastic products, but both require a container of transport capacity. Hence large infrastructure planning requires close attention to trade volume as well as value.

3.3. Analysis of top trade gateways

As mentioned in section 3.1, the top 12 (of 48 total) trade gateways by trade value are two airports, five seaports, and five land gateways. Together, they accounted for 85.6 percent of total trade in 2016. Figure 3.7 ranks trade value via the top 12 gateways between 2011 and 2016, which has changed overtime. For example, Noi Bai Airport moved up from third in 2011 to second in 2016. Similarly, Tan Son Nhat Airport upgraded from the fifth position in 2011 to the fourth position in 2016. Meanwhile, the rank of Hai Phong seaport complex has fallen from the second position in 2011 to the third position in 2016, and Cai Lan seaport ranked sixth in 2011, fell to eighth in 2016. In terms of land-gateways, Huu Nghi Lang Son moved up from eighth in 2011 to fifth in 2016.

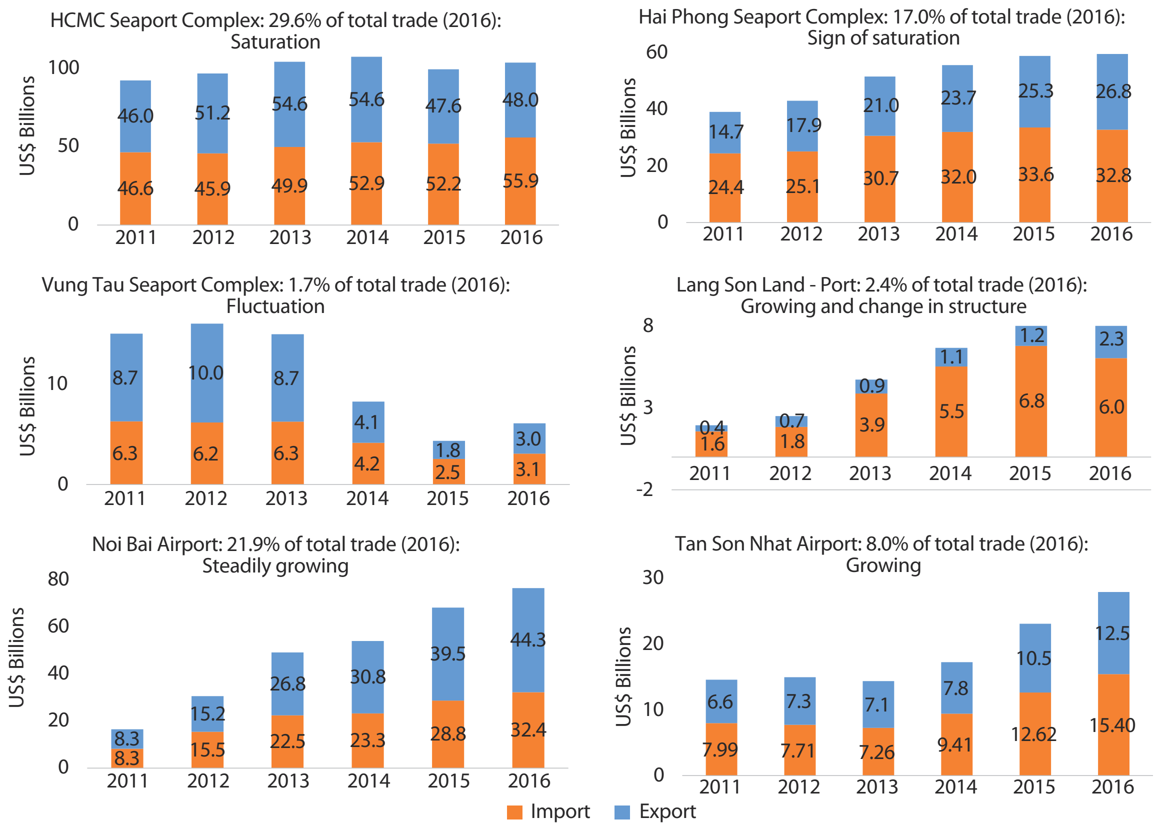
FIGURE 3.7. **Top 12 gateways by trade value**



Source: Customs data, calculation by authors.

Changes in trade value through the top 12 gateways, especially in terms of ranking interexchange in transportation modes, reflect changes in the product mix structure of key value chains. Among the top 12 gateways, there are six that are most statistically significant: HCMC Seaport Complex, Hai Phong Seaport Complex (Hai Phong City), Vung Tau Seaport Complex (Ba Ria-Vung Tau Province), Tan Son Nhat Airport (HCMC), Noi Bai Airport (Hanoi City), and Huu Nghi land gateway (Lang Son Province).

FIGURE 3.8. **Six most significant gateways by trade value**



Source: Customs data, calculation by authors.

In short, data analyzed in this chapter shows trade value increased but unevenly across gateway type, leading to structural change in the relative importance of gateway type. For example, the share of trade via air gateways increased rapidly from 15.6 percent in 2011 to 39.5 percent in 2016, while the share of trade via sea gateways reduced dramatically from 78.8 percent in 2011 to 56.1 percent in 2016. This reflects the drastic shift in export structure from primary exports including crude oil and non-oil (coal, stone, sand, gravel, aluminum, copper, etc.) and resource-based exports (agriculture-based products) to high-tech exports (electronics, cell phones, incorporated circuits, etc.). It reflects the structural change in products: rapid increases in products with small volumes but high values, such as mobile phones, electronic components, high fashion exports, and high-value, processed agricultural products.

Export structural changes bear heavily on investment allocation to international gateways according to appropriate logistics modes. This report reveals the current air gateway capacity would not be able to catch up to this shift in export structure (especially for Tan Son Nhat airport). The report recommends including value-chain analysis in developing a policy framework for international trade gateways (which is currently lacking) that would guide related master planning and prioritized investment. Additionally, the capacity of Ho Chi Minh City's seaport complex is saturated and further capacity extension seems impossible (due to its limited area and urbanization). The report recommends enhancing the utilization of Vung Tau's seaport complex and a substitute solution for the current situation in Ho Chi Minh City's seaport complex. From the report's findings, we recognize the importance of airports and seaports, but it is even more important to focus policy on the ease of access and egress to those gateways.

CHAPTER 4

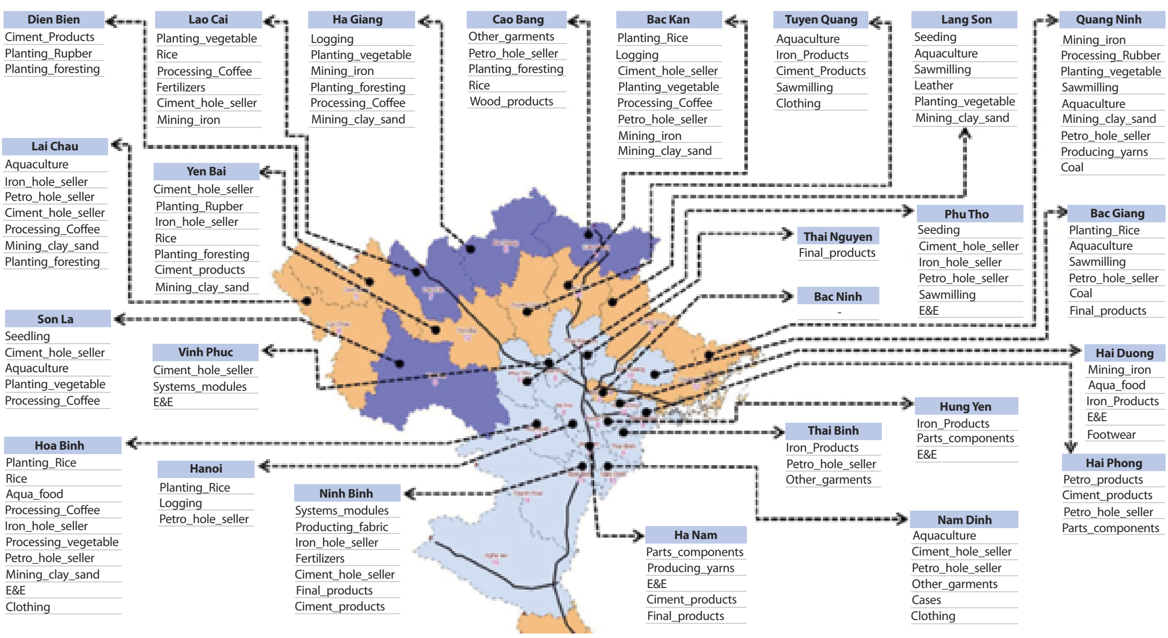
Regional specialization and coordination

This chapter recommends transport infrastructure investment for regional development take into account effective regional links and connectivity of value chains. Moreover, decisions on transport infrastructure investment should be based on a conducive environment for regional specialization and inter-regional cooperation (rather than unhealthy competition) for public investment sources.

4.1. Provincial specialization

Provincial specialization in all 14 identified (see report section 2.1) value chains and their segments is defined based on Location Quotients (LQs) computed from the Enterprise Census 2011 and 2016. Map 4.1 shows provincial specialization in northern Vietnam for 2016 and Map 4.2[9] shows provincial specialization in southern Vietnam. In addition, comparing LQs for 2011 and 2016 allows us to take a dynamic perspective of specialization patterns in each of the provinces. Location quotients that increase over time (for a particular subsector) reflect stronger relative provincial specialization. In contrast, provinces with lower LQs reflect lower relative specialization for the selected subsectors.

MAP 4.1. **Locational distribution of provincial specialization in the North**



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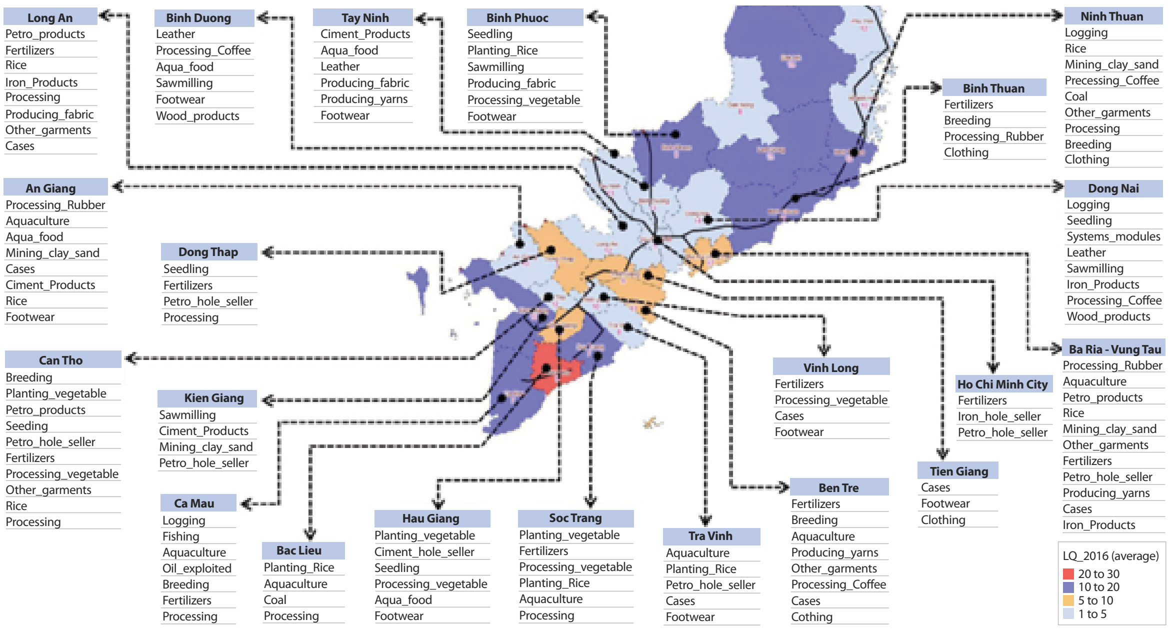
Source: Enterprise Census 2016 calculation by authors.

9 Map 4.2 shows Ho Chi Minh City specializes in three sectors: fertilizers, iron, and petroleum. This may result from data constraint or the fact that headquarters of these sectors' largest producers are located in HCMC, even though their production is elsewhere.

MAP 4.2. **Locational distribution of provincial specialization in the South**



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Source: Enterprise Census 2016 calculation by authors.

Table 4.1 exemplifies the relative specialization of the Ca Mau Province in the South. In 2016, the Ca Mau Province specialized in aquaculture (including aqua-breeding, aqua-culturing, and aqua-processing), but also oil and gas exploitation, and fertilizers. The latter two value chains are interlinked because natural gas services input to fertilizer production. This regional specialization trend has been strengthened between 2011 and 2016.

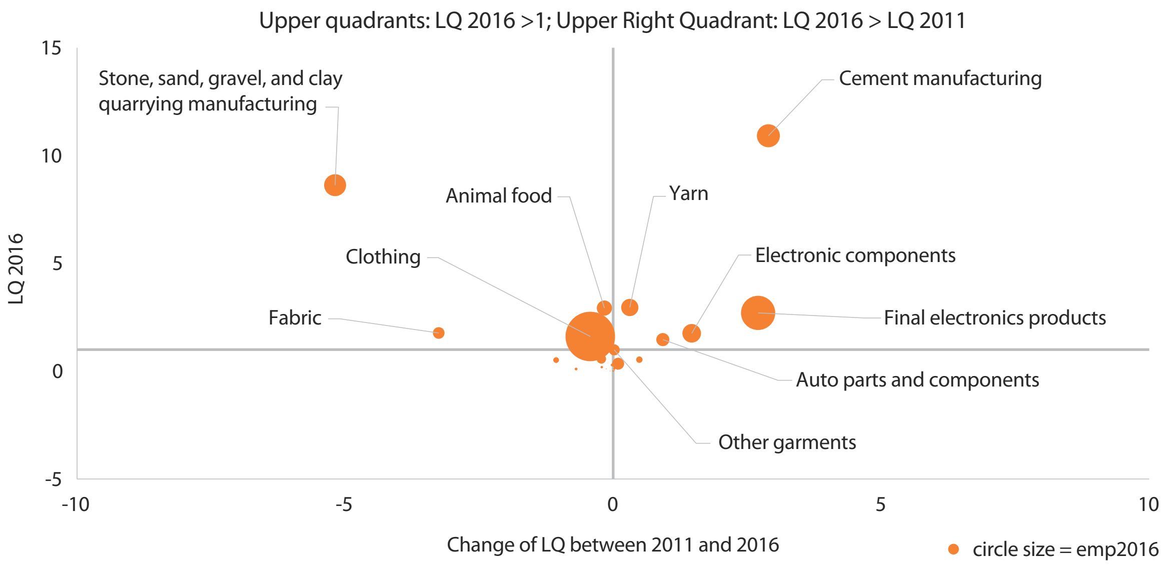
TABLE 4.1. **Regional specialization of Ca Mau province**

Specialized Production	Employment 2016	LQ 2011	LQ 2016	Change in LQ (2011 - 2016)
Aqua-processing	18,622	26.3	27.7	1.4
Aqua-culturing	155	2	5.1	3.1
Aqua-breeding	472	13.2	20.3	7.1
Crude oil and gas extraction	186	0	6.3	6.3
Fertilizers	896	0.2	8.9	8.7

Source: Enterprise Census 2011 and 2016, calculation by authors.

Figure 4.1 demonstrates that Ha Nam Province specializes in the subsectors plotted above the x-axis in the upper quadrants (with LQ 2016 > 1), including textile and garment, electronics, cement, auto parts, and animal food. Among those, the subsectors that are plotted in the upper-right quadrant (with higher LQ 2016 > LQ 2011) show stronger relative specialization, while those plotted in the left quadrant (showing LQ 2016 < LQ 2011) show weaker specialization. The textile and garment value-chain structure has changed over time: it is less relatively specialized in fabric and clothing, and more specialized in yarns. This change would require a shift in labor skills, and a conducive policy environment for increased competition in the labor force. The electronics specialization has emerged since 2011. Between 2011 and 2016, Ha Nam became more specialized in manufacturing final cement products, and relatively less specialized in stone and sand exploitation. This may reflect a shortage of local inputs or the provincial government's increasing awareness of environmental protection.

FIGURE 4.1. **Regional specialization of Ha Nam province**



Source: Enterprise Census 2011 and 2016, calculation by authors.

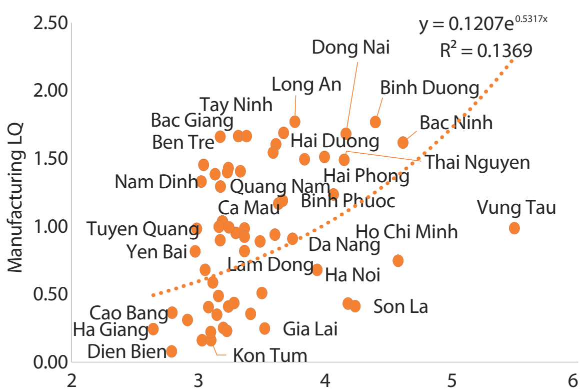
Regional specialization patterns as demonstrated by the Ca Mau and Ha Nam examples were performed for all 63 provinces. This regional specialization analysis can be used by stakeholders (government, development partners, and the private sector) for various purposes, including but not limited to regional planning and development (an integrated multisectoral approach), interregional coordination, job and skills development analyses, and particularly value-chain/cluster-based connectivity and GVC integration. Data analysis in this report could be used to provide the LQ 2016 and the change since 2011 (LQ2016-LQ2011) for all 14 identified sectors across all 63 provinces.

Changes in provincial specialization can create opportunities for lagging regions like poor and remote provinces. This report shows the garment segment of the textile and garment value chain has shifted from Red River Delta provinces (Hai Duong, Bac Ninh, Ha Nam) to a lagging province (Tuyen Quang) between 2011-2016. The shift in provincial specialization needs to be reviewed more closely in separate focused studies.

4.2. Aligning trade and growth strategies with regional specialization

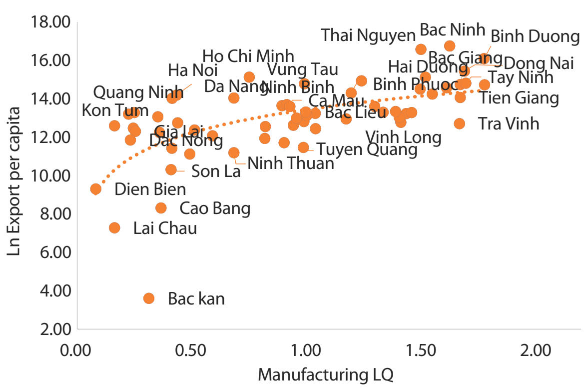
In Vietnam, a higher relative regional specialization in manufacturing activities (as measured by LQ) is associated with higher per capita income (and to a lesser extent exports) and lower regional poverty (Figures 4.2-4.4).

FIGURE 4.2. **Manufacturing agglomeration versus provincial income**



Source: Enterprise Census 2011 and 2016, Customs data, calculation by authors

FIGURE 4.3. **Manufacturing agglomeration versus provincial trade**

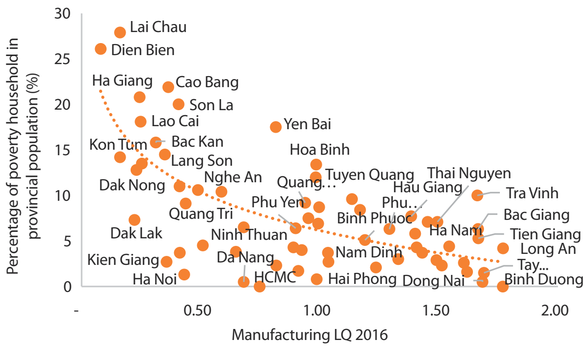


Source: Enterprise Census 2011 and 2016, Customs data, calculation by authors

Understanding the geographic structure of value chains is important for formulating policy on regional coordination, integrating value-chain links, and for planning human capital in appropriate regions and areas accordingly. Changes in provincial specialization can create opportunities for lagging regions, and value-chain development could help address regional inequality issues. The report therefore recommends sharing provincial specialization information with all concerned parties including central and local governments, the private sector, and development partners.

The report also recommends that investment in transport infrastructure for regional development planning and implementation consider effective regional links and value-chain connectivity, not only public investment discretions. Public investment, especially for transport infrastructure, can be optimal if it is not fragmented or duplicated due to excessive regional competition, but allocated for objective regional coordination based on real value-chain spatial structure and links.

FIGURE 4.4. **Manufacturing agglomeration versus poverty**



Source: Enterprise Census 2011 and 2016, Customs data, calculation by authors

Our evidence shows manufacturing density and value-chain concentration have a positive interrelationship with income, exports, and employment in local areas. Regional specialization measured by LQ is a dynamic metric, changing over time. Provinces change their participation in the value chain for various reasons. For example, emerging value-chain expansion following a move of foreign-led firms to the locality as in the case of Samsung, policy changes, increased skilled human resources, or internal labor movements. The information on local specialization is important for understanding the geographic structure of value chains. The government needs this information to formulate policy on regional coordination, integrate value-chain links, and for support human capital improvements nationally.

4.3. Core versus lagging regions

Several issues have been identified that require reform to overcome the constraints of low agglomeration and longer transport distances in Vietnam (Farole and Winkler, 2012): First, industrial land in Vietnam is cheap, while urban-residential land is expensive. Land policies have caused excessive conversion of agricultural to industrial land but prevented urbanization of people and jobs. Second, the current city classification system could be updated and refined. It currently promotes urban expansion and investment, but in an unsystematic way that does not take into account a specific city's needs. It could also include a spatial development framework aligned with Vietnam's economic development strategy.

Third, there is lack of coordination, particularly of policies, at the regional and national level, especially regarding mass transit infrastructure development. Integrated transport and logistics platforms need to be mainstreamed. Key supply-chain bottlenecks include roads to big ports, and important road corridors and expressways. Fourth, the government should not neglect rural-urban links to strengthen the competitiveness of the agribusiness sector. They should focus on connecting regional cities to major agricultural zones (for example the Mekong River Delta and Central Highlands) (World Bank, 2016).

Finally, it is crucial to acknowledge that different types of lagging regions require different types of policies. Agglomeration research shows the likelihood of exporting is higher in core regions and this has implications for national and regional policies. There also needs to be the right balance between connectivity policies, particularly in lagging regions, and policies addressing other critical factors, or policies for attracting foreign direct investment (FDI) (see Box 4.1).

Box 4.1. Policies for different types of lagging regions

Agglomeration research shows the likelihood of exporting is higher in core regions. Core regions are characterized by a higher density of firms and exporters in a specific sector (localization economies and export spillovers), but also by a significant sector diversity that allows for resource sharing including specialized suppliers and labor (urbanization economies). Both help overcome the fixed-entry costs to exporting. As a result, firms located in core regions tend to export more compared to firms located in noncore (lagging) regions. They also import more, underlining the importance of imports for increased export competitiveness in the context of GVCs (import-to-export).

The findings of this agglomeration research and the likelihood of exporting has implications for national and regional policies. It is widely recognized that past interventions that specifically aim to lower spatial inequalities within countries, ranging from infrastructure investments, wage policies, deregulation, promotion of clusters, development of industrial parks and economic zones, and fiscal incentives to attract investment have been unsuccessful. In a world where import and export times are critical, particularly in manufacturing, attracting investment to noncore regions can seriously impede firms' overall competitiveness.

But where the opportunity to attract investment to noncore regions is realistic, it is crucial to identify and address location-specific barriers to importing and exporting. This is more likely to be the case for peripheral regions that have a larger economic mass and greater opportunity to link to regional and global value chains, whereas other peripheral regions are better suited to serve domestic markets (see framework table below). Suitable policies should focus on two objectives: (i) increasing the competitiveness of the region and its firms, and (ii) improving its connectivity with domestic and international markets. This requires countrywide growth and trade strategies to be aligned with regional comparative advantage.

A framework for competitiveness policies in different types of lagging regions:

Region type	***Nature of policies***
Near the core	- Many traditional regional policies may be effective, including investment incentives and export-oriented incentives
	- Promotion and facilitation of agglomeration, including industrial parks/SEZs and cluster policies
	- Investment climate reforms
Peripheral but with economic mass	- Targeted FDI attraction (following comparative advantage and industry lifecycles)
	- Support for competitiveness of existing industry clusters
	- Transport connectivity and infrastructure
	- Investment climate reforms
	- Firm-level competitiveness interventions (training, finance, etc.)
	- Critical importance of governance
Peripheral and without density	- Limited prospects for export-oriented investment – focus on endowment-based opportunities if applicable (such as mining, agriculture, tourism)
	- Focus on social infrastructure and connectivity
	- Firm-level competitiveness interventions

Better connectivity represents a "two-way road". On one hand, it attracts new investors. But if other critical bottlenecks are not addressed at the same time, the increased competition might force local firms and resources to leave the region (brain drain). It is also important to consider the nature of FDI when formulating policy. Connectivity is much more important for efficiency-seeking FDI than for market-seeking FDI, since accessibility to core regions and to international trade gateways are more relevant for the former.

Source: Farole and Winkler (2012), Farole (2013).

CHAPTER 5

Economic zones and value chains

This chapter emphasizes the necessity of rethinking and modernizing industrial and economic zones to make them best support domestic supply chains links and connectivity for better GVC integration.

5.1. Industrial agglomeration/concentration through economic zone development and value-chain development

Vietnam established its first economic zone in Tan Thuan in Ho Chi Minh City (HCMC) in 1991. Since then six models of economic and industrial concentrated zones have been formed and developed in Vietnam[10]. These zones have defined geographic boundaries, often in geographically advantageous locations, and operate based on specific preferential policies separated from the rest of the economy to promote exports, attract Foreign Direct Investment (FDI), and create jobs, among others. To date, Vietnam has 18 coastal economic zones, 26 border economic zones, and 328 industrial parks as shown in Map 5.1.A. The economic and industrial zones have cumulatively attracted 52 percent of the total FDI in Vietnam, and have accounted for 42 percent of the total industrial output and 52 percent total exports nationwide (MPI, 2018).

Despite considerable achievement over the past 25 years, these models have had mixed results in meeting their desired objectives. The existing zone model faces several constraints, namely the lack of firm links within and outside zones, mostly between lead FDI firms and domestic firms in domestic supply chains, leading to weak spillover effects. In addition, the inconsistent quality and availability of infrastructure inside and outside these zones limits efficient connectivity and locational advantage from a supply-chain perspective. Moreover, the acceleration of planning and establishing economic and industrial zones in the absence of a clear strategic vision, clear demand, and appropriate master planning create unnecessary competition among provinces for limited infrastructure development resources.

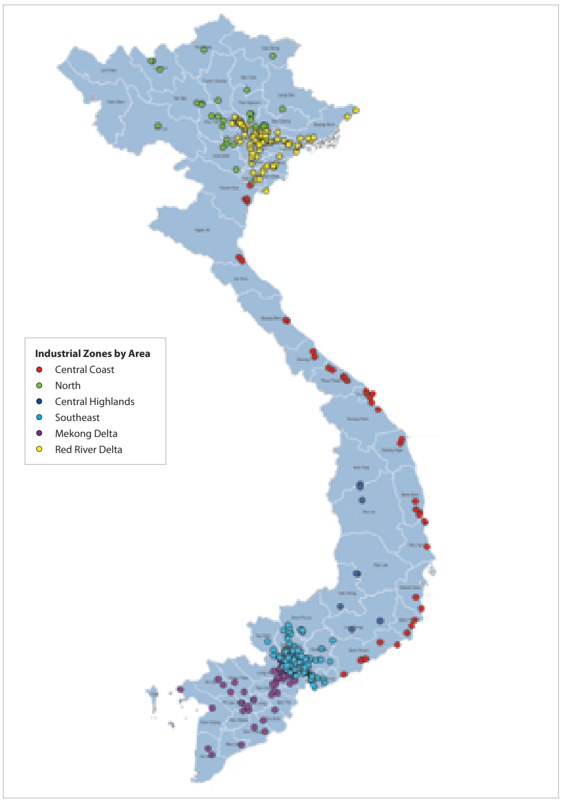
Overall, the zone model faces many challenges, including that the zone planning process—still mostly driven by local government real estate development initiatives—does not match industrial demand (the average occupancy rate of zones in Vietnam is about 40 percent), and industrial and trade-related stakeholders (like the Ministry of Industry and Trade) have not been involved in the process of building a nationwide industrial strategy. These challenges lead to fragmentation and inconsistency. Zones are heavily reliant on fiscal incentives (most zones are competing for generous incentives and as a result are less focused on the overall business environment) and the demand for both skilled and unskilled labor in the zones outnumbers the supply. Furthermore, there is no monitoring and evaluation framework and most zones do not have a solid system to regularly collect and analyze relevant data or help to gauge their progress.

The characteristics and spatial structure of industrial parks and economic zones are far different from those of value chains. Map 5.1 compares the spatial structure of industrial zones to the spatial structure of the textile and garment value chain. Although industrial and economic zones are formed on a small, delimited area designed for multidisciplinary industries with preferential policies, the spatial structure of a value chain opens up in larger areas, sometimes much larger, with preferential policies not applying to the whole value chain.

10 Namely, Export Processing Zones (EPZs), Industrial Parks (IPs), High-Tech Parks (HTPs), Economic Zones (EZs), Concentrated Information Technology Zones (CITZs), and High-Tech Agriculture Parks (HTAPs).

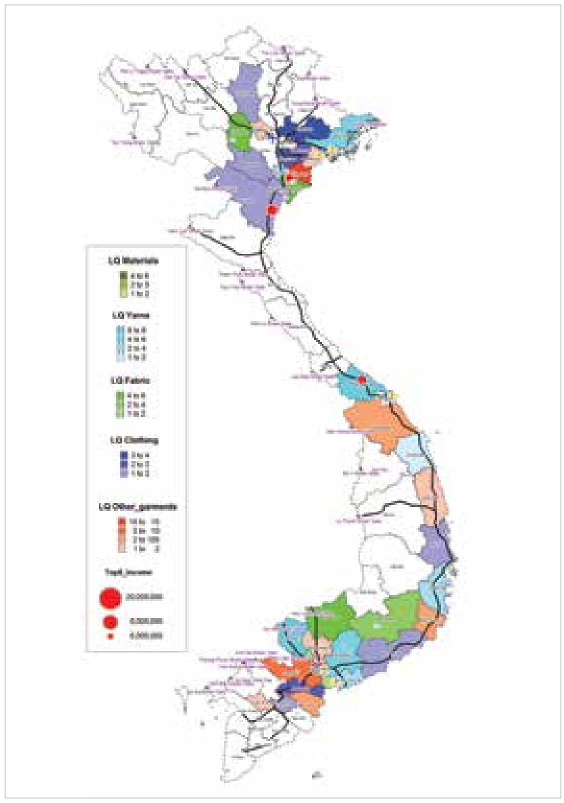
MAP 5.1. **Spatial structure of industrial zones versus the textile and garment value chain**

MAP 5.1.A: ***Industrial zone spatial stucture***



Source: MPI and other sources.

MAP 5.1.B: ***The textile and garment value chain spatial stucture***



Source: I/O Table 2016, Enterprise Census 2011 and 2016.

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International experience shows (Zeng, 2010) that the difference in spatial structure and the policy disparity inside and outside the fenced zones generally prevents or constrains links throughout the entire value chain. Depending on the characteristics of each chain, the effect of interaction differs. The majority of FDI firms get involved at the final processing stage of the production for export, and are located inside zones. Firms at the upstream segments of the value chains—often domestic, private enterprises—are mostly located outside zones (Table 5.1).

TABLE 5.1. **Share of establishments, employment, and revenue of firms in zones**

	Firms in zones (%)	Firms' employment in zones (%)	Firms' revenue in zones (%)
1. Aquaculture			
- Animal food	18.8	59.7	63.4
- Processing	16.5	44.3	46.9
2. Textile and garment			
- Producing yarns	30.9	72.3	83.9
- Producing fabric (weaving, knitting, finishing)	19.5	56.5	67.1
- Clothing	7.4	36.2	36.7
- Other garments	9.2	33.7	41.1
3. Leather and footwear			
- Leather	50.9	82.0	87.0
- Leather products	14.3	8.9	35.7
- Cases and bags	8.8	47.6	44.7
- Footwear	18.5	47.4	52.0
4. 3C electronics (consumer, communication, computer)			
- Electronic components	48.6	78.5	78.6
- Subassemblies			
- Final products	43.4	90.0	97.0
5. Automotive vehicles			
- Parts and components (PTLK)	50.7	87.1	89.9
- Systems - modules	21.7	64.4	73.8
- Final assembly	32.3	40.8	42.2
6. Wood products			
- Sawmilling	5.1	12.2	16.6
- Wood products	5.4	15.3	23.0
7. Rice			
- Seedling	1.3	14.2	25.9
- Planting	0.6	0.4	0.2
- Rice	6.0	14.5	12.5
8. Coffee			
- Processing	5.5	29.5	69.8
9. Rubber			
- Processing	7.6	8.1	45.6
10. Vegetables and fruit			
- Processing	6.4	15.4	17.7

Source: Enterprise Census 2016.

The aquaculture value chain analysis in the report shows that only 16.6 percent of aqua-processing firms are located in economic zones, but account for 44.3 percent of sectoral employment and generate 46.9 percent of sectoral revenue, showing economic zones are hosting the anchor firms in this particular value chain (see Table 5.2).

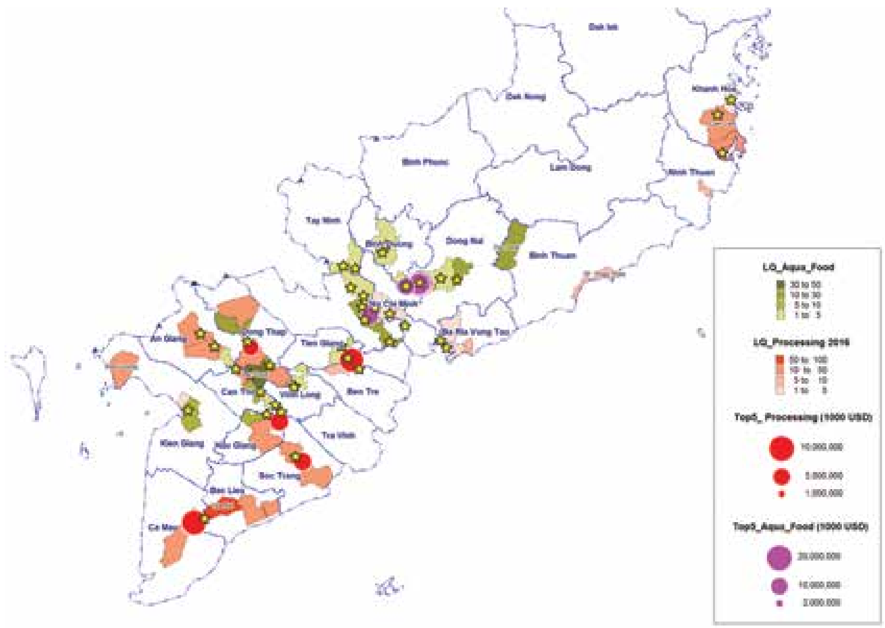
TABLE 5.2. **The aquaculture value chain and related industrial and economic zones**

Aquaculture value chain	Firms			Employment			Revenue (Billion VND)		
	Total	In IPs & EZs	%	Total	In IPs & EZs	%	Total	In IPs & EZs	%
Animal food	776	146	18.8	73,652	43,985	59.7	255,633	162,055	63.4
Aqua-breeding	508	0	0	6,819	0	0	2,366	0	0
Farming (aqua-culturing)	574	0	0	8,981	0	0	3,376	0	0
Nonfarming (fishing)	826	0	0	36,259	0	0	10,265	0	0
Aqua-processing	1,264	208	16.5	197,171	87,442	44.3	228,042	106,849	46.9

Source: Enterprise Census 2016.

Map 5.2 shows the distribution and colocation of aqua-processing and animal food segments, and their firms in the top ten (with industrial density measured by district-level LQs) in relation to industrial parks and economic zones, whose location is marked by stars.

MAP 5.2. **The aquaculture value chain and economic zones**



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Source: Enterprise Census 2016, calculation by authors.

5.2. Economic zones and clusters

An industrial cluster is generally defined as a geographic concentration of interconnected firms in a particular field with links to related institutions. Although clusters come in various forms and several scholars have tried different typologies, all clusters share one commonality: each comprises numerous different size firms belonging to one branch of industry. Box 5.1 presents China's experience in developing cluster-based economic zones and facilitating localized cluster growth.

Box 5.1. China's experience with economic zones and clusters: "top-down" versus "bottom-up"

While SEZs are normally constructed through a "top-down" approach by government policies, most clusters are formed in an organic way through a "bottom-up" process. Some clusters, however, have emerged from or within industrial parks or export-processing zones over time, but not often in low- and middle-income countries. Because cluster formation takes time and requires an ecosystem based on market forces, the purely top-down approach to cluster creation should be exercised with caution, especially in low-capacity countries, where many such efforts have failed. The challenges, however, should not necessarily prevent governments from facilitating the formation, growth, or scale-up of emerging clusters. Inevitably, it is easier to devise policies for a functioning cluster and devilishly hard to call a cluster into existence. In this sense, a mixture of bottom-up and top-down approaches to cluster development is possible. Some cases in China perfectly illustrate this "mixed" approach.

Despite that governments can have more control in developing SEZs than industrial clusters, an SEZ is not necessarily easier to develop, and many SEZ initiatives have failed. The success of SEZs requires a capable government and a well-functioning market system, at least within the zone or park. Designing an SEZ using a purely cluster approach might be possible but there is a risk of failure unless the market signals are clear, and the government has a perfect understanding of the domestic comparative advantages, and market situations (both domestic and international) that are often beyond their capacity.

In China, while market forces are usually responsible for the initial inception of local industrial clusters, the government supports or facilitates them in various ways, including setting up an industrial park based on an existing cluster, like the Wenzhou (Zhejiang province) footwear cluster, and the Foshan (Guangdong province) home appliances cluster, etc. Meanwhile, after decades of development, some clusters have begun to grow out of certain SEZs, like the information and communication technology clusters in Zhongguancun (Beijing) and Shenzhen, the electronics and biotech clusters in Pudong (Shanghai), the software cluster in Dalian, and the optoelectronics cluster in Wuhan. The emergence of these clusters actually hinges on the success of the SEZs, which serve as their "greenhouse," and on market forces over time. Furthermore, in recent years, some cities have set up cluster-type industrial parks, or "specialized industrial parks," such as the liquid crystal display (LCD) high-tech park in Kunshan, and the Wuxi Wind Power Science and Technology Park and the Photovoltaic Industry Park in Jiangsu Province. In these examples, two different models are converging. However, despite the fact that in recent years SEZs and clusters in China have overlapped to some extent, in most cases their origins, development trajectories, market segments, firm compositions, operation levels, and success factors are different.

The key factors of China's success in developing SEZ and industrial cluster include:

- *Strong governmental commitment and support to pilot market-oriented economic reforms*. This determination ensures a stable and supportive macroenvironment for reform and new policies.
- *Institutional autonomy*. Local governments were given the authority to develop and manage zones or clusters, which allowed them more freedom in pursuing new policies and development measures deemed necessary to vitalize the economy.
- *Technology learning, innovation, upgrading, and strong links with the domestic economy*. It is important to emphasize technology learning and innovation, and foster links between zones, domestic enterprises, and industrial clusters through supply chains or value chains.
- *Clear objectives, benchmarks, and competition*. Coupled with their autonomy, SEZs or industrial clusters are closely measured and monitored against their objectives, and competition also helps to maintain good performance.
- *More support for local clusters*. While the government put a lot of effort into SEZs, they also gave more support to developing and upscaling local clusters.

Source: Zeng (2010, 2015).

5.3. How economic and industrial zones can contribute to value-chain creation and development

The first policy objective for leveraging economic and industrial zones to create and develop value chains is that these zones should promote value-chain links and connectivity. This requires a clear strategic vision and appropriate master plans. Second, zone policies also need to be revised and supplemented to promote cluster development. Cluster links, while they may not fully reflect the entire value chain, include important links of one or more value chain that require spatial and policy priorities to facilitate input-output links of the broader chain. Both policy objectives similarly promote links and connectivity. Third, policies should also address the impacts of urbanization and spontaneous zone development along the main transport corridors. The following policy recommendations target these three broad objectives.

We acknowledge it is not always easy or even practical to stick industrial zones with policy objectives of creating cluster links. Often the "beggar can't be the chooser", especially for poorer and peripheral provinces. The successful model of the Nomura Industrial Zone in Hai Phong was so costly that even Ho Chi Minh City, Hanoi, and Danang—which are in a much better position to select and direct FDI projects—failed to duplicate it due to immediate pressure to attract investors. This suggests that good master planning is not enough. Supportive measures to nurture and strengthen business links along the value chains to build up clusters are more crucial to achieve the master plans' goals.

Vietnam's recently launched supplier development program is a supportive measure that developed to ensure firms can respond to investor demand, build small and medium enterprise (SME) capacity, and embed a comprehensive set of policies in links. The program was launched by the Industry Agency under the Ministry of Industry and Trade in collaboration with IFC in 2018.

Policies should also address the impacts of spontaneous zone development along the main transport corridors. In Vietnam, there seem to be issues with over or under capacity of infrastructure (for example ports) between the North and South. Policies should promote an integrated approach to infrastructure upgrading within transport corridors, particularly those connected to trade gateways, to avoid independent upgrading (for example of a port) and bottlenecks in connecting infrastructures (for example connector roads).

It is also important to ensure SEZs that aim to attract FDI do not penalize local procurement, but instead, that such policies support links to local suppliers (see Box 5.2).

Box 5.2. Policies supporting links and the role of economic zone

Investment, incentives, and rigid requirements from foreign investors should not penalize local procurement. First, investment incentives like waiving import duties could disincentivize local sourcing, if value-added tax or other taxes still apply for domestic procurement. Other disincentives include restrictions on the flow of goods and labor in and out of SEZs, or barriers for trading between firms inside SEZs with firms outside. The reason for these practices could be a combination of export processing focus from foreign investors, but also the spatial and legal structures that govern SEZs thereby inhibiting integration of domestic actors outside the SEZs. Second, the government should encourage foreign investors to use flexible approaches to local sourcing to integrate domestic firms, especially SMEs, into their supply chains. Innovative approaches could include breaking procurement into smaller lots, establishing parameters for contracting with groups of smaller firms, or offering accelerated payment terms and upfront payment.

Strategies and incentives policies to attract foreign investors can incorporate investment targets. These include access to fiscal incentives and privileged land and facilities (for example, in economic zones). For example, the government could require potential investors to prepare a local link and spillover strategy as part of their licensing application package. This will work well for large-scale FDI projects that are likely to deliver substantial long-term rents. In cases where potential investors are competing for access to a concession, an exploration license, or some other exclusive right, the submission of their local link and spillover strategy could be a component of the evaluation. In Australia's mining sector, for instance, an Industry Participation Plan is required to access tariff concessions offered to investors in the sector. Criteria for assessing an Industry Participation Plan include, among others: employment creation, skills transfer, regional economic development, technology transfer and R&D, and "full, fair and reasonable opportunities" for suppliers to tender. Below is a summary of policy recommendations that can be considered when implementing link policy, including targeting, institutional arrangements, coordination, and monitoring:

- Spillover policies should be integrated directly into national industrial policies.
- Many low-and-middle-income-country governments will need to build capacity in their own institutions to implement spillover policy effectively.
- Responsibility for delivering the spillover agenda should be held at a senior ministerial level rather than as an add-on activity for the investment promotion agency.
- Given the huge potential base of beneficiaries in the domestic supply sector, targeting will be necessary.
- Another approach for targeting and efficient delivery may be to implement some supply-side interventions through existing industry clusters.
- Where technical support is provided to domestic SMEs, concurrent financing support should be included.
- Finding sustainable funding for link and spillover programs should be a priority at the outset.
- Matching grant programs can be another way to develop sustainable funding and can help crowd-in additional financing from foreign investors.
- Establish sector forums for communication and coordination between government and the private sector around links and spillovers.
- Multistakeholder partnerships can be effective in designing and delivering link and spillover programs.
- Multistakeholder dialogues can be effective in managing expectations.
- Monitoring is critical to ensure more effective policy and to encourage transparency and facilitate communications.

Many country cases suggest policies fostering links as part of systematic supplier development programs, industrial upgrading programs, and spatial development programs, that also integrated investors and their requirements, and emphasized local capacity building were most successful. These are seen in Singapore, Malaysia, Chile, Costa Rica, and South Africa, compared to measures that were merely supply-driven, and neither comprehensive nor focused on active support for SME capacity building. One issue to consider is scale: many programs can only handle a limited number of suppliers, so including the private sector or establishing public-private partnerships is key. But case studies also show that programs targeting the most promising suppliers led to the best outcomes.

The government should lead the planning on the comprehensive framework for link development and discuss with multinationals who take a lead in implementing these programs. This parallel approach will help leverage complementary activities and secure additional private-sector funding. It will also be effective in meeting investor demand. For example, foreign investors could provide operational assistance to suppliers, while government support programs focus on more general management and technical training. Or, multinationals could offer consultancy on quality improvement, while national quality bodies assist with certification. Or, investors might offer technical training, while government programs incentivize the use of new technology.

Experience has shown that supplier development programs are instrumental in attracting and retaining additional FDI. This is because foreign investors that have developed strong links in the host economy are less likely to leave due to the high costs of building new supplier networks. Small development projects (SDPs) can also help attract additional FDI. Established local firms that are productive and supply multinational enterprises (MNEs) are a big draw for new investors looking to set up operations in a country.

Source: Farole and Winkler (2014).

While private firms can help train the local workforce, governments should take a proactive training approach to prepare their labor force and domestic firms to meet the needs of foreign operations. This should be part of the government's investment promotion plan whereby they identify what type of FDI they would like to attract and then conduct a supply-side analysis to assess whether the current workforce has the necessary skills (vocational, managerial, etc.) and whether domestic firms can meet the required standards (for example labeling standards, sanitary, and phytosanitary standards, etc.).

For example, in countries with plentiful natural resources, governments can set up centers for necessary vocational training and certification like for oil and gas technicians. Similar programs can be developed for the manufacturing, agriculture, and services sectors. The government can also work with education and training institutions and industrial associations to set up apprenticeship programs and provide incentives like training credits to encourage the private sector to collaborate on vocational training and certification.

Box 5.3 describes an ongoing donor-funded initiative in Uganda (the E4D/SOGA program) that provides health, safety, and environment (HSE) and bid management training to local suppliers.

Box 5.3. Employment and skills training in uganda (E4D/SOGA)

The E4D/SOGA project promotes local skills development and enterprise capabilities to enable participation in natural resource-based industries. The project is jointly funded by BMZ, UKAID, NORAD, and Shell, and implemented by GIZ GmbH. E4D/SOGA supports local suppliers in Uganda's oil industry through HSE training (phase I) and bid management training (phase II).

Phase I was implemented in 2016–17 by E360 (a Ugandan firm specialized in HSE training), Astutis (a leading international HSE training provider), and the Association of Ugandan Gas and Oil Service Providers (AUGOS). This project phase was implemented in three stages to enable 30 local companies to successfully adopt industry-compliant HSE practices. In the first stage, the program selected 30 companies and 60 participants in consultation with AUGOS, and assessed firm-level training needs. In the following stages, participants completed two weeks of in-house, tailored HSE training, and two months of coaching at the firm level to implement company-specific HSE changes. Preliminary results suggest that 24 of the 30 companies believe they are better equipped to win tenders as a result of the project, and 128 supplier agreements have been made since. A total of 462 jobs have been created as a result of the increase in contracts awarded to these companies.

Following the positive impact of phase I, E4D/SOGA (in conjunction with E360) is implementing a second phase to improve the competitiveness of Ugandan enterprises in bidding processes. Over 230 companies applied for the training, from which 40 companies and 80 decision-makers were selected through a competitive process. This ongoing initiative (launched in January 2018) plans to train participants in market research, developing sales master plans, pricing strategies, financial planning, and setting up strategic partnerships. Twenty of the participating enterprises will receive further support through individual mentoring and coaching.

Source: Ritwika Sen, "Enhancing local content in Uganda's Oil and Gas Industry." UNU-WIDER working paper 2018/110.

In South Korea, the Masan Free Trade Zone (FTZ) provides a good example for generating links between the zone and local firms, where Masan FTZ administration actively promoted the link between local industries and investors in the FTZ. FTZ firms have linked to the local economy through subcontracting and domestic purchases, and have performed positively in generating net exports and spillover effects. By doing so, the zone authority allowed preferential access to intermediate goods and raw materials to local companies supplying FTZ firms. In addition, the zone administration provided technical assistance to subcontracting firms. Granting 'equal footing' to local suppliers of capital and intermediate goods, and using subcontracting mechanisms from zone enterprises to local producers were among the most effective measures. These methods, combined with overall trade and investment reforms, fostered successful export-oriented zones and backward/forward links between the FTZ and the local economy (Jeong and Zeng, 2016).

CHAPTER 6

Implementing trade-oriented connectivity and competitiveness policies

This chapter highlights key policy recommendations.

6.1. Making connectivity policy and transport investment more robustly trade-oriented by integrating the comprehensive value-chain connectivity assessment and trade gateways analysis

At present, the objectives of improving trade growth and trade competitiveness are not clearly linked with the objectives of developing connectivity policies and investment transport infrastructure. Trade information, especially on value chains, is rarely used in policy formulation and implementation. There remains a lack of in-depth analyses on spatial structure and connective propensity along various linked segments of value chains to inform relevant policies and investment for transport infrastructure development. This chapter suggests related policies, transport master plans, and investment priorities should be formed and implemented to support trade more strongly.

Chapter two provided a new four-step methodology for a comprehensive value-chain connectivity and competitiveness assessment that identifies corridors and gateways critical for key domestic export-oriented value chains. These corridors are defined based on spatial structure of input-output links, industrial concentration, and hierarchical connective propensity linking all segments of value chains with international trade gateways. This important information should guide related policies for and investment to transport infrastructure to effectively enhance trade competitiveness and improve GVC integration. The chapter identified key trade corridors and gateways for ten selected value chains (see section 2.1) of national comparative advantage, good trade performance, and governmental priority. These are the aquaculture, textile and garment, leather and footwear, electronics and electrical equipment, motor vehicles, wood products, rubber, rice, coffee, and fruits and vegetables value chains.

Furthermore, chapter three scrutinized international trade gateways and their trade flows and structure showing the share of total trade through air gateways has increased rapidly from 15.6 percent in 2011 to 39.5 percent in 2016, while the share of trade via sea gateways plummeted from 78.8 percent in 2011 to 56.1 percent in 2016. This primarily reflects the drastic shift in export structure from primary exports including crude oil and non-oil (coal, stone, sand, gravel, aluminum, copper, etc.) and resource-based export (agriculture-based products) to high-tech exports (electronics, cell phones, incorporated circuits, etc.). This structural change in products –a rapid increase in small but valuable products like mobile phones, electronic components, high fashion exports, and high-value, processed agricultural products requires the transport system and its investments supporting exports to consider a shift from logistics perspectives, based not only on trade growth but also (and more important) on structural change and developing domestic value chains.

We suggest formalizing the comprehensive value-chain connectivity and competitiveness assessment and trade gateway analysis into new transport and trade strategies. Actions would require authorities to formalize these analyses and appoint lead agency and research institutions to regularly conduct these studies, guide interagency coordination, and integrate their outputs and outcomes into trade policy, export-import strategy, and national and provincial socio-economic development strategies and master plans.

One of the proposed activities is to include the information and policy analyses on the trade flows and key value chains into the transport strategy for 2030. Trade-related indicators should be factored into renewed transport strategy to better benchmark Vietnam against international practice and to monitor policy implementation. Key trade indicators would include trade cost reduction, and Vietnam's improved position in the interrelationship between efficient connectivity, measured by the quality of trade-related infrastructure, and trade development, measured by trade per capita, etc.

In conjunction, the import-export strategy for 2030 should also be renewed to include trade-related infrastructure factors including policies concerning transport and logistics. Similarly, Vietnam should consider including infrastructure-related indicators such as trade-related transport capacity (road, airway, seaway and ports, railway) and logistics performance indicators into import-export strategy to promote this critical policy coordination.

In selecting ten value chains to demonstrate the four-step methodology for value-chain-based connectivity and competitiveness analysis in chapter two, the report used existing datasets to produce empirical results. Looking forward, when scrutinizing structural changes in developing GVCs, policy makers should also account for mega trends that may disrupt GVCs, notably the acceleration of the digital transformation and associated de-globalization process. Over the medium to long term, GVCs will consolidate, with fewer countries and firms participating. Automation may result in reshoring manufacturing and therefore the comparative advantage in cheap labor enjoyed by low-and-middle-income countries like Vietnam may be quickly eroding. In other words, infrastructure investments should not only support current economic activities (and, therefore, inevitably reinforce the current economic structure), but also be forward-looking and consider emerging trends and future developments. The proposed methodology allows for close follow-up with dynamic change in spatial structure and connective propensity of existing and emerging value chains in Vietnam.

Policy makers may face some trade-offs when using information on GVC-based connectivity for master planning given limited resources and capacity. For example, developing connective infrastructure and gateways to support electronics GVCs may come at the expense of aquaculture value chains. This is already happening in Vietnam, when infrastructure in the Mekong River Delta does not keep pace with rapidly rising demand, while in the North, activities along some highways are relatively low.

6.2. Establishing an efficient mechanism for coordinating trade and transport connectivity and GVC policies, and implementing policy recommendations

It is vital to establish an effective interagency coordination mechanism to implement this recommendation for multisectoral policies and investment related to pro-trade transport infrastructure and GVC integration. This mechanism should be put in context for Vietnam to enhance its trade competitiveness.

An institutional framework for implementing trade-oriented connectivity policy that supports enhanced national competitiveness and GVC participation is essential. Figure 6.1 presents the integrated four-pillar framework for trade facilitation and logistics (Pham and Oh, 2018).

FIGURE 6.1. **Integrated four-pillar framework for trade facilitation and logistics**

1. Regulatory framework for trade facilitation and standards

- *Actors:* Customs, border management and trade-related specialized agencies;
- *Policy levers:* (i) rationalize non-tariff measures; (ii) simplify customs and other border management procedures; (iii) apply risk-based inspections and post-clearance audits; (iv) target Information Communication Technology (ICT) and single window; and (v) make regulations transparent.

2. Trade-related infrastructure and connectivity quality

- *Actors:* Government (MOT, MOIT, MOF, MPI) and the private sectors;
- *Policy levers:* (i) master planning on trade growth demand; (ii) intermodal coordination; (iii) investment policy for efficient use with private sector participation.

3. Regulations for logistics services, logistics service providers/users

- *Actors:* Transport operators, logistics service providers and users;
- *Policy levers:* (i) competitive logistics services; (ii) human capacity.

4. Institutional framework for inter-agency coordination and implementation arrangements

- *Actors:* Government (leaders, public agencies, the private sector, development partners);
- *Policy levers:* (i) improved interagency coordination; (ii) institutional capacity building and change management; (iii) mechanism for enhancing consultation and partnership with the private sector; (iv) clear roles, responsibilities, and implementation arrangements; (v) practical results framework and regular performance monitoring.

Source: Pham and Oh (2018).

Pillar one covers issues related to the regulatory framework for trade facilitation and standards that involve customs, border management, and trade-related specialized agencies. Pillar two deals with trade-related infrastructure and connectivity quality, the main topics of this report. The main actors are line ministries like Ministry of Transport (MOT), Ministry of Industry and Trade (MOIT), Ministry of Finance (MOF), and Ministry of Planning and Investment (MPI), among others, and the private sector. Policy levers include those responsible for developing connectivity policies, transport master plans, and prioritized investments to support trade growth, for intermodal coordination, and for formulating investment policy for efficient use with private sector participation. Pillar three covers regulations for logistics services and providers including transport operators and logistics service providers and users, mostly in the private sector.

Pillar four on consolidating the institutional framework for interagency coordination and implementation arrangements involves government leaders, actors from the three other pillars, the private sector, and development partners. Policy levers are those that (i) improve interagency coordination, (ii) build institutional change management capacity, (iii) establish mechanisms for enhancing consultation and partnership with the private sector, (iv) develop clear roles, responsibilities, and implementation arrangements of key stakeholders, (v) and develop practical results frameworks and regularly monitor reform performance.

The report recommends that the National Trade Facilitation Committee (NTFC) should take the lead in coordinating trade, trade-related transport, and GVC policies by providing strategic direction and guidance, and supervising related multisectoral policies, particularly for delivering Policy Recommendation One. This committee was established according to the Prime Minister's Decision

1899/QD-TTg dated April 10, 2016, chaired by Deputy Prime Minister Vuong Dinh Hue, with senior representatives from 20 line ministries, primarily to comply with the WTO's Trade Facilitation Agreement (TFA). More important, this committee has been assumed to coordinate multiagency efforts to facilitate trade, reduce trade costs, and improve trade competitiveness.

In response to the World Bank's policy recommendations (Pham and Oh, 2018), the Prime Minister issued the Decision 684/QD-TTg dated June 4, 2019 to revise and supplement the Decision 1899/QD-TTg by adding the role to coordinate interagency efforts on national logistics development. This additional function makes the upgraded NTFC a perfect body to coordinate multisectoral policies on trade, traded-related transport and connectivity, and GVC development for trade competitiveness as proposed in the four-pillar framework and all recommendations in this report. We further suggest strengthening this mechanism by recommending the committee appoint an interagency taskforce to assist managing this assumed task.

6.3. Securing firm-level data for qualified multisectoral policy analyses on trade, transport, and value chains

Relevant data sets should be in place with appropriate and regularly updated statistical indicators on value chains and gateways to ensure reliable analysis informs connectivity policy and investment in trade-related infrastructure. Much of the information and data needed for such analyses is missing and/or difficult to collect. This is partly due to a new approach that requires complex datasets and time for statistical systems to respond, but more important due to strict regulations for disclosing raw and firm-level data. We propose issuing relevant regulations to make firm-level trade and transport data available for comprehensive value-chain connectivity assessment and trade gateways analysis, as well as establishing an effective mechanism for better data collection, processing, and coordination at national and sectoral statistics levels among the General Statistics Office (GSO), the Ministry of Transport, the General Department of Customs, and others to supplement the data. Innovative methodologies using big data for real-time analysis should be explored toward this modern policy formulation process.

The availability of such information and analysis can help address so-called information externalities and agglomeration effects (Krugman, 1991). Greater competitiveness and effectiveness require specialization in areas where an integrated presence of related and supporting activities can support an optimum productivity level that any individual company would find hard to achieve.

The analysis would use considerable firm-level data to address research questions and inform key findings. Disaggregated data would be combined from various sources, including: (i) input-output data for value-chain link identification, (ii) enterprise data (per industry, per province, per commodity, per industrial park, per industry, etc.) for capturing regional concentration of domestic supply chains, (iii) transportation data and origin-destination (OD) flows (both within supply-chain structure and between cluster locations and trade gateways), and (iv) border/port trade data (land gateway, seaport, and airport) with the Harmonized System (HS) code of export and import volume.

Input-output table data for value-chain links identification: Input-output (I/O) tables focus "on the interrelationships between industries in an economy with respect to the production and uses of their products and products imported from abroad." (UN, 1999). In Vietnam, an I/O table is a model that reflects inter-sectoral relationships in the whole process of production and usage of products for final consumption, asset accumulation, and export of goods and services for the entire economy. In other words, an I/O table indicates how many products of other sectors are needed to produce a final product for an industry and vice versa. It allows researchers to analyze inter-sectoral relationships, evaluate production efficiency, and calculate indicators and indexes for macroeconomic management, economic analysis, and forecast. Vietnam's I/O table 2016, developed by the GSO, is the sixth edition of the I/O table, covering 164 industries.

This study uses I/O tables for sectoral, value-chain mapping based on backward links. Starting from sectors producing final products, first-tier sectors are defined as inputs purchased directly by the initial sectors. Repeatedly, second-, third- or lower-tier supplying sectors are computed. Once the main source industries are identified, we can diagram the value chains. Diagrams show the respective inputs (including their sector classification codes) and the direction of flows.

Enterprise data for capturing regional concentration of domestic supply chains: In Vietnam, the GSO has conducted Enterprise Censuses every five years since 1995 and sample surveys every year between the censuses. The Enterprise Censuses of 2011 and 2016 are the two most recent. The censuses and surveys collect basic information on enterprise business activities, labor, operating results, investments, etc.

We use Enterprise Census data to calculate the location quotient (LQ) index for each district and province, which allows us to analyze industrial agglomeration at district and provincial levels across the country, and to map potential industrial clusters and value-chains links from the I/O table.

Transportation data and origin-destination (OD) flows: This model utilizes disaggregated commodity flow data, for the most freight intensive activities, to estimate existing freight flows across the network by mode (road, rail, inland waterway, and air) and OD information on key clusters with domestic supply-chain structure of commodities. In Vietnam, the MOT has conducted some OD studies, but they are not necessarily linked nor regularly conducted. Commodities included in these studies were not matched with VSIC system. The Enterprise Census questions should be revised to collect missing data and information on transportation OD flows to create a standard model that—even if it were improved—could be used by provincial and central-level planners and policy makers. The output would be standardized, irrespective of various inputs, and regularly updated.

Customs data for gateway analysis: A key for value-chain analysis and mapping is identifying the location and concentration of trade gateways. Customs data from all gateways, collected and managed by the Vietnam Customs Office, provides this information, including the location and trade value of imported materials and exported commodities at international gateways at HS-8-digit level. Together with these two data sources mentioned above (I/O tables and Census Data), data on trade gateways helps capture all commodities flows and economic activities in a value chain to fully map its connective model – 4.

Data on origin-destination flows of goods from the digital traceability system: Vietnam is relatively more open to trade than other low-and-middle-income countries, with 14 FTAs signed to date. A goods' origin traceability system is crucial for trade facilitation and FTAs effective use. Furthermore, such a system would help not only improve supply-chain performance, but also enable key stakeholders including government agencies and the private sector to collect a comprehensive and reliable value-chain dataset for connectivity and competitiveness analysis and make relevant business decisions. It will also allow policy makers to trace products origins to avoid fraudulent trade and ensure rules of origin for clean production and export. Sooner or later Vietnam should think about developing a digital traceability system for key value chains and could consider block-chain technology as a platform.

Because this value-chain analysis is critical for businesses and the private sector, the report recommends building an information point with convenient access to publicly available information about value-chain links and spatial structure, including but not limited to geographic location and value-chain links, provincial specialization, international gateways' statistics, etc.

To be sustainable, such a multidisciplinary, cluster-development data center would require strong interagency coordination and a government-private sector partnership. Optimally, this center would be managed by a government agency, strongly motivated to use the data (which could oversee development master planning, competitiveness enhancement, and connectivity policy and investments). For coordinating data inputs, this agency should be mandated to work with the various sources of the previously mentioned data sets (GSO, customs, transport, other development partners, etc.) and empowered to manage data sharing with the private sector. Preferably, the center would be overseen by the trade facilitation and logistics policy coordination mechanism of the NTFC proposed in (Section 6.1).

Regular updates and visualization of indicators on industrial concentration and commodities flows is useful for all stakeholders, policy makers, academics, researchers, and businesses alike. Box 6.1 provides a good example from the United States, in pooling a comprehensive dataset and organizing it into key statistical indicators for policy makers and the private sector to use.

The report recommends sharing the information on provincial specialization for all concerned parties including central and local governments, the private sector, and development partners. The information on value-chain links, spatial structure, and connectivity is important not only for policy formulation, but also for the private sector to proactively participate in domestic supply chains as a significant part of GVCs. Such information is crucial to inform the domestic private sector for effective participation into GVCs. This is especially essential in Vietnam where more than 90 percent of the domestic private sector are small firms who lack this information and have weak links to foreign invested firms.

The information on value-chain links, spatial structure, and connectivity could be made available on a cluster-mapping website following the U.S. model, with information collected and analyzed via the comprehensive value-chain connectivity assessment and trade gateways analysis, on big data in real time. It would be developed and shared publicly, for both policy makers and the private sector not only to implement Policy Recommendation One but also to fulfill Vietnam's e-government initiative.

Vietnam should consider developing a similar cluster-mapping project as the United States, with data sources and operational organizations properly ascribed. In addition to the cluster website, online freight-flow modeling can be developed based on OD flow data. The website and online freight-flow modeling would provide dynamic, visual information for governments and businesses to understand and shape the competitive landscape for a range of industries. The website would also help local governments understand local specialization and regional comparative advantages to promote strategic investment and lay the groundwork for new industries.

Box 6.1. Visualization of cluster mapping in the United States

The U.S. cluster mapping website, *www.clustermapping.us*, is a national initiative that provides open data on regional clusters and economies to support U.S. business, innovation, and policy. Users find interactive, robust data and tools to understand clusters and regional business environments, improve institutions, and locate appropriate partners across the country. Launched in September 2014, the website is a collaboration between the U.S. Commerce Department's Economic Development Administration (EDA) and the Institute for Strategy and Competitiveness at Harvard Business School to generate practical and user-friendly cluster tools.

Cluster mapping is designed to enable systematic comparison across regions. Strong clusters are those where their location quotient (the cluster's relative specialization) puts them in the top 25% among U.S. regions in their respective category. The main underlying data source for generating benchmark cluster definitions is the U.S. Census Bureau's County Business Patterns on employment, establishments, and wages by six-digit NAICS code (North American Industry Classification System). These data are collected at state and local level for economic areas, metropolitan and micropolitan statistical areas, and counties. The cluster data on the website is refreshed when new underlying industrial data becomes available, which is typically each year in June or July.

The cluster-mapping website is valuable because it defines a set of standardized national clusters, which allow objective identification of a cluster's regional competitiveness. It also enables comparisons and relative performance measurements between any regions in the United States, which are crucial for understanding and improving regional economic competitiveness. Cluster patterns across the country may reveal unique advantages, disadvantages, and opportunities in a region. Against these national standards, regions can dig deeper using local knowledge to identify their "region-specific clusters". The mapping helps provide information on these region-specific clusters, as many of the initiatives focus on these more specific sectors.

The U.S. cluster mapping website is used by governments, economic developers, and businesses to understand and shape the competitive landscape for a range of industries. Local officials are using the data to make strategic investments, recruit new companies, and lay the groundwork for new industries. Across the United States, cluster-mapping tools enable users to reinvent and modernize economic development strategies – all driven by open data.

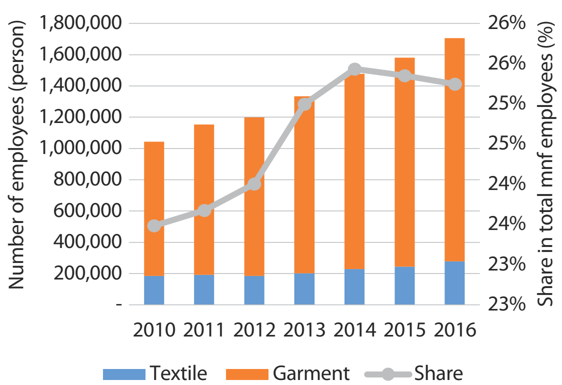
Source: http://www.clustermapping.us

Annex 1

Analysis of the textile and garment value chain

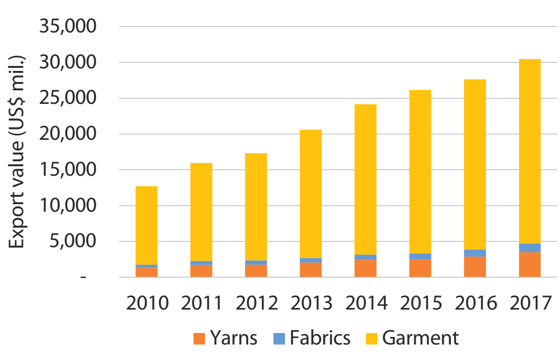
A1.1. Industry overview

FIGURE A1.1. **Employment in textile and garment**



Source: Statistical yearbook 2015, 2017.

FIGURE A1.2. **Textile and garment exports**

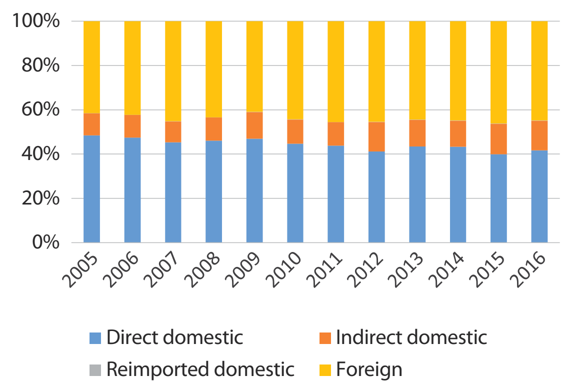


Source: ITC Trademap, 2017.

The textile and garment (T&G) industry has been a key Vietnamese industry for some decades, since the opening of the economy in the late 1980s. As a labor-intensive sector, it generated 25 percent of jobs in the manufacturing sector in 2016. As shown in Figure A1.1, from 2010 to 2016, employment in T&G increased from one million people to 1.6 million, thus on average, about a hundred thousand new jobs were absorbed by the sector each year. Although the absolute number of employees increased, the sector's share in total manufacturing employees decreased slightly from 25.4 percent to 25.2 percent, implying faster employment growth in other manufacturing sectors.

T&G has been a major exporting sector for decades. Figure A1.2 shows export value grew an average of 14 percent per year, from US$ 8 billion in 2007 to US$ 31 billion in 2017. Clothing is a major export product of the sector, with more than 80 percent share, while exports of upstream products (yarns and fabrics) contributed 11 and 4 percent respectively.

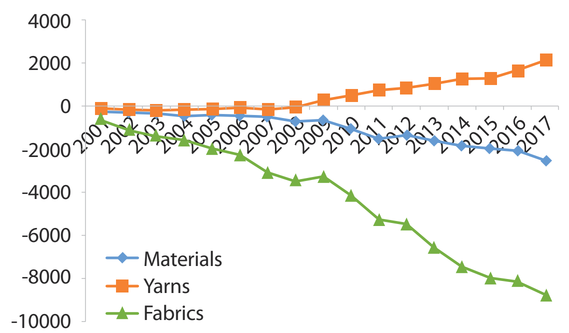
FIGURE A1.3. **Decomposition of the T&G export**



Source: OECD, 2017.

Figure A1.3 illustrates the decomposition of gross exports in the sector. The foreign value-added component in Vietnam's T&G export increased slightly from 42 percent in 2005 to 45 percent in 2016. In the same period, direct domestic value addition dropped from 48 percent to 42 percent. This decrease was compensated by an increase of 3 percent in indirect domestic value addition, from 10 percent to 13 percent. Clearly, the T&G sector has not changed their structure in value addition in the last decade. However, even though the value addition shares did not change dramatically, the level of domestic value addition grew substantially.

FIGURE A1.4. **Trade balance of up- and mid-stream T&G segments**



Source: ITC Trademap, 2017.

The situation of the T&G sector is reaffirmed by the trade balance of upstream segments. As shown in the Figure A1.4, Vietnam gained a trade surplus in yarns from 2008, but had trade deficits in raw materials and fabrics – inputs and outputs of yarns. This is to be expected given the country imports upstream inputs for downstream production and export. Trade balance data show Vietnam's T&G sector relies heavily on imported inputs. However, the sector may find it difficult to satisfy the rules of origin of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the European Union Vietnam Free Trade Agreement (EVFTA) and enjoy their tariff preferences.

A1.2. Value-chain links

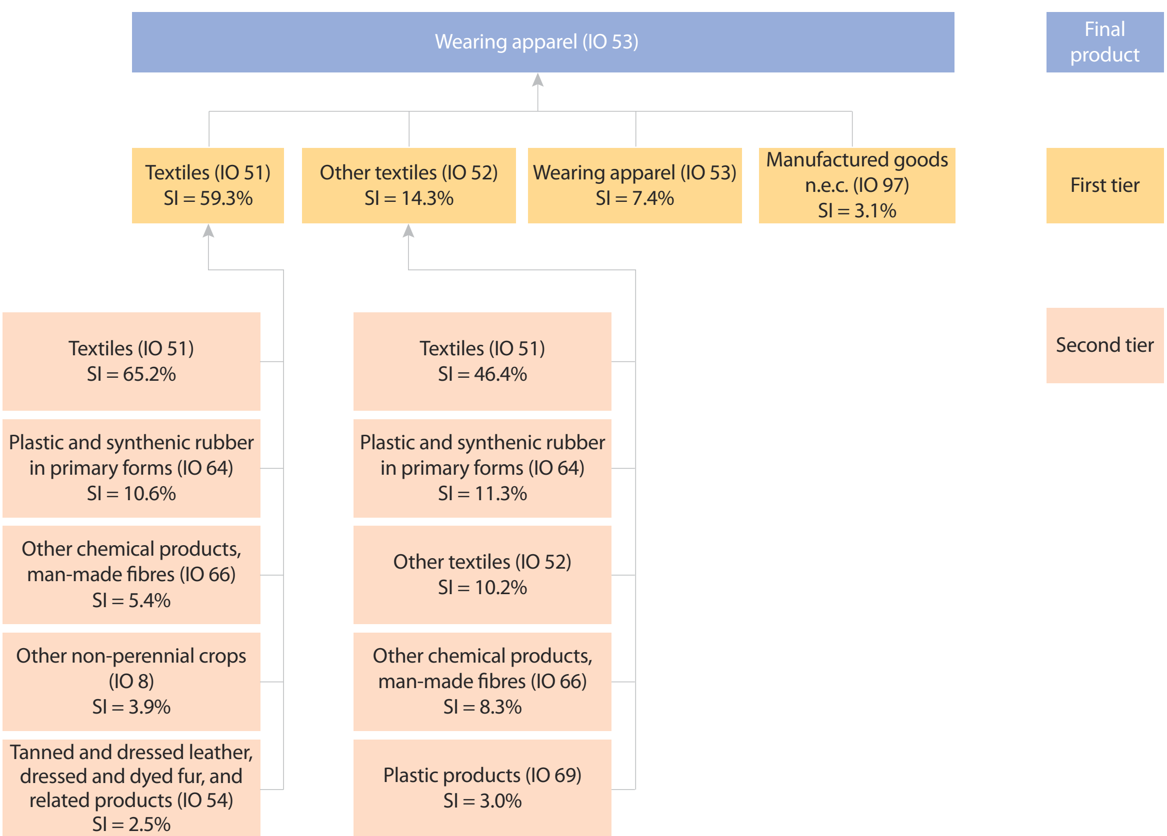
The T&G value-chain structure obtained from the 2016 input-output (I/O) tables is shown in Figure A 1.5. The analysis applies a sourcing intensity of 2% as threshold. That is, those supplying sectors with sourcing intensities below 2% are not considered in the graph. In addition, the analysis excludes services inputs and activities (for example agricultural services) as well as capital goods (for example machinery) and also does not consider forward links to consuming sectors (for example wholesale/retail trade).

In 2016, the top four first-tier supplying sectors to wearing apparel were textiles (59.3%), other textiles (14.3%), wearing apparel (7.4%) and manufactured goods not elsewhere classified (n.e.c). (3.1%), representing 84 percent of total inputs to the sector. For the subsequent analysis the exact underlying percentages are not critical; the main goal is to identify the T&G value-chain links and structure, the location of actors involved in certain value-chain segments, and their connectivity.

The main suppliers to the textile sector include inputs from the textiles sector itself (65.2 percent of all inputs supplied to the textiles sector), but also plastics and synthetic rubber in primary forms (10.6%), other chemical products, man-made fibers (5.4%), other nonperennial crops (3.9%) and leather and fur (2.5%).

The largest supplying sectors to other textiles are almost identical and include the textiles sector (46.4 percent of all inputs to other textiles), followed by plastics and synthetic rubber in primary forms (11.3%), other textiles (10.2%), other chemical products, man-made fibers (8.3%), and plastic products (3%).

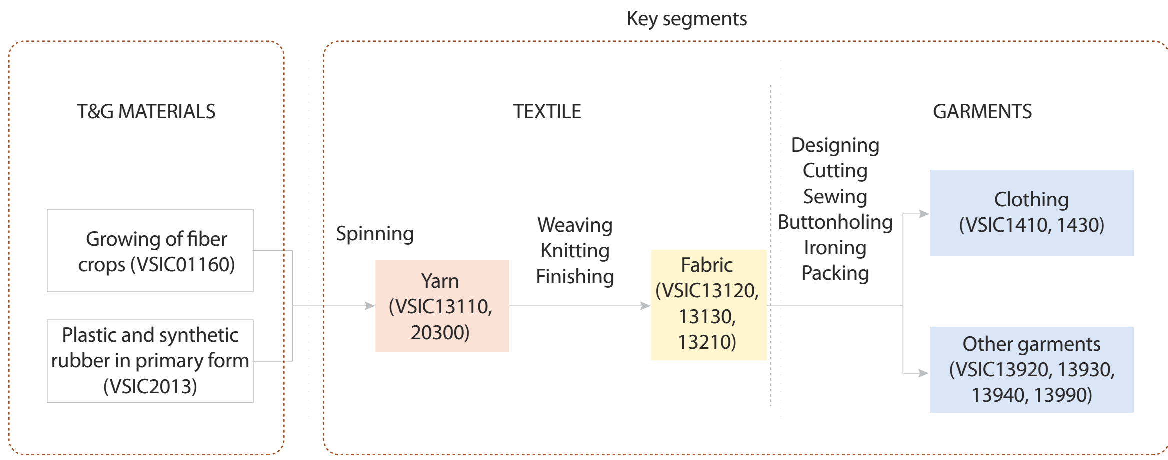
FIGURE A1.5. **T&G value-chain links**



Source: I/O Table 2016, authors.

Comparing the value-chain structure against existing value-chain maps confirms the most relevant inputs to apparel production are natural and synthetic fibers as well as yarn and fabrics. Industry experts suggest the refined T&G value-chain links depicted in Figure A1.6. The T&G value chain consists of five segments: (i) Producing materials (growing fiber crops and plastics and synthetic rubber in primary form), (ii) Producing yarns (spinning), (iii) Producing fabric (weaving, knitting, finishing), (iv) Garments (designing, cutting, sewing, buttonholing, ironing, packing), and (v) Other garments (designing, cutting, sewing, buttonholing, ironing, packing).

FIGURE A1.6. **T&G value-chain segments**



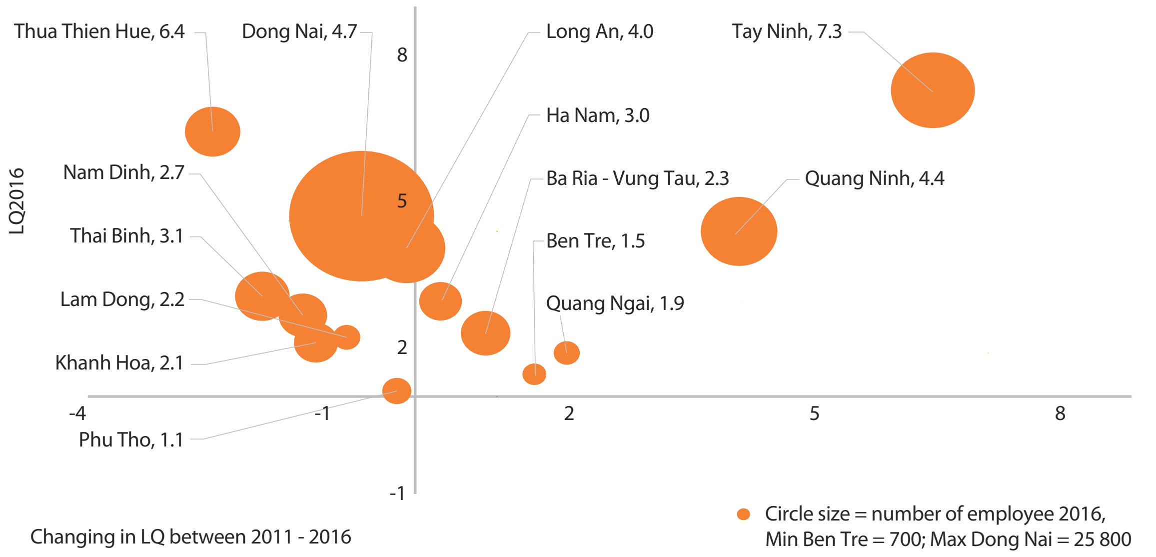
Source: Authors.

A1.3. Spatial structure and value-chain mapping

This section identifies geographic locations of clusters linked to the five segments of the T&G value chain. Scatterplots show the location quotients (LQs) by province for each segment. Figure A1.7 shows the spatial structure of yarn production, the second segment of the T&G value chain. The provinces above the horizontal y = 1 line are those for which the LQ exceeds 1, in other words whose relative specialization in yarn production is greater than the national average, based on employment data. Those provinces in the upper-right quadrant additionally increased their LQ between 2011 and 2016, which can be interpreted as stronger relative specialization in yarn spinning. The circle size denotes actual employment in the province in 2016.

Specialization patterns by province suggest Tay Ninh has the highest relative specialization in yarn production and also strengthened its specialization over time. Thua Thien-Hue has the second largest relative specialization by LQ, but their specialization declined from 2011. Dong Nai has the third largest relative specialization and employs many more people in yarn production. However, its relative specialization declined over the previous five years. Quang Ninh and Long An are also important provinces in their specialization in yarn production, but only the former became more specialized between 2011 and 2016.

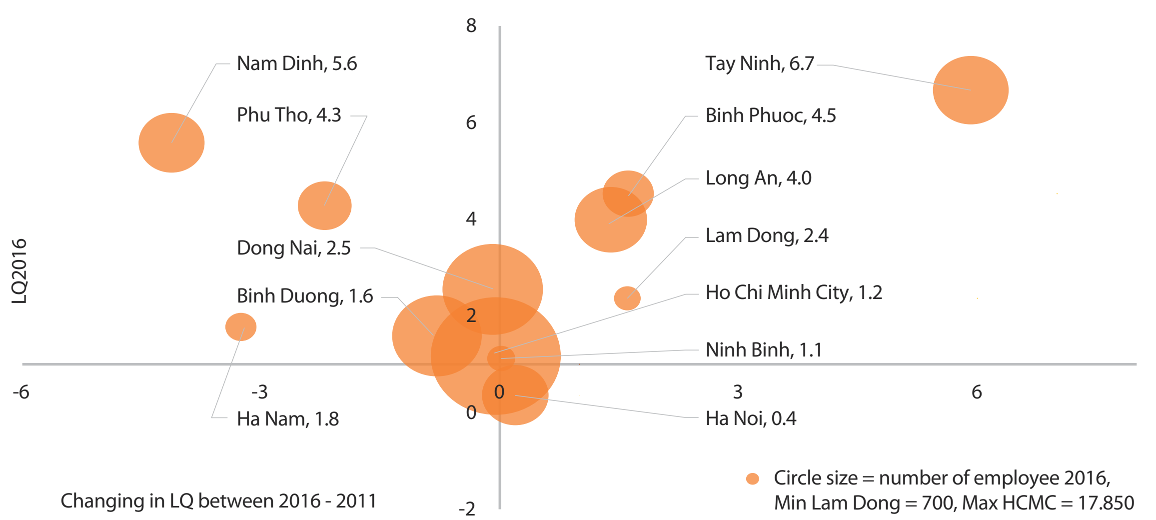
FIGURE A1.7. **Locational distribution of the yarn segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Shifting to the fabric segment, Figure A1.8 shows the growing importance of Tay Ninh not only in yarn production, but also in weaving, knitting, and finishing fabrics. The province had the highest LQ and greatest expansion of the segment since 2011. Other provinces specialized in yarn spinning also specialized in fabric weaving, knitting, and finishing, including Nam Dinh, Long An, Phu Tho, Dong Nai, and Lam Dong. Binh Puoc and Long An both had a relatively high specialization in 2016 and a strong increase since 2011 (upper right quadrant). And, while Ho Chi Minh City had a low and relatively constant LQ, it employed the largest number of workers in the fabric segment. Other provinces reduced their relative specialization in fabric production, in particular Nam Dinh, Phu Tho, Ha Nam, and Binh Duong, among others (upper left quadrant).

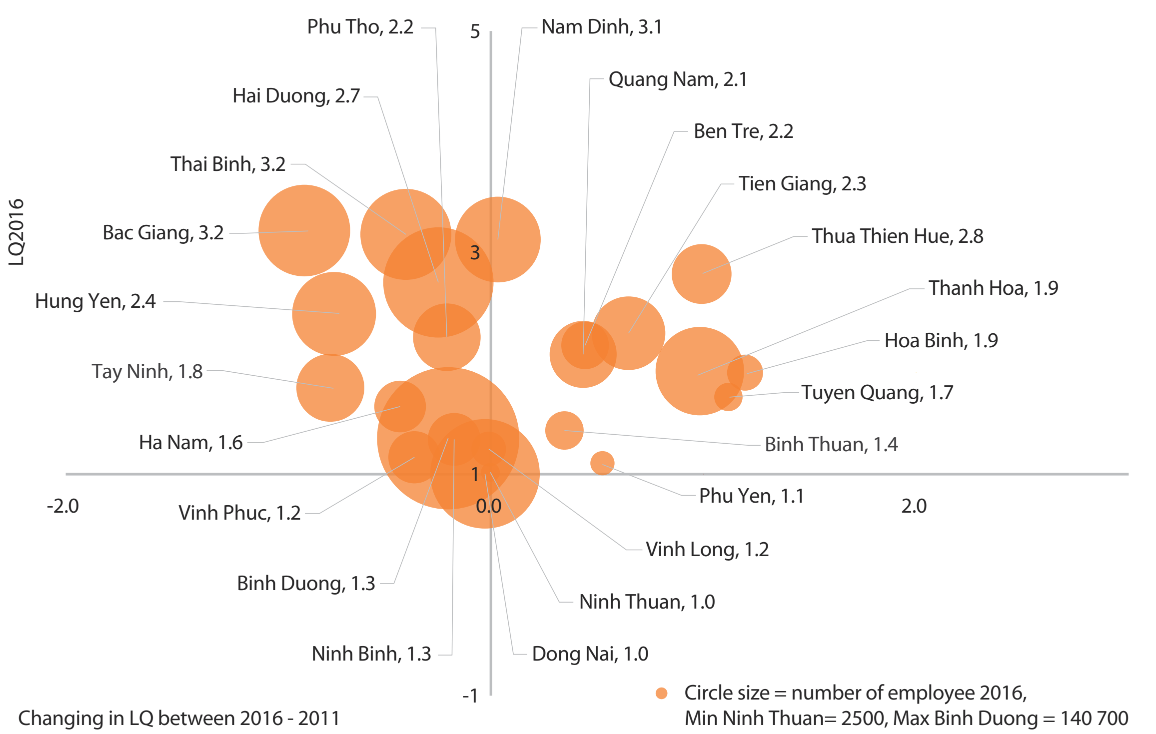
FIGURE A1.8. **Locational distribution of the fabric segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

The clothing segment involves a wider range of activities, from designing, to cutting, sewing, buttonholing, ironing, and packing, reflected by more provinces specialized in this segment (Figure A1.9). This segment also employed the largest number of workers in the T&G value chain. Scatterplots show several interesting trends. First, the provinces that employed a larger absolute number of workers in the clothing segment (like Binh Duong and Dong Nai) and provinces with larger LQs (like Hai Duong, Thai Binh, Bac Giang, and Hung Yen, among others) had a lower relative specialization over time (upper left quadrant). Second, several provinces increased in relative specialization in clothing (upper right quadrant), including Thua Thien Hue, Tien Giang, Quang Nam, and Thanh Hoa, which employed the greatest number of clothing workers among these provinces.

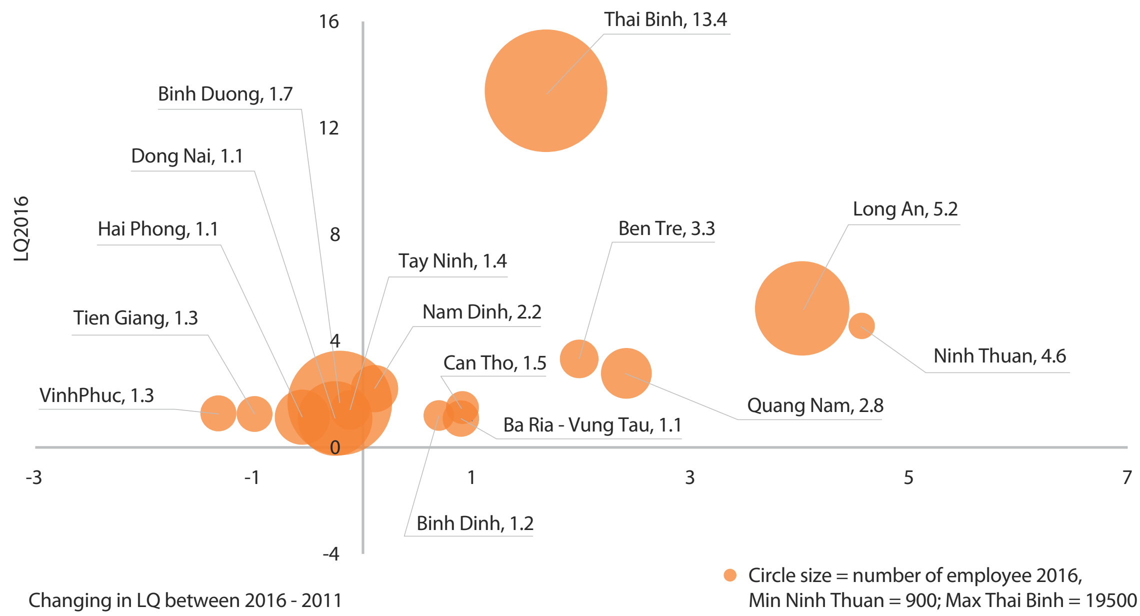
FIGURE A1.9. **Locational distribution of the clothing segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Figure A1.10 outlines Thai Binh and Long An were dynamic provinces with increased specialization in other garments activities, employing many workers in this segment. Additionally, provinces like Quang Nam, Ben Tre, Ba Ria–Vung Tau, Can Tho, and Binh Dinh increased specialization in this segment but employed fewer workers (upper-right quadrant). Among the provinces with declined specialization (upper-left quadrant) we find again Binh Duong and Dong Nai, which employed much of the workforce in the segment. The declined specialization in these two provinces follows the trend in other segments of the T&G value chain.

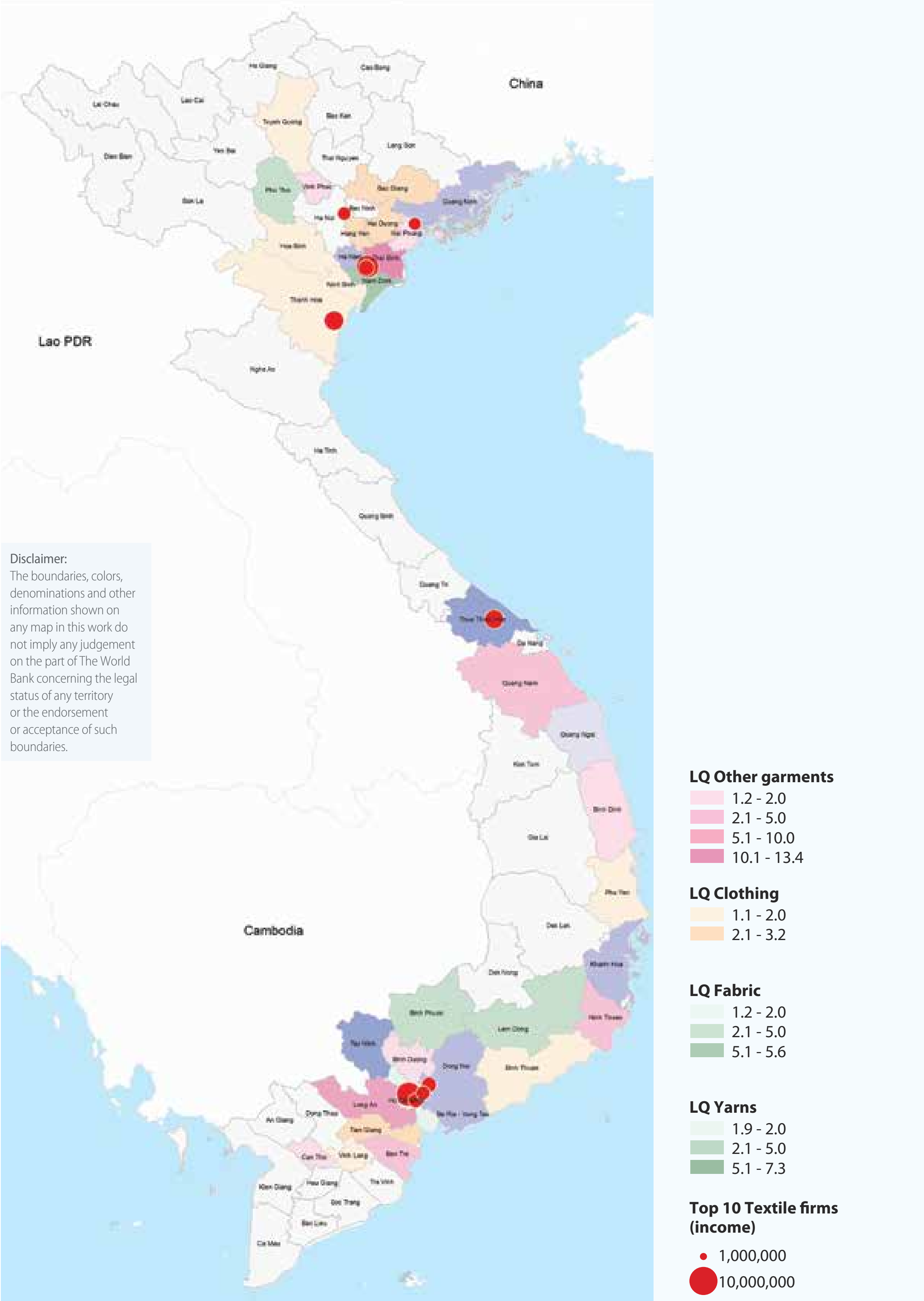
FIGURE A1.10. **Locational distribution of the other garment segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Map A1.1 summarizes the provincial specialization patterns depicted in the previous scatterplots. The five segments of the T&G value chain are shown in different colors: producing materials in green, yarn in turquoise, fabric in bright green, clothing in dark blue, and other garments in red. Darker shades indicate a higher LQ or relative specialization, while lighter shades suggest a lower provincial specialization.

MAP A1.1. **Geographic distribution of the T&G value chain**



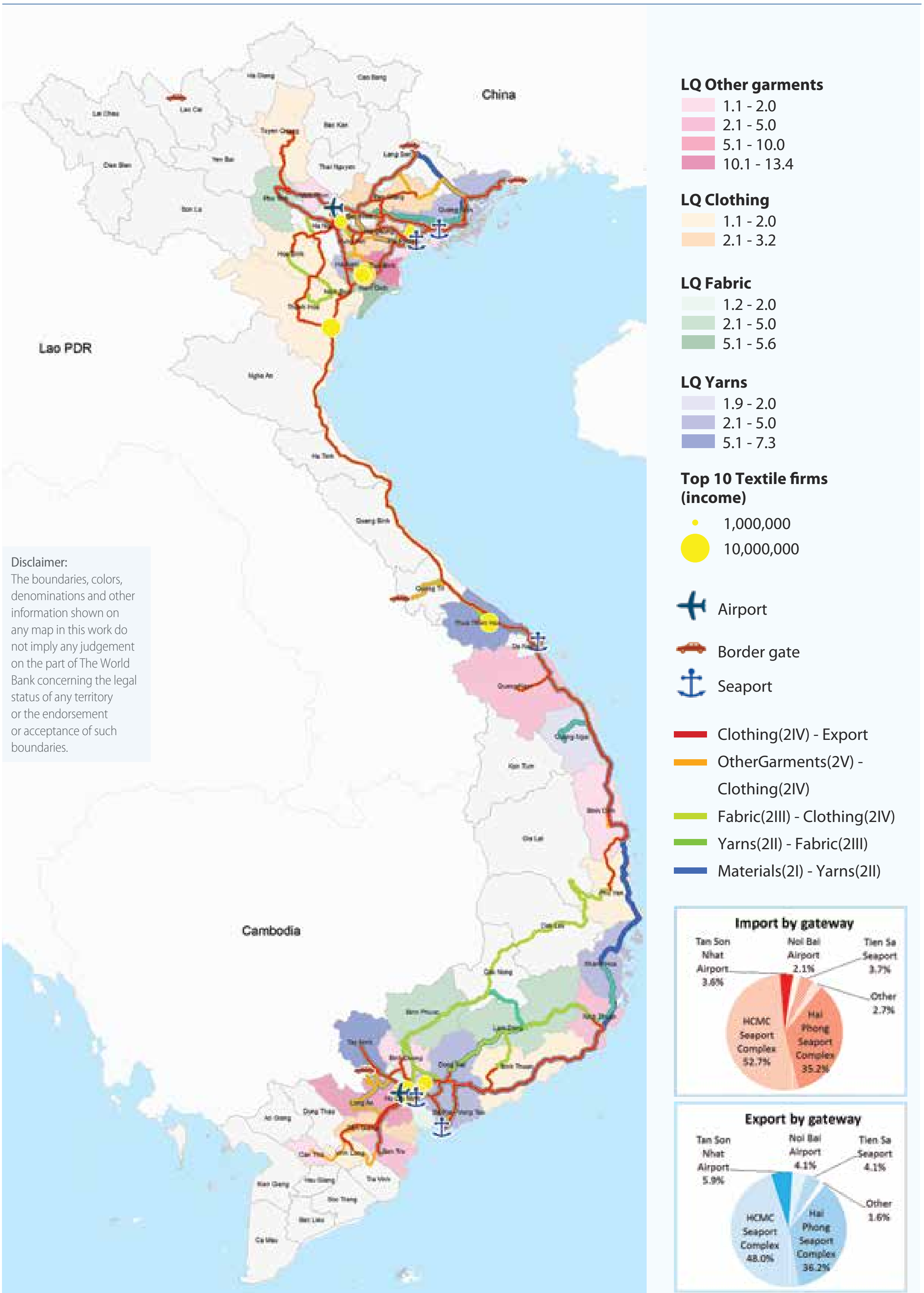
Source: I/O Table 2016, Enterprise Census 2011 and 2016, calculation by authors.

A1.4. Value-chain-based connectivity and key corridors

Map A1.2 highlights connective propensity of the T&G value chain. Each segment in the value chain uses different transportation corridors.

- From materials to yarns: NR22, NR22B, NR1 (Hue – HCMC), NR51, NR56, NR20, NR24B, Phap Van – Cau Gie expressway, NR5, NR18, NR4B, NR1 (Lang Son – Ha Noi)
- From yarns to fabrics: NR22B, NR13, NR14, NR28, NR51, NR56, NR20, NR27, NR1 (Khanh Hoa – Ninh Thuan, Quang Tri – Quang Ngai), NR24B, NR9, NR18, Noi Bai – Lao Cai expressway (to Phu Tho), NR32, Phap Van – Cau Gie – Ninh Binh expressway (to Ha Nam), NR21A (Ha Nam – Nam Dinh)
- From fabrics to apparels: HCMC - Trung Luong expressway, NR1 (HCMC – Vinh Long, Lang Son – Quang Ngai), NR62, NRN2, NR22, NR13, NR14, AH17, NR26, NR19C, NR20, NR55, NR51, NR56, HCM – Long Thanh – Dau Giay expressway, NR9, NR12B, NR45 (Thanh Hoa), NR217, Phap Van – Cau Gie – Ninh Binh expressway (Ha Noi - Ha Nam), NR21A (Ha Nam – Nam Dinh), NR38, NR39, Ha Noi – Bac Giang expressway, NR2 (Phu Tho – Tuyen Quang), Noi Bai – Lao Cai expressway (to Phu Tho), NR32
- For apparel exports: NR2 (Phu Tho – Tuyen Quang), Noi Bai – Lao Cai expressway (Phu Tho), NR1 (Lang Son – Phu Yen, Binh Thuan – Vinh Long), NR18, AH14, NR21A (Ha Nam – Nam Dinh), Phap Van – Cau Gie – Ninh Binh expressway (Ha Noi - Ha Nam), Ha Noi – Bac Giang expressway, NR47, NR15, HCM road (Hoa Binh - Thanh Hoa), AH13, NR19C, HCMC - Trung Luong expressway, HCM – Long Thanh – Dau Giay expressway, NR51, NR56, NR22

MAP A1.2. **Connective propensity of the T&G value chain**



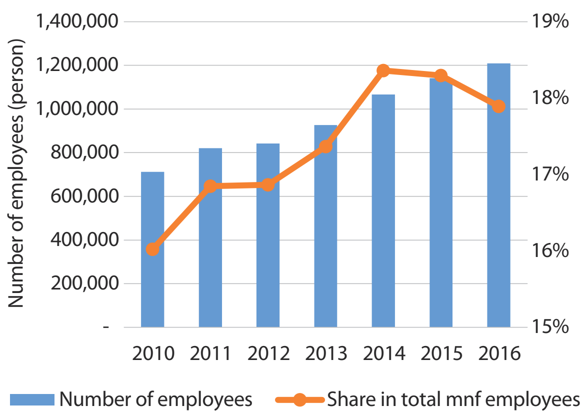
Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs data, calculation by authors.

Annex 2

Analysis of the leather and footwear value chain

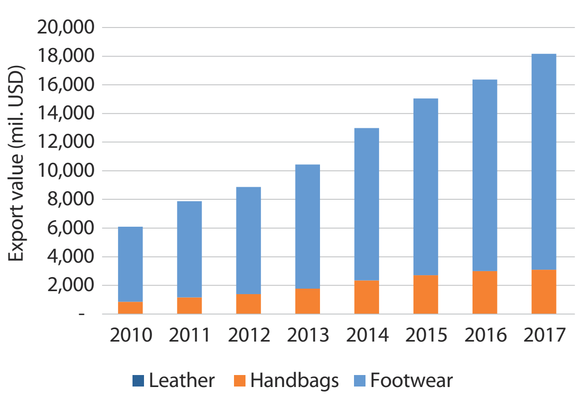
A2.1. Industry overview

FIGURE A2.1. **Employment in leather and footwear**



Source: Statistical yearbook 2015, 2017.

FIGURE A2.2. **Leather and footwear exports**



Source: ITC Trademap, 2017.

In addition to the textile and garment sector, leather and footwear is another labor-intensive and export-oriented Vietnamese sector. Figure A2. 1 shows from 2010 to 2016, employment in the sector increased from 700 thousand to 1.2 million people, and its share in total manufacturing employees grew from 16 to 18.5 percent. From 2014 onward, leather and footwear employment increased in absolute value but its share in total manufacturing employment decreased modestly from 18.4 to 17.9 percent. This suggests there has been faster employment growth in other sectors.

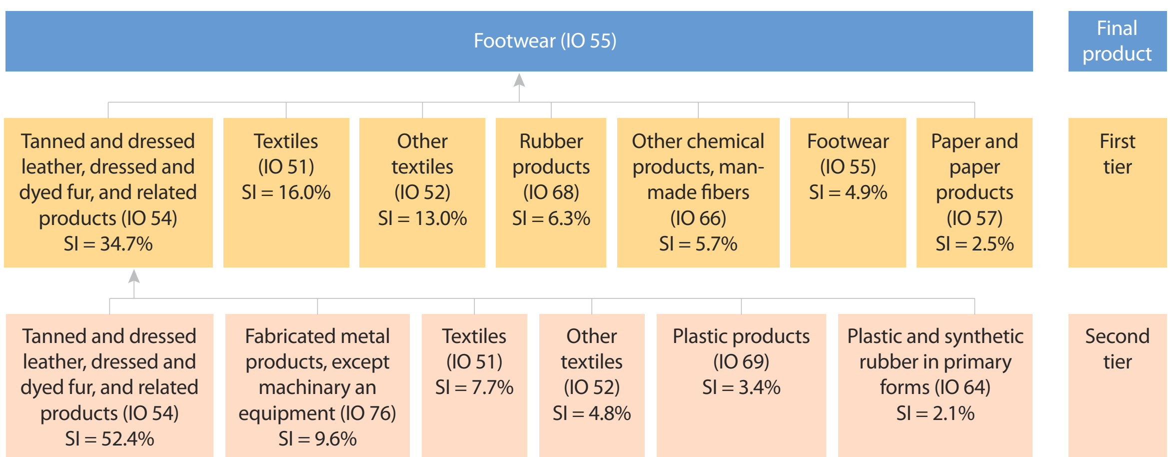
Figure A2.2 shows export of leather and footwear products grew 17 percent between 2010 and 2017, from US$ 5.5 to 18 billion. Footwear is a major export, accounting for more than 80 percent of the sector export value, followed by handbags with a share of 17 percent, and leather products with just 0.1 percent.

The export structure shows Vietnam's leather and footwear sector seemed to focus heavily on final products but not upstream products. This can be confirmed by the sector's import data. In 2017, the sector imported more than US$ 700 million. The top three imported products were parts of footwear (uppers and parts thereof, and outer soles and heels), and raw leather, which accounted for more than 60 percent of the sector's total import value.

A2.2. Value-chain links

Inter-sectoral links have been identified from the I/O table 2016 for the leather and footwear sector and graphed in Figure A2.3. The links show footwear in Vietnam is mainly made from leather and textile materials, accounting for 34 and 29 percent respectively. Compared to 2012, the share of textile materials increased slightly from 25 percent to 29 percent, implying a trend toward more textile footwear. It is impossible to disaggregate the data to the sectoral level for precise textiles used in the garment or footwear segments.

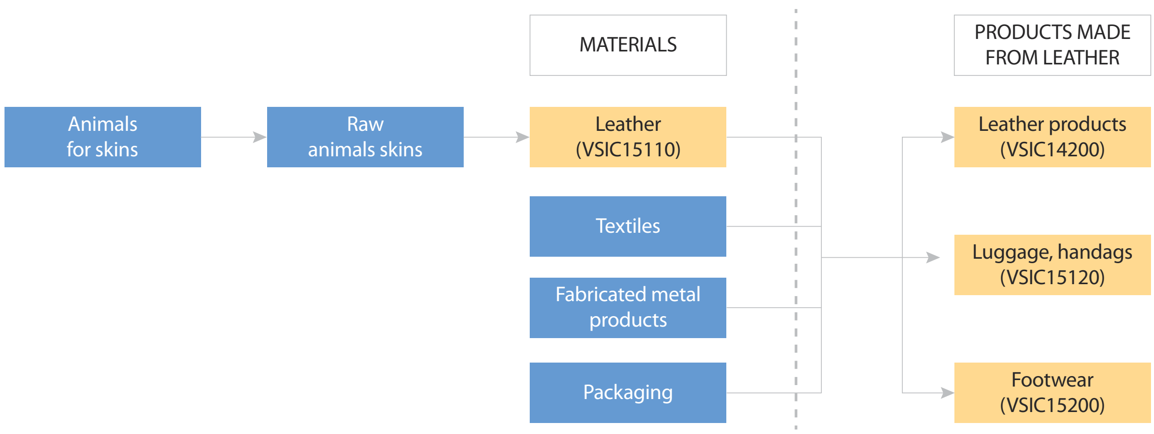
FIGURE A2.3. **Leather and footwear value-chain links**



Source: I/O table 2016, authors.

Key segments in the leather and footwear sector are refined in Figure A2.4. Other related materials are still included in the figure, but only key segments were considered in analyzing the value-chain links, including leather (VSIC 15110), leather products (VSIC 14200), handbags (VSIC 15120), and leather footwear (VSIC15200).

FIGURE A2.4. **Leather and footwear value-chain segments**

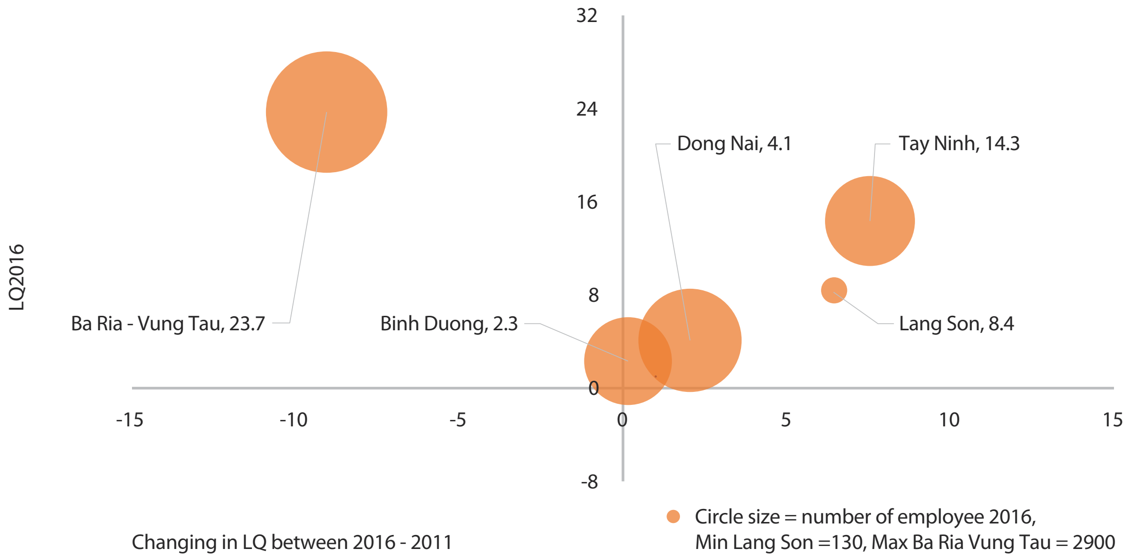


Source: Authors.

A2.3. Spatial structure and value-chain mapping

Consistent with the findings that an upstream leather and footwear sector has not developed in Vietnam, Figure A2.5 shows very few provinces had a high specialization of leather production, barring Ba Ria - Vung Tau, Binh Duong, Dong Nai, and Tay Ninh. Another province, Lang Son, also appears in the map, but their employment was not significant despite having a high LQ which increased between 2012 and 2016. This may imply that leather production activity has emerged in Lang Son recently.

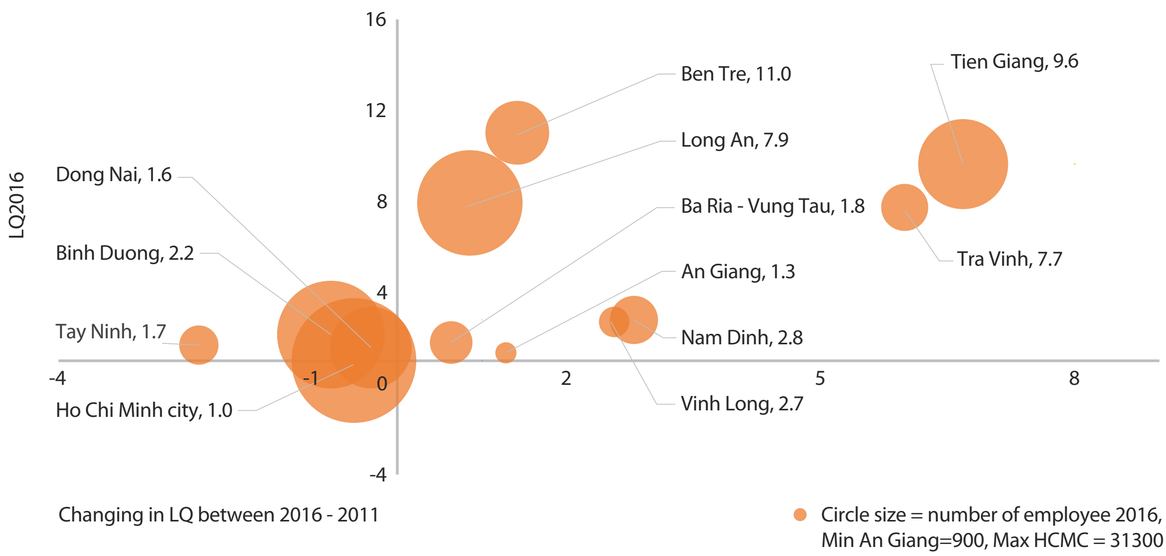
FIGURE A2.5. **Locational distribution of the leather segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Figure A2.6 shows provinces with a high production concentration of handbags and other leather products. Ho Chi Minh City (HCMC), Binh Duong, and Dong Nai provinces had high employment but low LQs, which decreased between 2012 and 2016. This implies the sector structure in these provinces has been shifting to other segments. In contrast, the figure shows the segment is emerging in other provinces with a high LQ, and positive change between 2012 and 2016, including Long An, Ben Tre, Tien Giang, and Tra Vinh. Ba Ria - Vung Tau, Nam Dinh, Vinh Long, and An Giang provinces had no significant concentration, with low LQs and low employment.

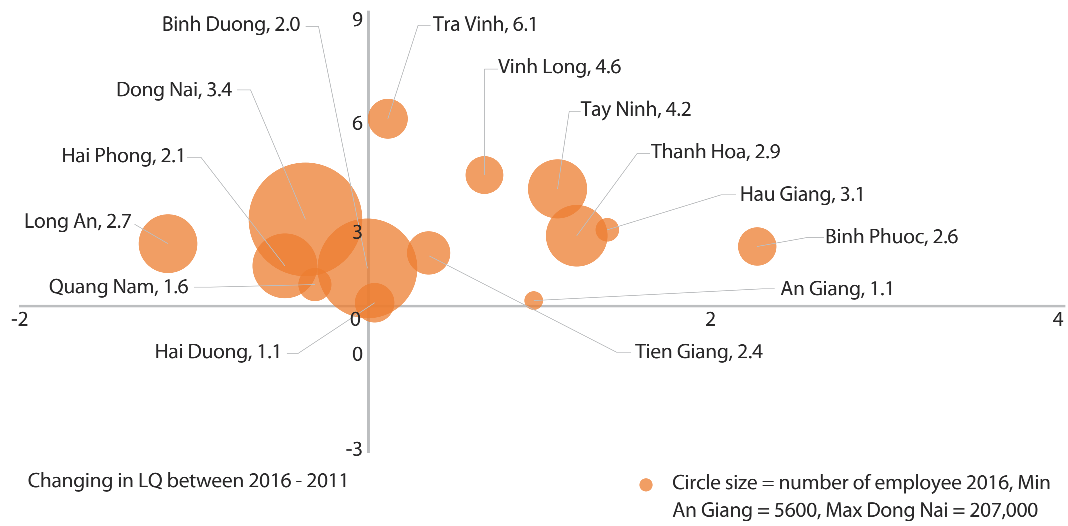
FIGURE A2.6. **Locational distribution of the handbags and other leather segments**



Source: Enterprise Census 2011 and 2016, calculation by authors.

There were more provinces with a high concentration of footwear production activity as shown in Figure A2.7. Tra Vinh, Vinh Long, Tay Ninh, Thanh Hoa, Hau Giang, and Binh Phuoc provinces had high LQs that increased between 2012 and 2016. Binh Duong and Dong Nai are the largest hubs but decreased in LQ between 2012 and 2016. Other provinces with a negative change in LQ were Hai Phong, Hai Duong, Quang Nam, and Long An.

FIGURE A2.7. **Locational distribution of the footwear segment**



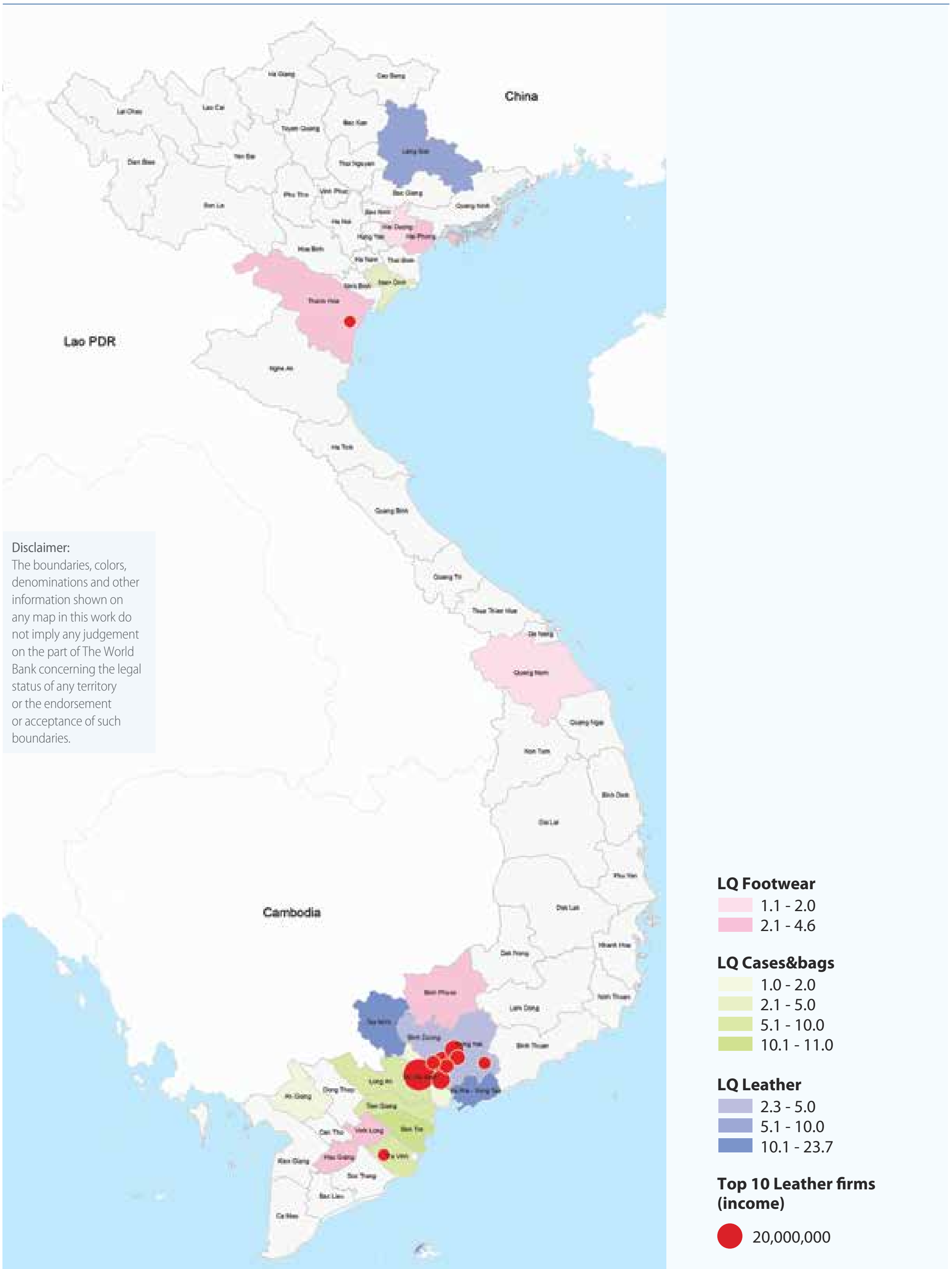
Source: Enterprise Census 2011 and 2016, calculation by authors.

Combining findings from the three figures above, it appears all segments of the value chain have existed in Binh Duong and Dong Nai, which are considered the hubs of leather and footwear in Vietnam. However, decreases in LQ between 2012 and 2016 in all segments in these provinces imply these provinces might be downsizing in this sector or seeing faster growth of other sectors. The data also indicate northern provinces are not competitive in leather and footwear, with few provinces appearing in the figures, and none having a significant LQ index.

Map A2.1 demonstrates the provincial specialization patterns of the leather and footwear value chain. The three segments are shown in different colors: producing leather in green, handbags and other leather products in turquoise, and footwear in bright green. Darker shades denote a higher LQ or relative specialization, while lighter shades indicate a lower specialization. Red circles denote the largest final production firms in the sector.

There is obvious leather and footwear specialization in the South, where all segments of the value chain exist, and the top five largest firms are located. In the North, materials are mainly imported from China through Huu Nghi (Lang Son province) and Mong Cai (Quang Ninh province) gateways, while footwear with upper leather (HS6403) and textile (HS6404) are mainly exported through the Dinh Vu seaport (Hai Phong province). Handbags and other leather products are exported equally via air (Noi Bai Airport) and sea (Dinh Vu). Trade data from the Central Region are not significant. Major products are footwear exported through Tien Sa seaport in Da Nang. Trade data from the South indicate the region is the most dynamic area of the sector. Besides footwear, handbags and other leather products are also major exports of the region. Most of these products are imported and exported via Cat Lai seaport, some through Cai Mep seaport, and very few via Dong Nai port. Dong Nai and Binh Duong are the hubs of the leather and footwear industry but import and export mainly through ports in Ho Chi Minh City, requiring well-organized logistics and transportation between Dong Nai and Binh Duong to the ports in Ho Chi Minh City.

MAP A2.1. **Geographic distribution of the leather and footwear value chain**



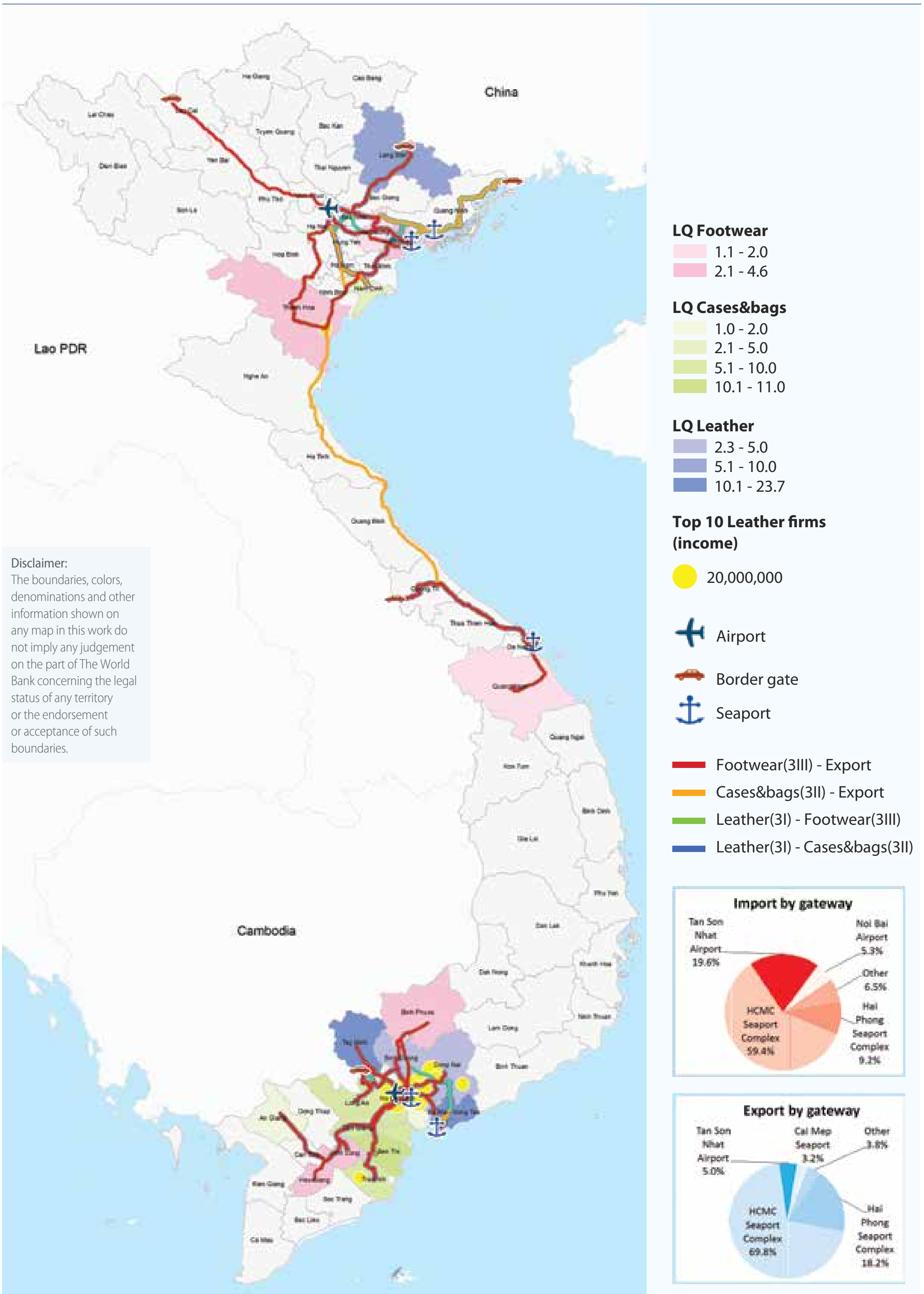
Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

A2.4. Value-chain-based connectivity and key corridors

Map A.2.2 demonstrates the main transportation corridors of the leather and footwear value chain. Each segment uses different corridors as follows:

- From leather to cases and bags: NR91, NR1 (Dong Nai – Can Tho, Lang Son – Ha Noi), HCMC - Trung Luong – My Thuan expressway, NR60, NR54, NRN2, NR22, NR22B, NR13, NR51, NR56, Phap Van – Cau Gie – Ninh Binh expressway (to Ha Nam), NR21A (Nam Dinh), NR18, NR5
- From leather to footwear: NR1 (Dong Nai – Hau Giang, Lang Son – Thanh Hoa)), HCMC - Trung Luong – My Thuan expressway, NR61, NR60, NR54, NRN2, NR22, NR22B, NR13, NR51, NR56, QL14 (Binh Phuoc), HCM Road (Hoa Binh - Thanh Hoa), NR18, NR5
- For cases and bags exports: NR91, NR1 (HCMC – Can Tho, Lang Son – Da Nang), NR51, HCMC - Trung Luong – My Thuan expressway, NR60, NR54, NRN2, NR22, HCM – Long Thanh expressway, Phap Van – Cau Gie – Ninh Binh expressway, NR21A (Ha Nam – Nam Dinh), NR18, AH14, NR10
- For footwear exports: NR91, NR1 (Dong Nai – Can Tho, Quang Tri – Quang Nam, Lang Son – Ha Noi), HCMC - Trung Luong – My Thuan expressway, NR61, NR60, NR54, NRN2, NR22, NR22B, NR13, HCM – Long Thanh expressway, NR14E, NR9, Noi Bai – Lao Cai expressway, NR47, HCM road (Hoa Binh - Thanh Hoa), NR10, AH14, NR18 (Bac Ninh), NR37 (Hai Duong)

MAP A2.2. **Connective propensity of the leather and footwear value chain**



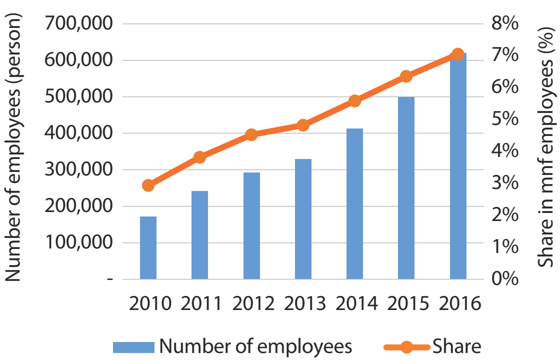
Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs data, calculation by authors.

Annex 3

Analysis of the electronics value chain

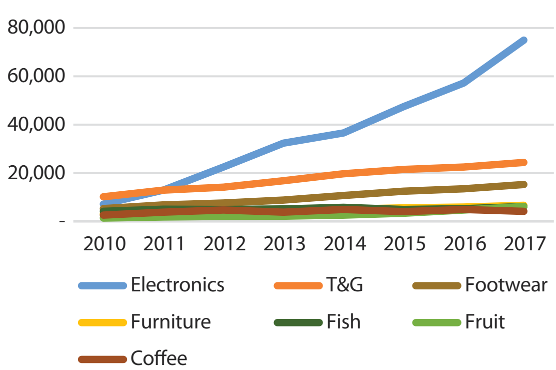
A3.1. Industry overview

FIGURE A3.1. **Employment in the electronics sector**



Source: INDSTAT, 2016.

FIGURE A3.2. **Electronics exports compared to other sectors**



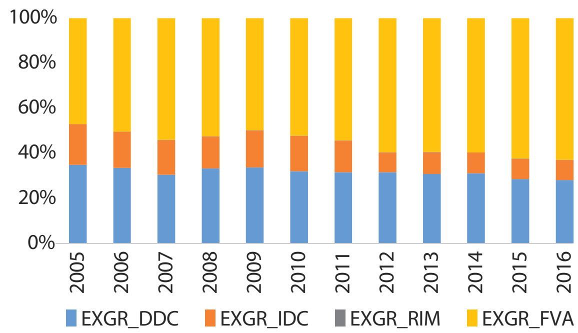
Source: ITC Trademap, 2017.

The electronics sector emerged in Vietnam in the last decade. The number of enterprises in this sector doubled from 613 in 2010 to 1399 in 2016, which supported jobs for 160 thousand employees in 2010 and more than 600 thousand in 2016. Figure A3.1 shows a sharp increase in electronics employment and its share in the manufacturing sector.

Figure A3.2 shows electronics exports grew drastically since 2010, from US$ 6 billion to US$ 70 billion in 2017, jumping from the second to the first largest export sector, leaving others far behind. More than half of these exports were telephone sets. The electronics export growth rate between 2010 and 2017 was 40 percent, while the growth rates of T&G and footwear were 13 and 16 percent respectively.

Figure A3.3 shows the decomposition of gross exports in the electronics sector into two portions: the foreign value addition (FVA), and the domestic value addition (DVA). The DVA consists of three components: (i) the direct value-added (DDC) contribution within the electronics sector, (ii) the indirect (IDC) contribution of upstream sectors supplying the electronics sector, and (iii) reimported intermediates (RIM). As illustrated in the figure, Vietnam's electronics export increasingly relied on the FVA. Its share fluctuated around 50 percent from 2005 to 2010, then gradually increased to 63 percent in 2016. As a result, DVA diminished its contribution in the value chain, with direct value addition dropping from 35 percent in 2005 to 28 percent in 2016, and indirect value addition from 18 percent to 9 percent in the same period. However, in GVCs, countries import to export and by doing so, they grow their exports, as well as the DVA embodied in them. It is implausible that Vietnam would have been able to grow its gross exports so dramatically if the sector did not import foreign parts and components.

FIGURE A3.3. **Decomposition of the electronics gross export**

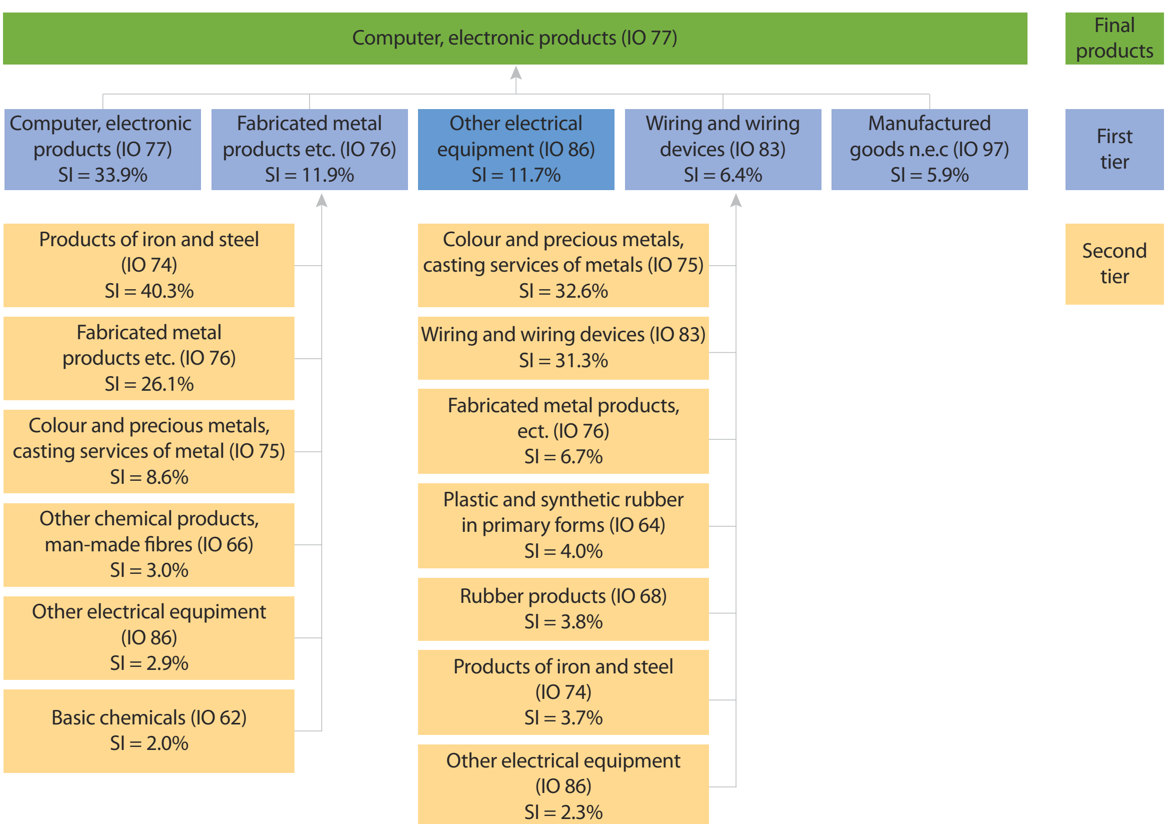


Source: OECD, 2017.

A3.2. Value-chain links

The electronics value chain is graphed in Figure A3.4 based on inter-sectoral links obtained from the I/O table 2016. The links show different value-chain tiers from up, middle, and downstream, with lower tiers providing inputs to produce goods in upper tiers.

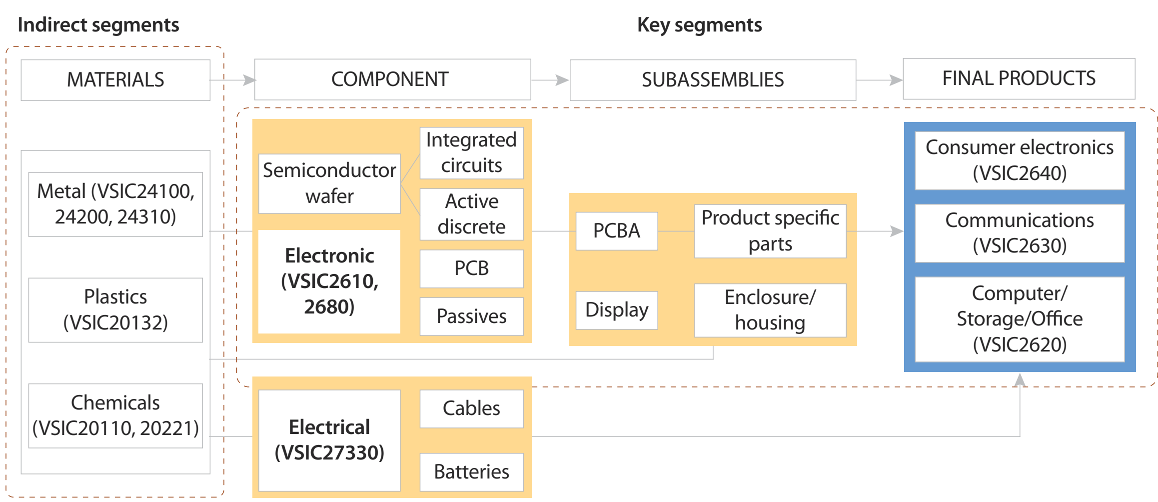
FIGURE A3.4. **Electronics value-chain links**



Source: I/O Table 2016, authors.

Since sectors in the I/O Table are more aggregated than the 4- and 5-digit VSIC codes, the links in Figure A3.4 show the main suppliers to the electronic sector include inputs from the electronic sector itself (more than one third). Therefore, to reflect the reality of the sector's value chain, the links in the initial graph are refined in the Figure A3.5. into three segments. The upstream segment provides inputs (materials – metals, plastics, rubbers, chemicals, etc.) to produce intermediate goods (electronic and electric components and subassemblies) in the middle segment, which are then used to assemble final products downstream (computers, communications, consumer electronic products (3C) electronics). Each segment is associated with corresponding VSIC codes provided in the figure. Electronic and electric (E&E) components and subassemblies belong to the same 5-digit group, and some specific parts and components are grouped with the final products, and are only broken down at product levels (6 and 7-digit groups). Therefore, at the VSIC 5-digit level, the electronics value chain can only be divided into two segments: E&E components and final products. However, when discussing trading of electronic products, SITC and HS systems allow separating into three segments: components, subassemblies, and final products.

FIGURE A3.5. **Electronics value-chain segments**

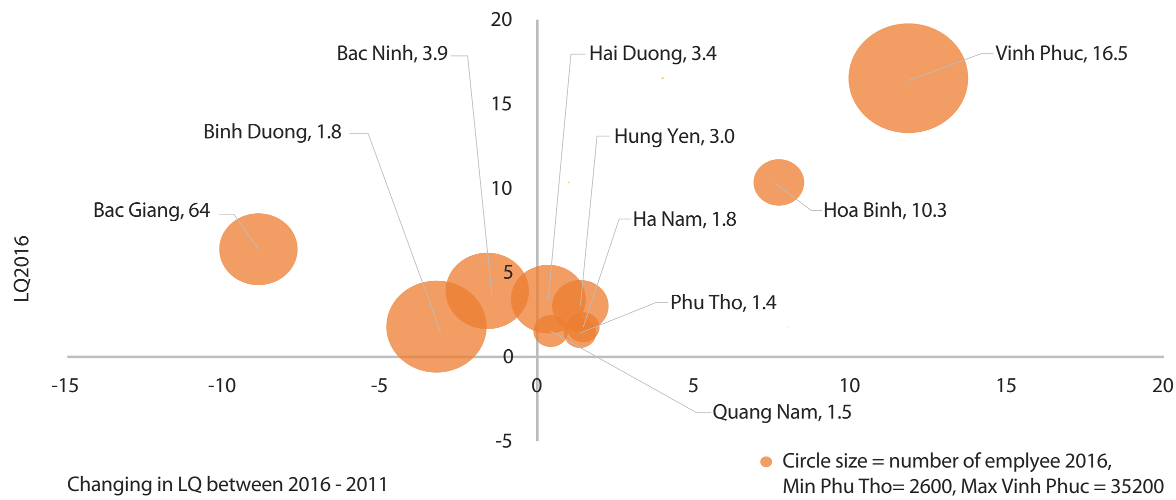


Source: I/O Table 2016, authors.

A3.3. Spatial structure and value-chain mapping

Provinces that had high specialization of electronic component manufacturing appear in Figure A3.6. The Y axis represents a province's LQ in 2016, and the X axis shows the change in LQ between 2011 and 2016. The circle size represents the number of employees in this segment in a province. Provinces in the upper-right quadrant increased participation in the electronics value chain, with high agglomeration and increased LQs between 2011 and2016. They include Vinh Phuc, Hoa Binh, Hai Duong, Hung Yen, Ha Nam, Phu Tho, and Quang Nam. Provinces in the upper left had decreased LQs. Their concentration was still higher than the national average but less agglomerative than in 2011. They are Bac Giang, Bac Ninh, and Binh Duong. Each had more than 10 thousand employees in the segment, therefore the decrease in LQ may not signify shrinkage in electronic component manufacturing but rather an expansion of other economic activities in these provinces, or because other provinces are emerging in this activity.

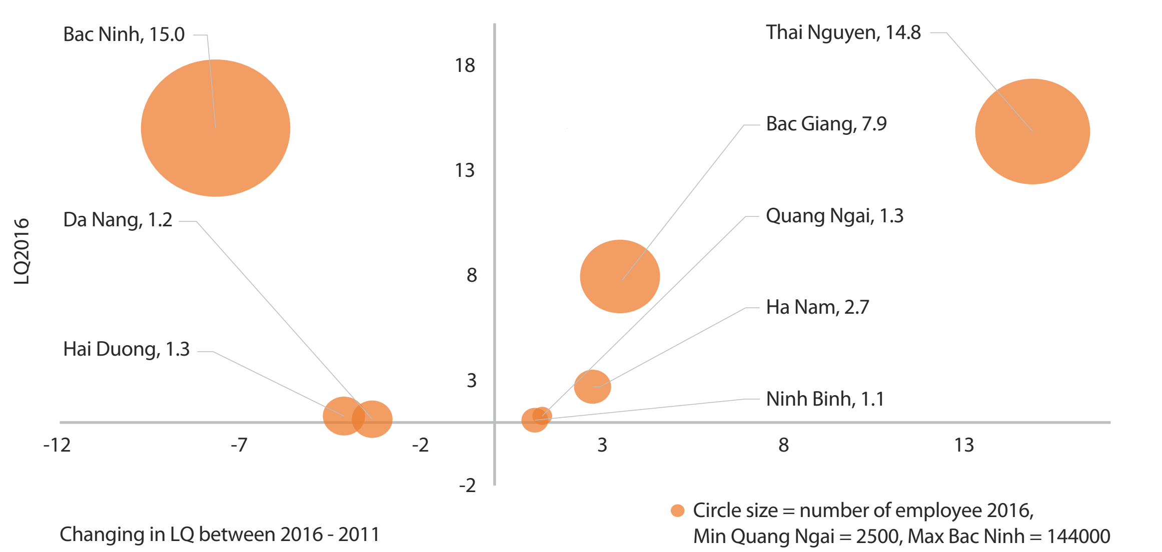
FIGURE A3.6. **Locational distribution of the electronics components segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Figure A3.7 shows provinces that had high concentration of final electronic product manufacturing. Thai Nguyen was the most dynamic province with the second highest employment in the segment, second highest LQ in 2016, and the largest increase in LQ between 2011 and 2016. Bac Ninh province had the highest LQ in 2016 and the highest employment, but its LQ in 2016 was lower than 2011. The changes in these two provinces are linked closely with Samsung's investment movement. Other provinces in the upper-right quadrant are Bac Giang, Ha Nam, Ninh Binh, and Quang Ngai, and in the upper left, Da Nang and Hai Duong.

FIGURE A3.7. **Locational distribution of the final 3c products segment**

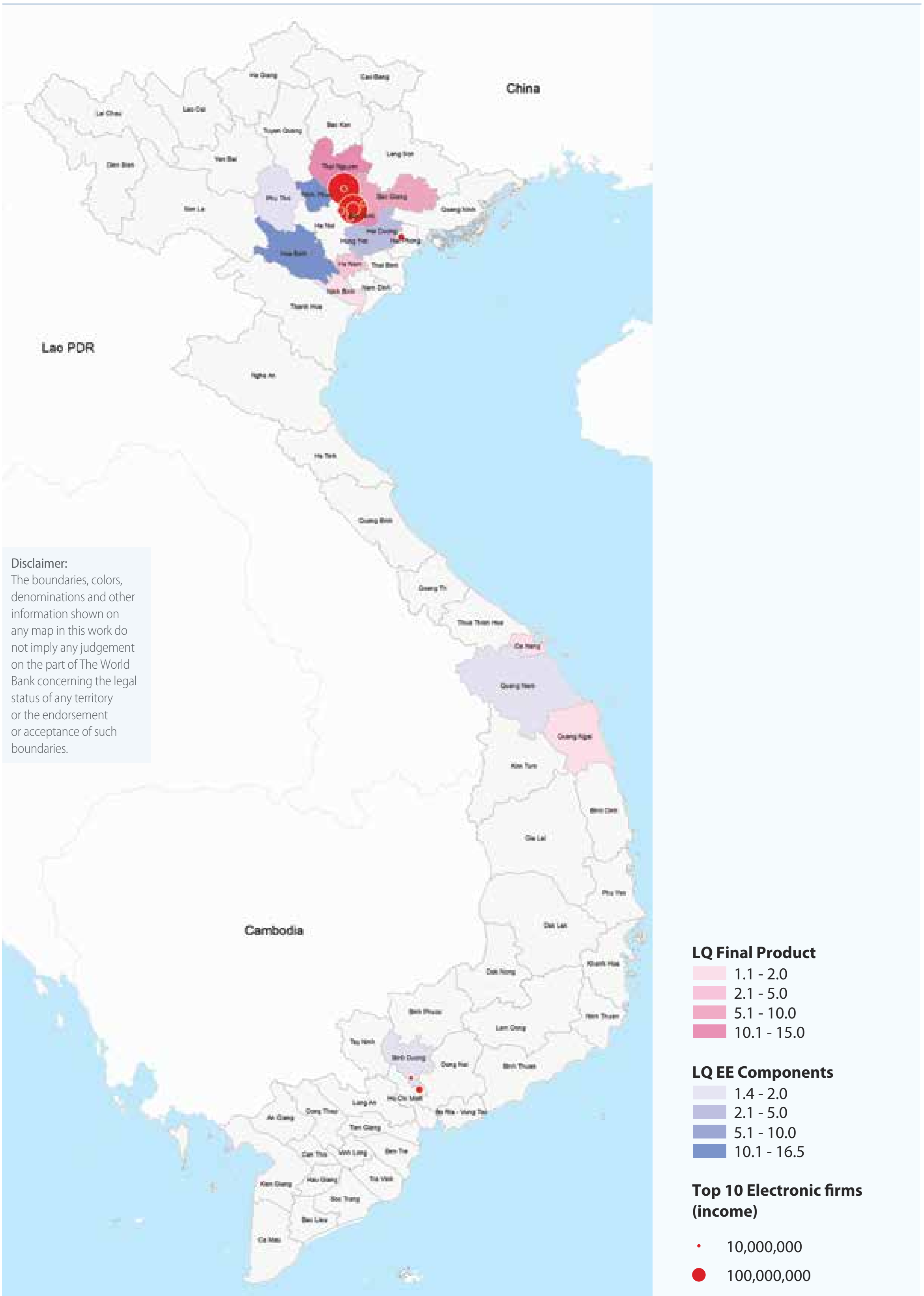


Source: Enterprise Census 2011 and 2016, calculation by authors.

From Figure A3.6 and Figure A3.7, we can see there was a specialization trend in electronics sector in northern provinces. It is not surprising to see the high LQs in Bac Ninh, Bac Giang, Vinh Phuc and Thai Nguyen, due to the presence of Samsung and its suppliers, while in other provinces, high LQs likely resulted from medium and large multinational, electronics companies like Brother in Hai Duong and Mabuchi Motor in Da Nang. Some provinces hosting giant electronic companies, for example Ha Noi with Panasonic and Canon, Hai Phong with LG, and Ho Chi Minh City with Intel and Samsung, do not appear in either figure. This may be because these companies hired fewer employees compared to other companies with similar revenues.

The geographic distribution of the electronics value chain is summarized in Map 3.1, confirming the electronics sector is highly concentrated in the northern provinces. The darker the color, the higher the LQ, and the greater the provincial agglomeration. Among the ten biggest companies in terms of revenue, most are located in the North. Different colors represent different segments in the value chain thus we can see both segments are highly concentrated in the North and can assume the electronics value chain has emerged in the northern provinces.

MAP A3.1. **Geographic distribution of the electronics value chain**



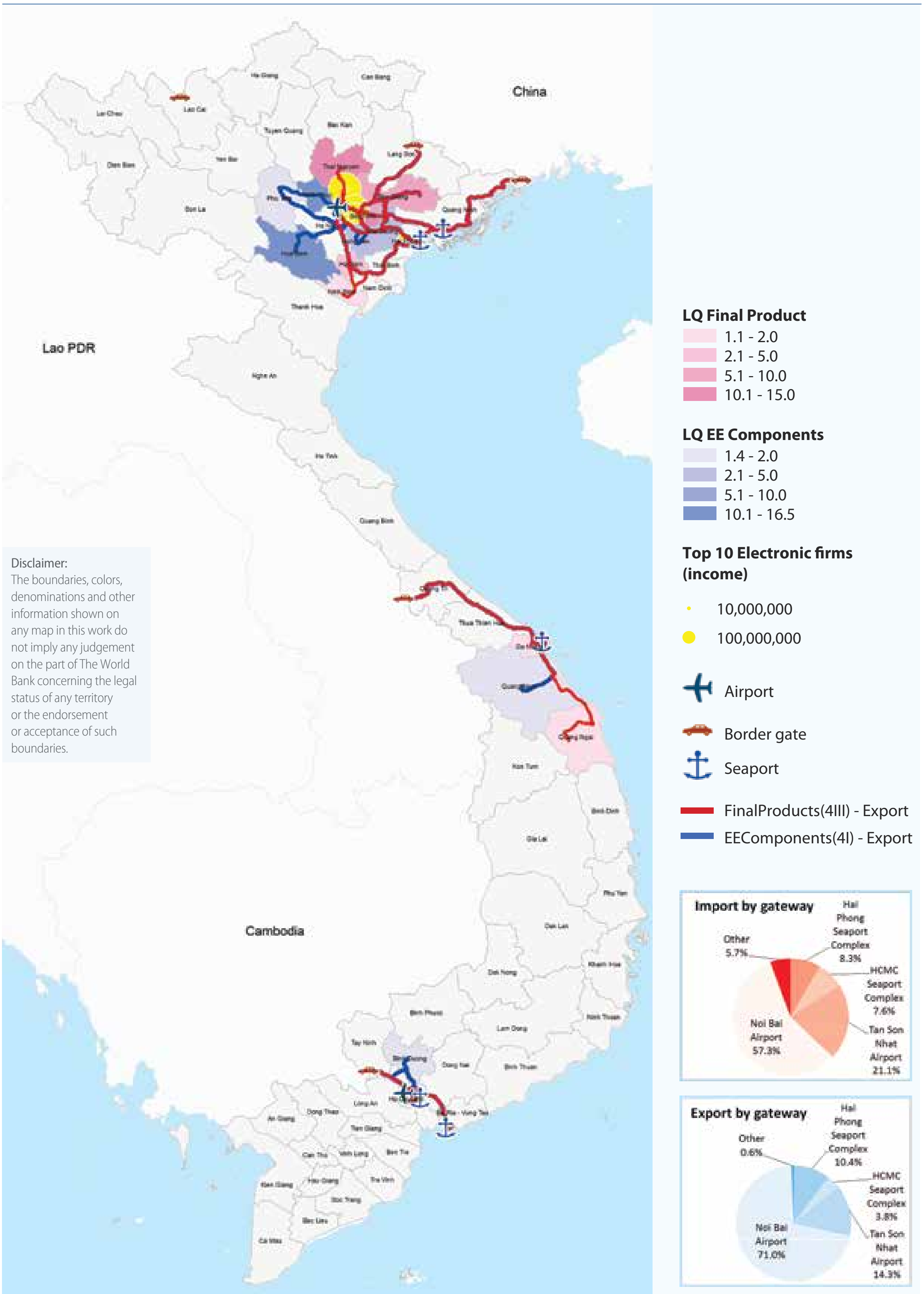
Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

A3.4. Value-chain-based connectivity and key corridors

Map A3.2 demonstrates the electronics value-chain connective propensity. Pie-charts demonstrate the trade value of electronics components and final products, showing the dominance of air transportation with 57 percent imported through Noi Bai airport, 21 percent through Tan Son Nhat airport, and only 8.3 and 7.6 percent through Hai Phong seaport and HCMC seaport, respectively. Most electronics products are also exported by air with more than 70 percent going through Noi Bai airport in the North, and 14 percent through Tan Son Nhat airport in the South. Only 10 percent are exported through the Hai Phong seaport, and 3.8 percent through the HCMC seaport. The main corridors for transportation of each segment in the electronics value chain are:

- For electronic parts and component exports: NR13, NR22, HCM – Long Thanh expressway, NR51, NR1 (Quang Tri – Quang Nam, Lang Son – Ha Nam), NR14E, NR9, AH13, NR32, Noi Bai – Lao Cai expressway (Phu Tho), Phap Van – Cau Gie – Ninh Binh expressway (to Ha Nam), NR21A (Ha Nam – Nam Dinh), NR10, AH14, NR18, NR31, NR38
- For electronic final product exports: NR22, HCM – Long Thanh expressway, NR51, NR1 (Quang Tri – Quang Ngai, Lang Son – Ninh Binh), NR24B, NR9, Ha Noi – Thai Nguyen expressway, Ha Noi – Bac Giang expressway, Phap Van – Cau Gie – Ninh Binh expressway, NR21A (Ha Nam – Nam Dinh), NR10, AH14, NR18, NR31, NR38

MAP A3.2. **Connective propensity of the electronics value chain**



Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

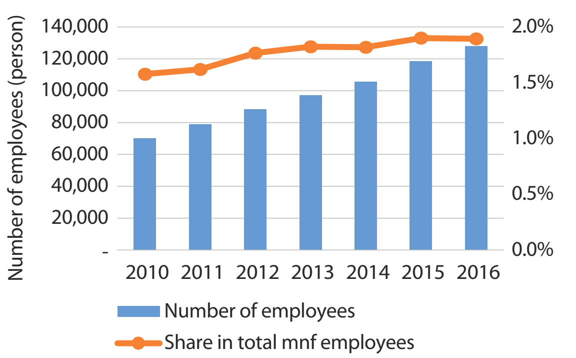
Annex 4

Analysis of the automotive value chain

A4.1. Industry overview

The automotive value chain is not young in Vietnam. It has developed for more than twenty years, with the establishment of vehicle assembly plants by multinational companies, like Toyota, Honda, Ford, GM, and Mercedes-Benz etc. So far, the industry's development has heavily relied on high tariff barriers on imported vehicles and the GVC allocation of those multinationals companies. Vietnam is one of five ASEAN countries with an automotive industry. Compared to the other four ASEAN countries, Vietnam has the smallest market size and production capacity. However, a high sector growth rate and big market potential of 100 million population are advantages of Vietnam's automotive industry. New entries of local auto makers recently, namely Truong Hai Auto Corporation (Thaco) and Vinfast, suggest the attractiveness of the sector in the near future.

FIGURE A4.1. **Employment in the automotive industry**

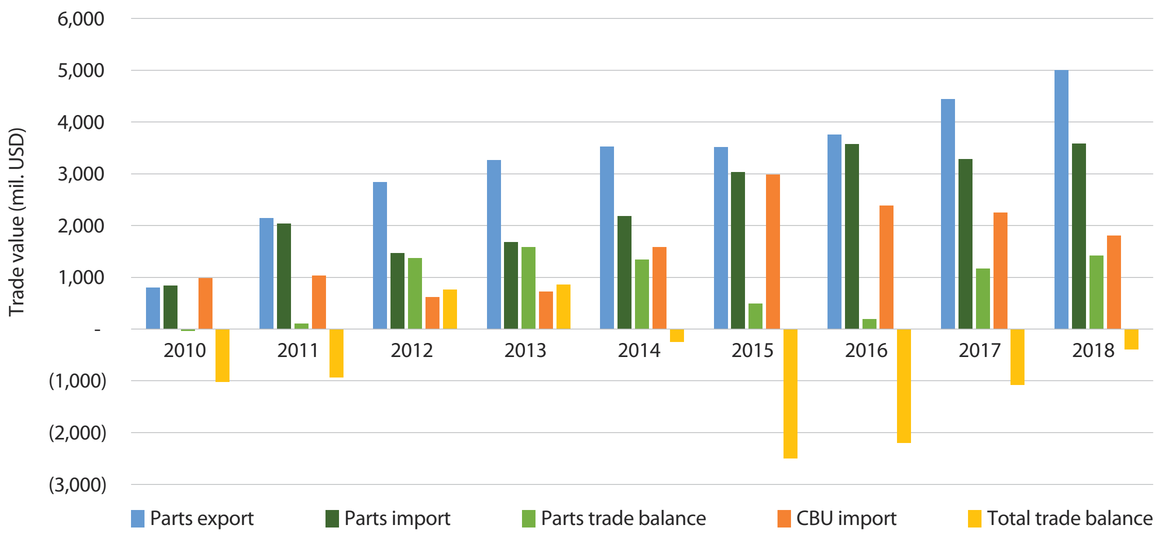


Source: GSO Statistical Yearbook, 2017.

The sector is characterized as a heavy industry by its high sophistication, and technological and capital intensiveness. However, thanks to the high sector growth between 2010 and 2016, sector employment increased from 70 thousand to about 130 thousand people, and its share in total manufacturing employment grew slightly from 1.6 to 1.9 percent as shown in Figure A4.1.

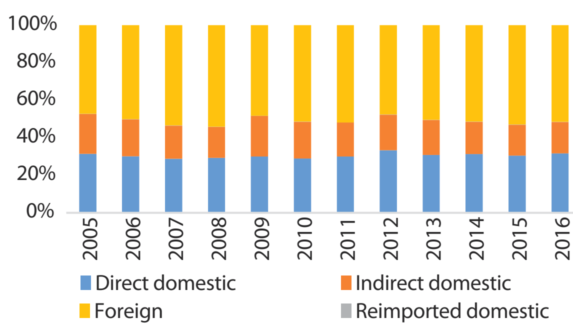
A single car has about 30,000 parts, counting every part down to the smallest screws. Some parts are made in-house by auto makers, but many are made by suppliers hierarchized in different tiers. The 30,000 parts are made from different raw materials (metal, rubber, plastics, glasses) and through different manufacturing processes. As such, proper sector development will have spillover effects to markets and create other sectors. Because of the small local market size and weak supporting industry, the localization ratio of Vietnam's automotive industry is still low compared to other ASEAN countries, and the sector naturally relies on imported parts and components. However, as shown by the trading data in Figure A4.2, Vietnam has a trade surplus in auto parts thanks to foreign export-oriented auto-parts makers locating in Vietnam, like Denso, Bosch, Yazaki, etc.

FIGURE A4.2. **Automotive sector trade value**



Source: Customs.

FIGURE A4.3. **Decomposition of the automotive gross export**



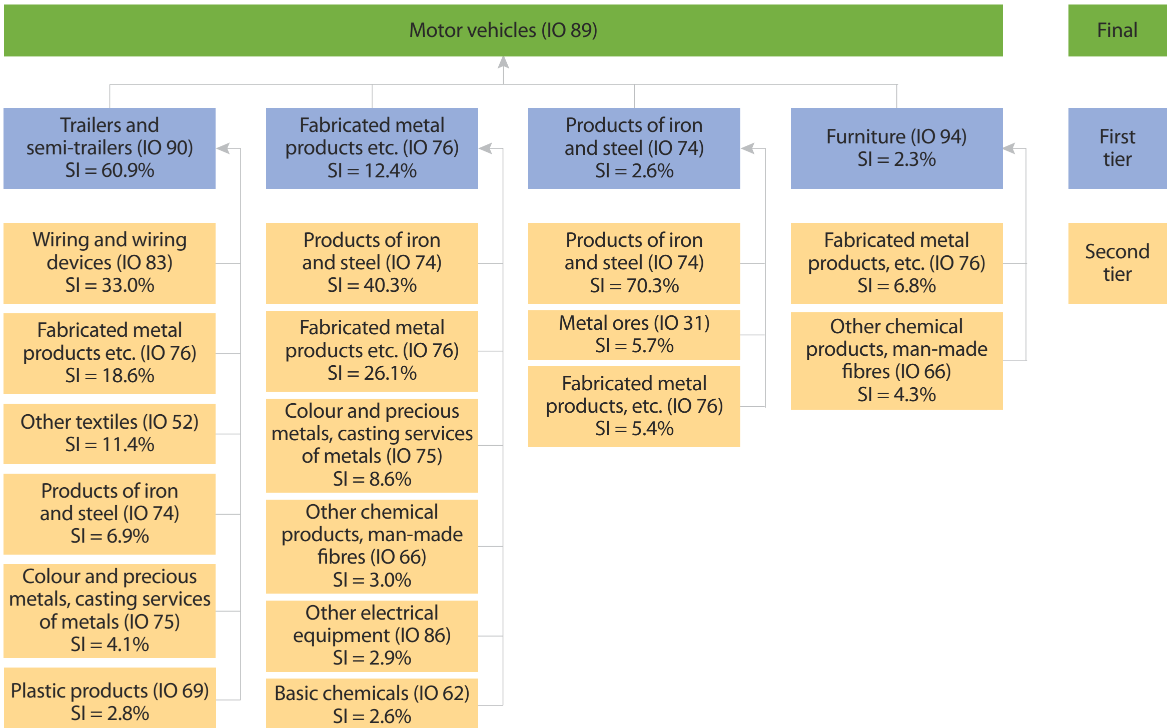
Source: OECD.

Figure A4.3 shows the decomposition of gross exports in the automotive sector. As illustrated, more than 50 percent value-added embedded in Vietnam's automotive exports (most are auto parts) derive from foreign sources. About 30 percent are directly from auto assemblers, and the remaining are from auto-parts suppliers.

A4.2. Value-chain links

As mentioned, a single car is sophisticated and assembled from more than 30,000 parts made from different sectors by different manufacturing processes. As such, identifying inter-sectoral links for the automotive value chain is challenging. The value chain obtained from the I/O table 2016 is graphed in Figure A4.4, which shows that first-tier suppliers provide trailers and semi-trailers, seats (grouped in the furniture sector), iron, steel, and metal products, while second-tier suppliers provide wiring, metal and plastic products, casting services, and so on.

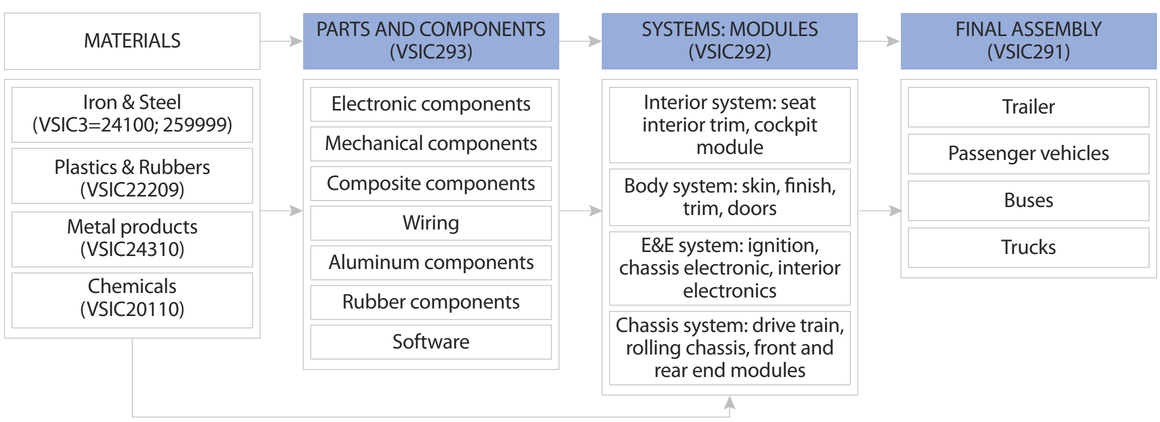
FIGURE A4.4. **Automotive value-chain links**



Source: I/O Table 2016, authors.

Because a single vehicle is assembled from many parts, the I/O table cannot describe the value chain in detail. To reflect the reality of the value-chain hierarchy, sector links are refined in Figure A4.7 into three segments, including (i) parts and components, (ii) modules, and (iii) final assembly. In Vietnam, due to the small local market size, most modules are imported or produced in-house by the auto makers (final assembly), thus the local value chain has been refined into two segments: parts and components (VSIC293), and modules and final assembly (VSIC292 and 291).

FIGURE A4.5. **Automotive value-chain segments**

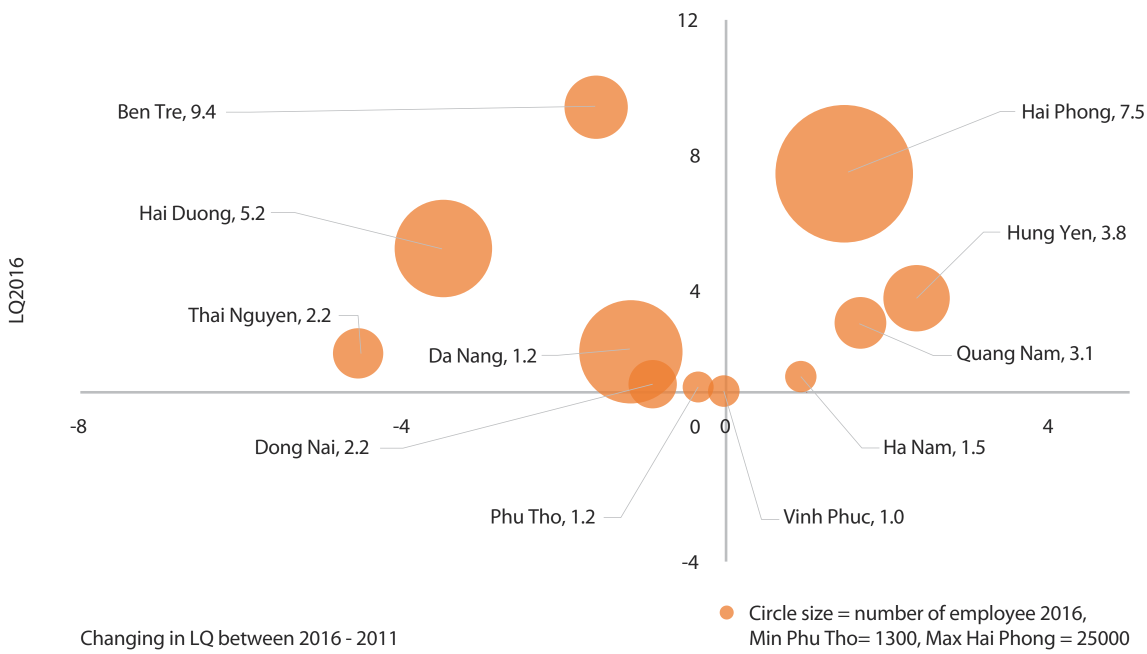


Source: Authors.

A4.3. Spatial structure and value-chain mapping

Figure A4.8 illustrates local distribution of auto parts and components. Provinces that had higher concentration of auto parts and components were plotted in the upper-right quadrant, including Hai Phong, Hung Yen, Quang Nam, and Ha Nam. Provinces that had high concentration (high LQ index) but decrease in LQ between 2011 and 2016 were plotted in upper-left quadrant, including Ben Tre, Hai Duong, Thai Nguyen, Dong Nai, Da Nang, Phu Tho, and Vinh Phuc.

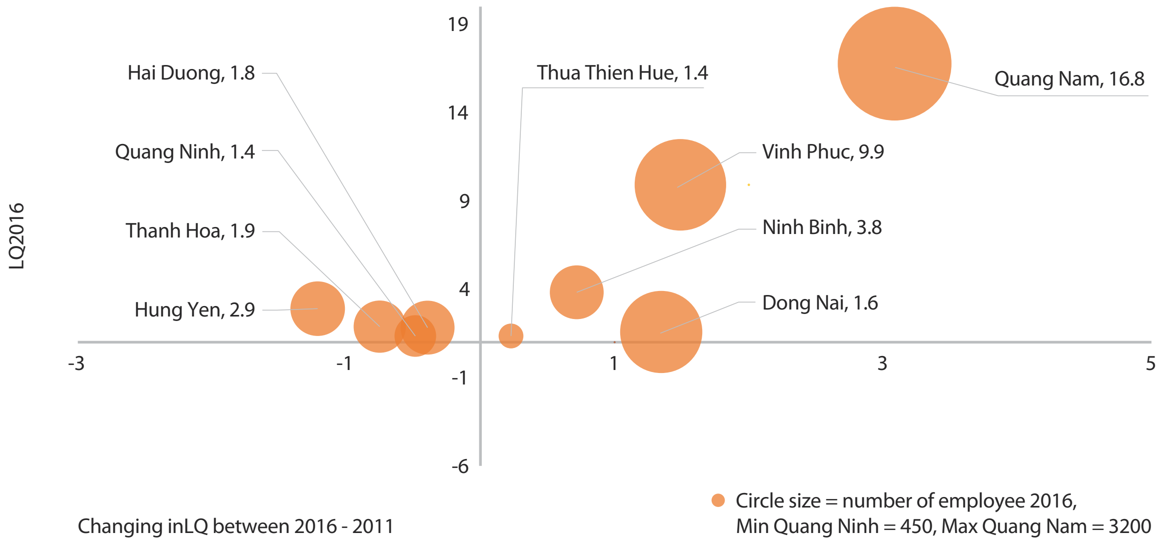
FIGURE A4.6. **Locational distribution of the auto parts and components segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Figure A4.9 shows the provinces that had high concentration of final assembly. The highest LQ and increase in LQ between 2011 and 2016 was in Quang Nam, because the Truong Hai Auto Corporation is located in the Chu Lai Economic Zone. Vinh Phuc is home to Toyota and Honda, while Dong Nam has Mercedes-Benz Vietnam and Isuzu. The automotive industry is a sophisticated sector that normally requires suppliers to set-up near assemblers to easily implement just-in-time (JIT) manufacturing. However, few provinces appeared in both figures suggesting links of the automotive value chain are still weak in Vietnam. This is because parts and components produced in Vietnam are mostly for export, while auto makers import parts and components to assemble in Vietnam, thus links between parts producers and assemblers are not strong.

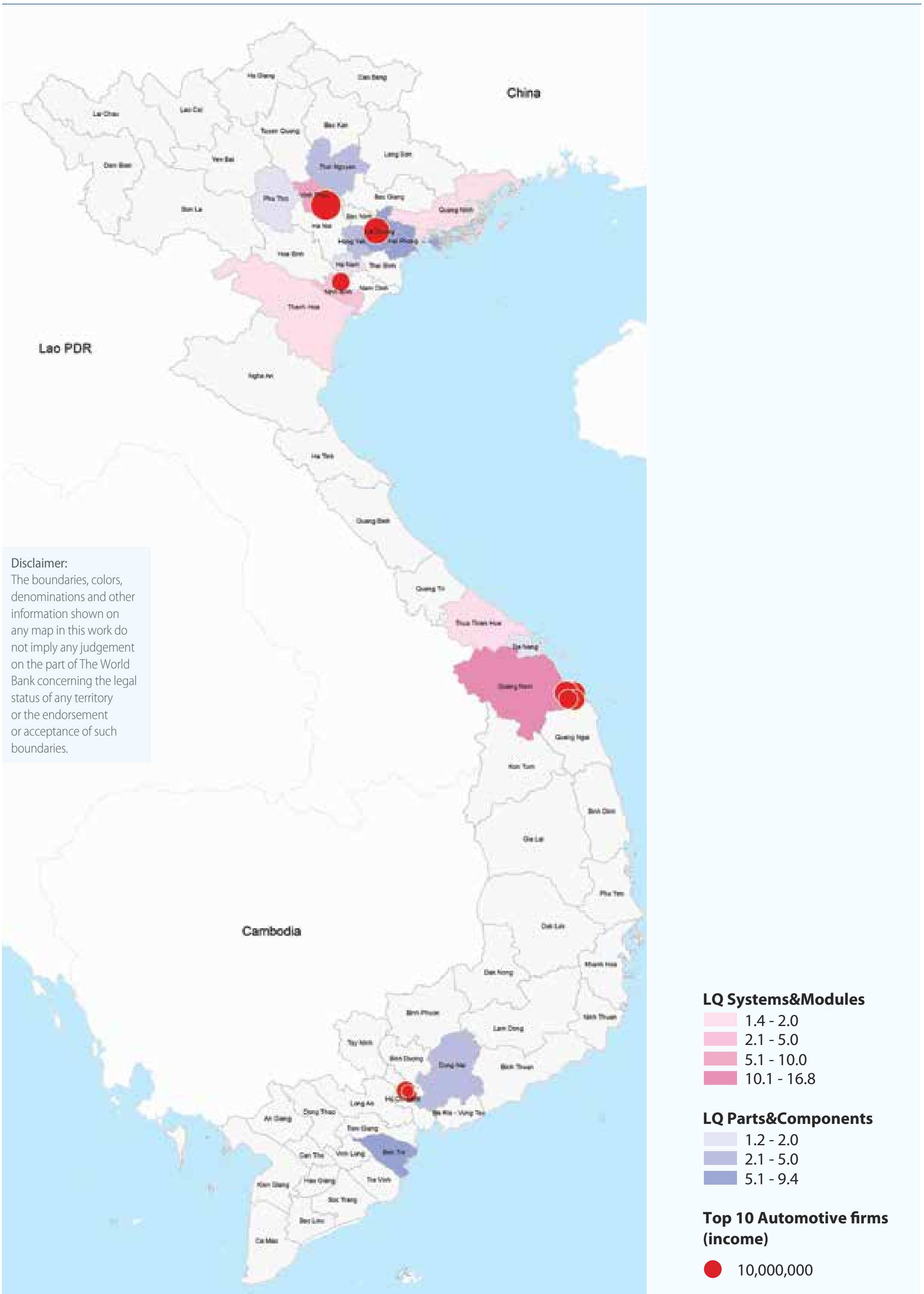
FIGURE A4.7. **Locational distribution of the modules and final assembly segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Map A4.1 shows the automotive value-chain spatial structure. The auto parts and components segment is shown in turquoise and the final assembly segment is in bright green. The top five largest automotive companies are shown in red circles, located in Vinh Phuc, Hai Duong, and Quang Nam. In the North, Vietnam imports completed vehicles (CBUs), including trucks (HS8704), passenger vehicles (HS8703), and special vehicles (HS8705) from China through Huu Nghi and Mong Cai land gateways, and from other countries through the Dinh Vu port. In central Vietnam, CBUs including trucks and passenger vehicles are mainly imported through Tien Sa port in Da Nang. Southern Vietnam imports trucks and passenger vehicles mainly through Cat Lai port.

MAP A4.1. **Geographic distribution of the automotive value chain**

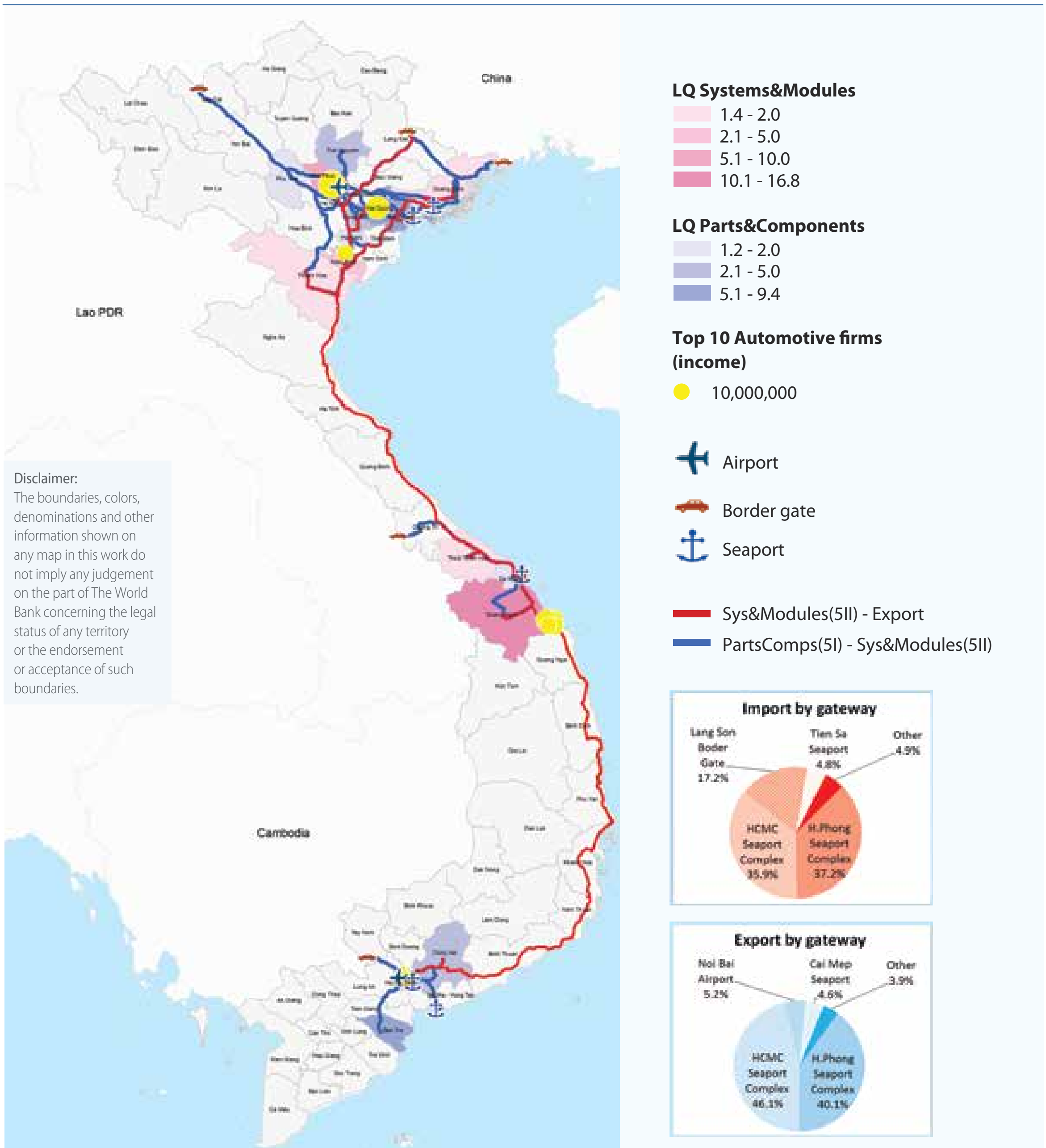


Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

A4.4. Value-chain-based connectivity and key corridors

Map A4.2 demonstrates the connective propensity of the automotive value chain. The two pie-charts show the importance of two seaports in Hai Phong and HCMC, for the automotive trade. These two seaports contributed more than 70 percent of total sector imports and 80 percent of total exports. Provinces should pay attention to local and regional automotive industry development to ensure there are no policy barriers to agglomeration of auto parts and components producers, and to ensure access for domestic and foreign suppliers and buyers.

MAP A4.2. **Connective propensity of the automotive value chain**



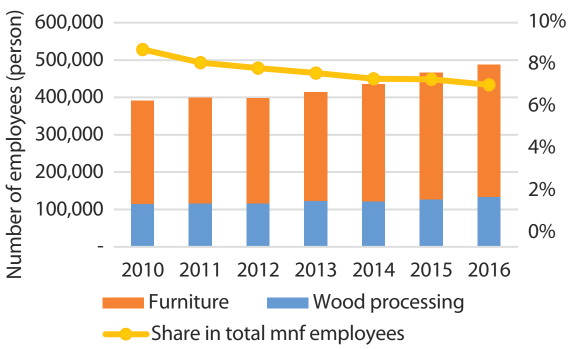
Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by author.

Annex 5

Analysis of the wood products value chain

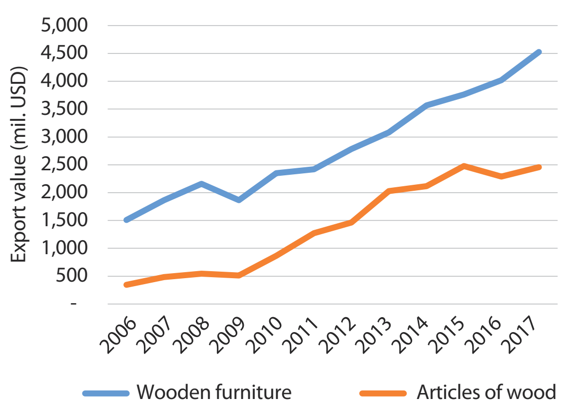
A5.1. Industry overview

FIGURE A5.1. **Employment in wood products manufacturing**



Source: Statistical Yearbook 2017.

FIGURE A5.2. **Rapid export growth in wood products**

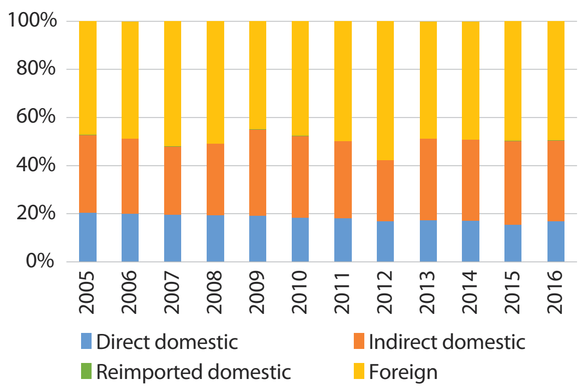


Source: ITC Trademap.

Wood products flourished in the past few years, with more than 8,000 wood processing and furniture manufacturing enterprises. However, employment in the sector did not change significantly. In 2010, wood processing and furniture manufacturing enterprises attracted nearly 400,000 workers, and about 100 thousand more workers by 2016, accounting for about 7 percent of the total labor of the manufacturing sector. Although it increased in quantity, the proportion of wood products labor in the manufacturing sector decreased from 9 percent in 2010 to 7 percent in 2016, proving strong labor development in other sectors as shown in Figure A5.1.

The wood sector is a key export industry of Vietnam, ranking fifth after electronics, textiles, footwear and machinery. In 2010, exports of wood products reached US$ 3 billion, up to US$ 6 billion in 2017, and US$ 8 billion in 2018. The wood sector is targeted to reach over US$ 10 billion in exports by 2020. The main wood exports were furniture and fuel wood. At present, domestic material timber does not meet the demand of wood industry. Each year, Vietnam imports about US$ 2 billion in wood materials to meet production needs for domestic and export markets. Figure A5.2 shows a high growth rate for exports of wooden furniture and wood articles over the past decade.

FIGURE A5.3. **Decomposition of wood products' gross export**



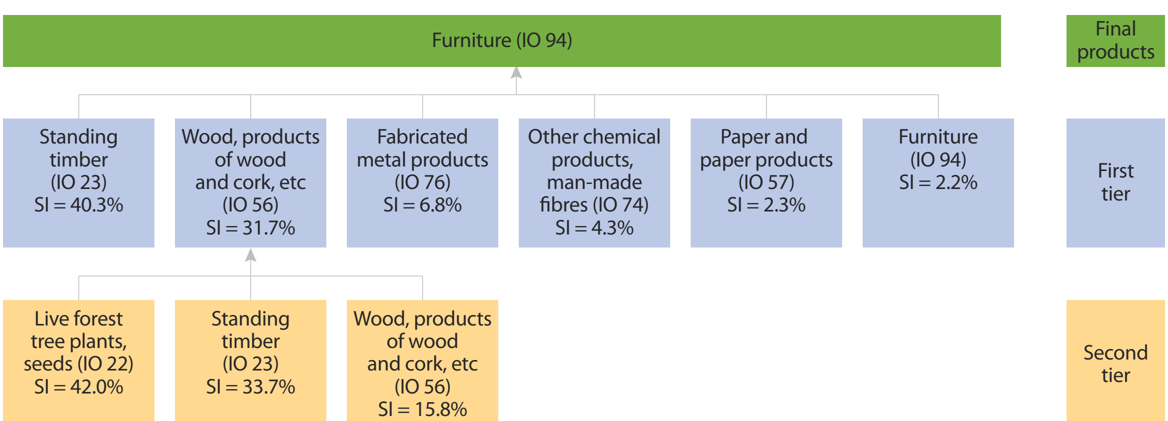
Source: OECD.

Figure A5.3 shows the value-added structure of Vietnam's wood exports. Generally, in the last 10 years, this structure did not change much. About 50 percent of the sector's added value was based on imports, over 30 percent from supporting industries, and nearly 20 percent created within the industry. Compared to other export-oriented sectors, the domestic value-addition of wood was quite high and stable. With the plan of planting and developing material forests, in the future, the value-added structure could continue to increase its domestic value addition.

A5.2. Value-chain links

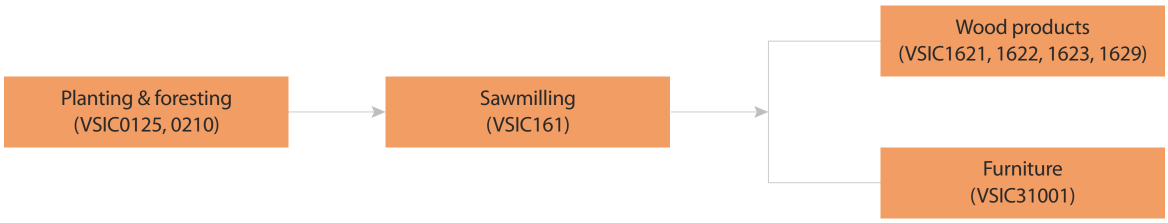
Inter-sectoral links for the wood products value chain are identified and graphed in Figure A5.4. The links show more than 70 percent of furniture were from standing timber and wood products. Because sectors in the I/O table are not disaggregated at 4- or 5-digit VSIC codes, the links show standing timber and wood products are inputs to its own sector. Therefore, the sector's value chain is refined in Figure A5.5 into four segments: planting and foresting, sawmilling, wood products (VSIC 1621m, 1622, 1623, and 1629), and furniture (VSIC 31001).

FIGURE A5.4. **Wood products value-chain links**



Source: I/O Table 2016, authors calculation.

FIGURE A5.5. **Wood products value-chain segments**

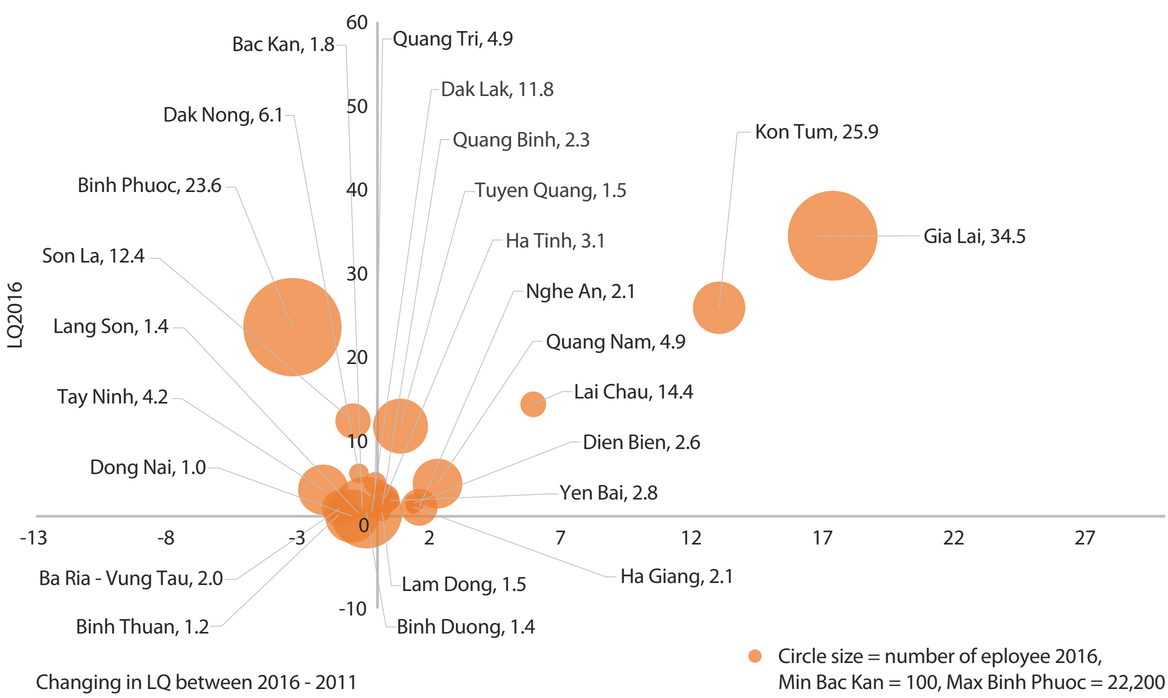


Source: Authors.

A5.3. Spatial structure and value-chain mapping

Figure A5.6 shows planting and foresting are concentrated mainly in western provinces. Gia Lai, Binh Phuoc, and Binh Duong provinces employ over 10,000 in the sector. From 2011 to 2016, planting and foresting were more concentrated in the provinces in the upper-right quadrant, including Gia Lai, Kon Tum, Lai Chau, and Quang Nam. These provinces are sources of materials for wood processing and furniture manufacturers.

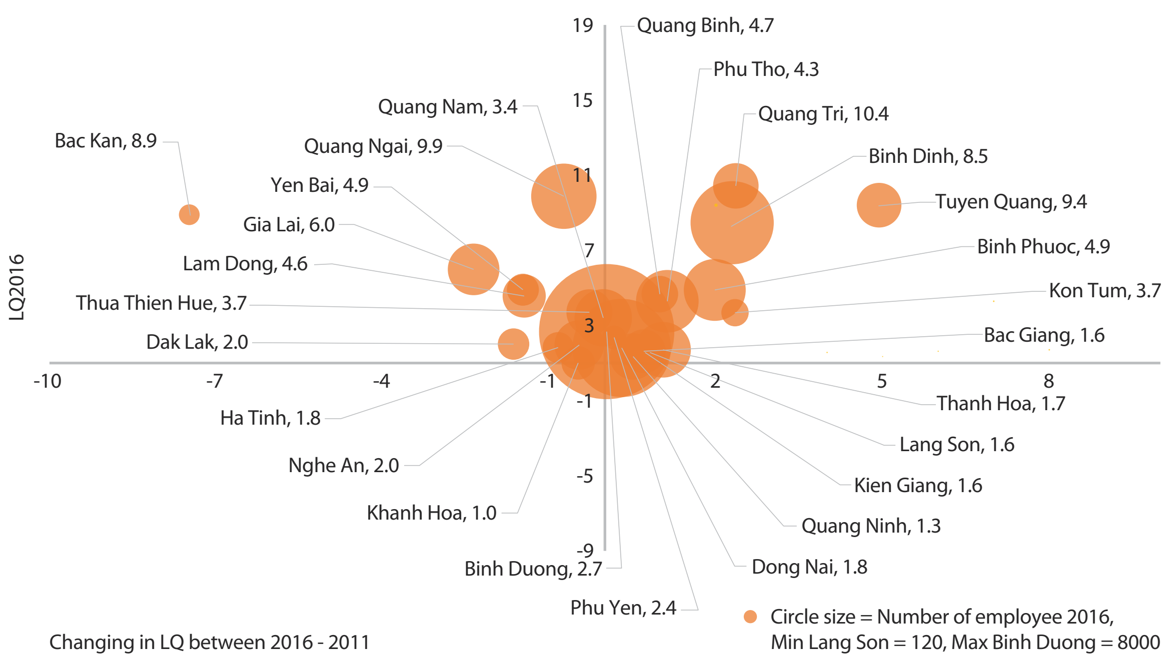
FIGURE A5.6. **Locational distribution of the planting and foresting segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

As seen in Figure A5.7., sawmilling was most concentrated in Binh Duong, with more than 8,000 employees. Binh Dinh also had high sawmilling agglomeration, with an LQ of 8.4 and more than 3,000 workers. Dong Nai also employed many sawmilling workers. Phu Tho, Tuyen Quang, Quang Binh, Binh Dinh, and Kon Tum provinces are plotted in the upper-right quadrant with high LQs in 2016, and greater concentration than in 2011.

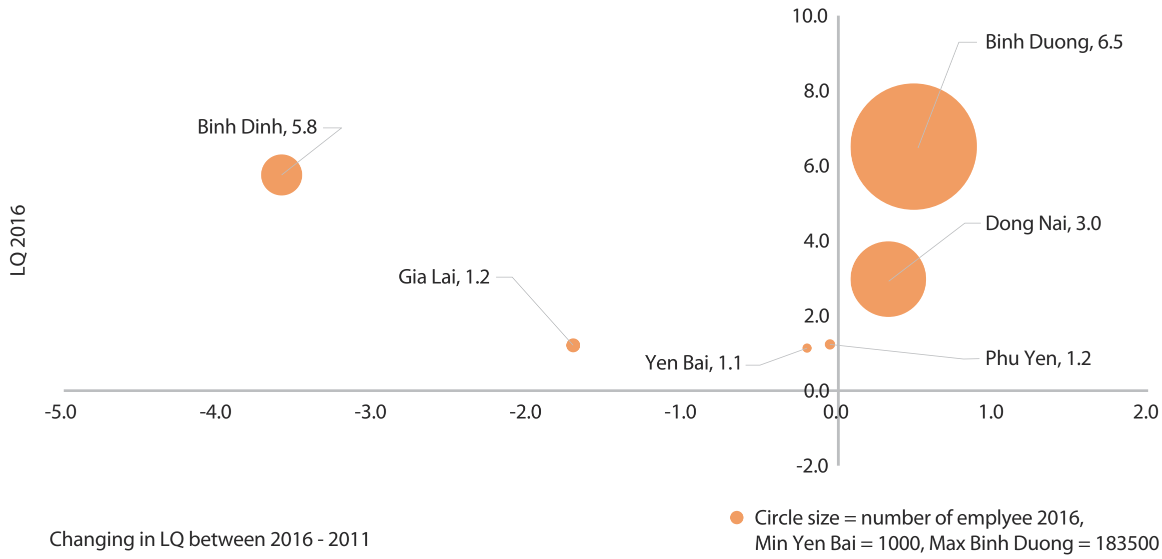
FIGURE A5.7. **Locational distribution of the sawmilling segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

The number of provinces highly concentrated in wood products manufacturing were much fewer than other segments. Figure 5.8 shows only a few provinces had high wood processing agglomeration, namely Binh Duong, Dong Nai, Binh Dinh, Gia Lai, Phu Yen, and Yen Bai. Notably, Binh Duong and Dong Nai have a large labor force, with 180,000 and 65,000 employees respectively. The 2016 LQs for these two provinces were also high and increased from 2011. The remaining provinces had small labor scales, and decreasing LQs between 2011 and 2016.

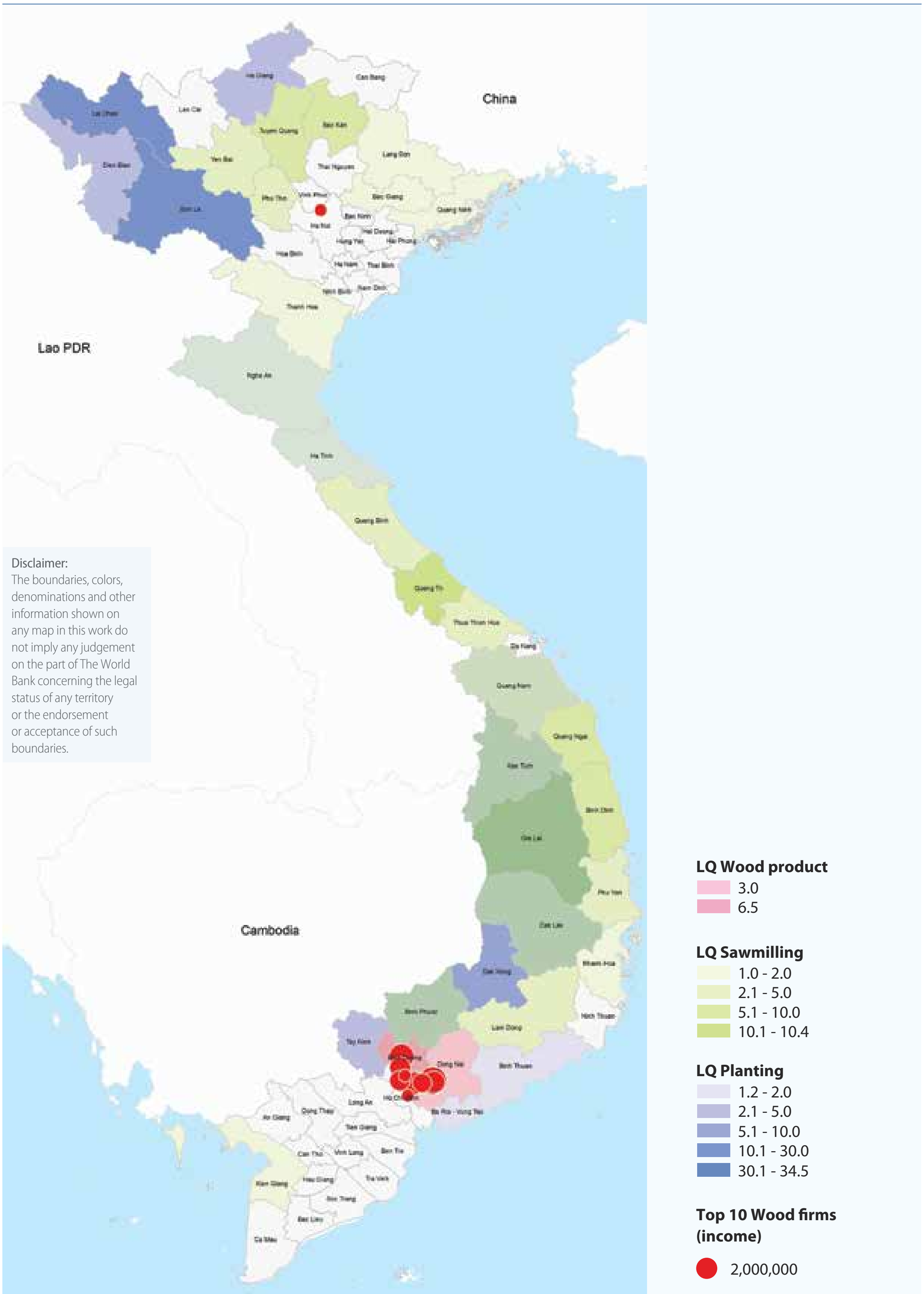
FIGURE A5.8. **Locational distribution of the wood products and furniture segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Map A5.1 shows the spatial structure of the wood products value chain. Planting and foresting segments were mainly concentrated in the Northwest and Central Highlands provinces, sawmilling activities concentration spanned the country, while production of wood products was highly concentrated in Binh Duong and Dong Nai. These two provinces are home to the five largest wood processing enterprises. Wood imports are mainly through Dinh Vu port in the North, Le Thanh gateway in Central Vietnam, and Cat Lai port in the South. The high volume of exported wood products through Mong Cai gateway suggests China may be a big market for Vietnamese wood products.

MAP A5.1. **Geographic distribution of the wood processing value chain**



Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

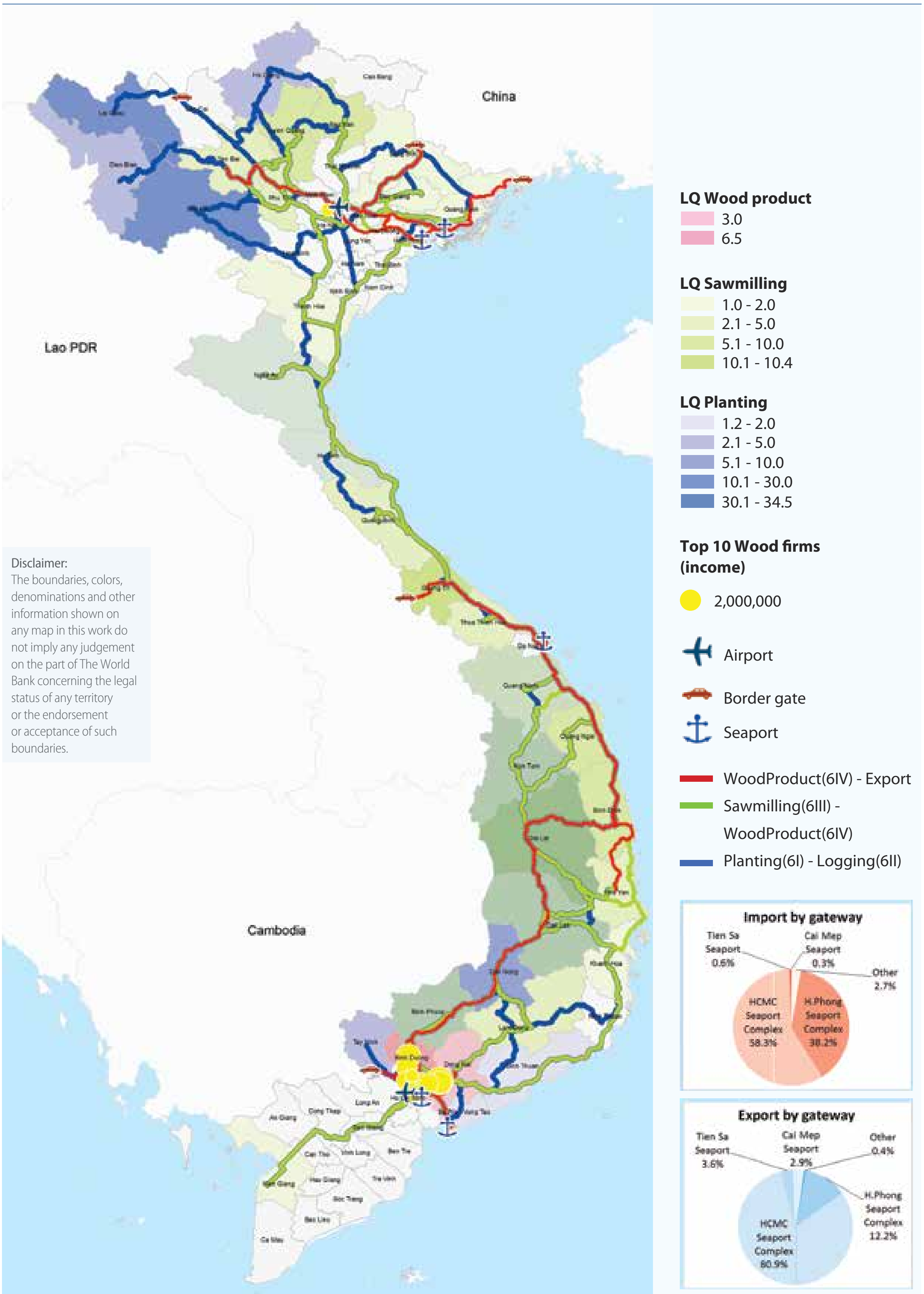
A5.4. Value-chain-based connectivity and key corridors

Map A5.2 shows connective propensity of wood products. Along the value chain, timber products are transferred from the Northwest and Central Highlands provinces to the sawmilling and wood processing provinces. As shown in the map, Binh Duong, Dong Nai, and neighboring provinces like Lam Dong, Binh Phuoc, and Tay Ninh have formed a wood processing cluster, with the presence of leading enterprises in the sector. In the central region, connecting the Central Highlands to coastal provinces from Quang Nam to Binh Dinh could also form a wood processing cluster. In the northern region, wood processing is not really agglomerated and there are fewer leading enterprises than in the South. Strengthening the wood products value chain depends on connecting northwest provinces to midland provinces and the Red River Delta region.

Below are the main transportation corridors for wood:

- From planting to logging: NR22, NR22B, NR51, HCM – Long Thanh – Dau Giay expressway, NR56, NR1 (Lang Son – Can Tho), NR80, HCMC - Trung Luong – My Thuan expressway, NR20, NR13, NR14, AH17, NR28, NR27, NR26, NR29, NR25, NR19, NR24, NR24B, NR14E, NR15, AH13, NR37, NR21A, NR32, NR279 (Dien Bien, Tuyen Quang), Noi Bai – Lao Cai expressway, NR4D, NR2, NR34, NR1B, Ha Noi – Thai Nguyen expressway, Ha Noi – Bac Giang expressway, NR38, AH14, NR4B, NR18, NR10
- From sawmilling to wood production: NR1 (Lang Son – Can Tho), NR80, NR13, NR14, HCM – Long Thanh – Dau Giay expressway, HCMC - Trung Luong – My Thuan expressway, NR51, NR20, AH17, NR26, NR29, NR25, NR19, NR24, NR24B, NR14E, NR21A, NR32, NR279 (Tuyen Quang), Ha Noi – Thai Nguyen expressway, Ha Noi – Bac Giang expressway, NR38, AH14, NR18, NR10
- For exports of wood products: NR22, NR51, NR13, NR14, AH17, HCM – Long Thanh – Dau Giay expressway, NR19C, NR19, NR1 (Quang Tri – Binh Dinh, Lang Son – Ha Noi), NR9, AH14, NR18, Noi Bai – Lao Cai expressway (to Yen Bai)

MAP A5.2. **Connective propensity of the wood products value chain**



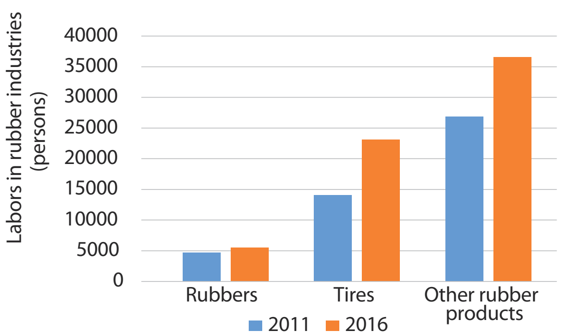
Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

Annex 6

Analysis of the rubber value chain

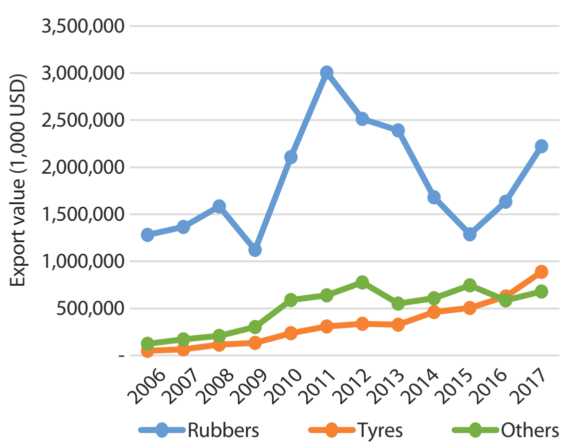
A6.1. Industry overview

FIGURE A6.1. **Employment in the rubber industry**



Source: GSO Enterprises surveys, 2011, 2016.

FIGURE A6.2. **Rubber sector exports**



Source: ITC Trademap.

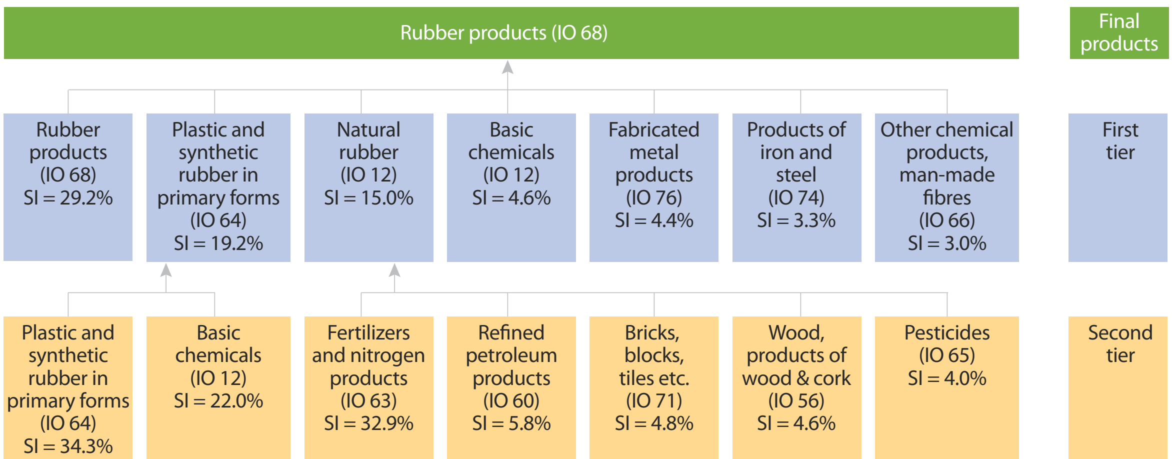
Rubber is an input material for final products and components manufacturing, appearing in most manufacturing industries like electronics, machinery, and vehicles. Between 2011 and 2016, rubber manufacturing enterprises created nearly 20,000 new jobs, with employment increasing from 45,587 to 65,232 (accounting for 0.5 percent of the nation's labor force), and the labor growth rate was 7.5 percent, higher than the national labor growth rate of 5.6 percent.

Recently, Vietnam exported more than US$ 3 billion in rubber and rubber products annually. More than half of Vietnam's rubber export turnover is from primary rubber. Vietnam currently ranks fourth in the world in natural rubber exports, after Thailand, Indonesia, and Malaysia. Vietnam's rubber industry depends heavily on the export market, accounting for over 80 percent of its output. Between 2011 and 2015, there was a sharp decline in global rubber prices, so although rubber exports increased in quantity they decreased in value. Since 2016, the global rubber price has gradually recovered, helping the domestic rubber export grow again.

A6.2. Value-chain links

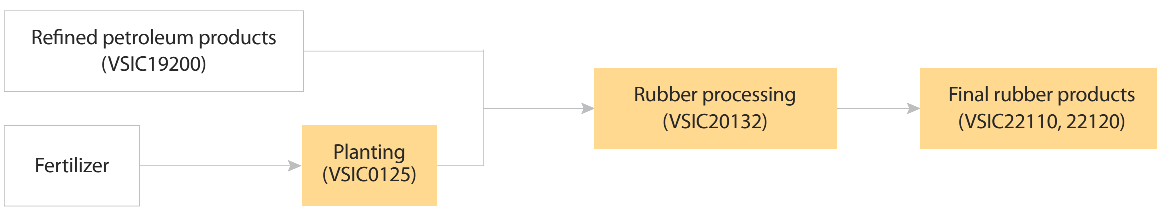
Inter-sectoral links for the rubber value chain are graphed in Figure A6.3. The links show the three main inputs for rubber products are rubber products (29%), rubber in primary forms (19%), and natural rubber (15%). Because sectors in the I/O table are not disaggregated at 4- or 5-digit VSIC codes, the table shows rubber products are inputs to its own sector. Therefore, the sector's value chain is refined in Figure A6.4 into three segments: planting (VSIC 0125), production of rubber in primary forms (VSIC 20132), and final rubber products (VSIC 22110, 22120).

FIGURE A6.3. **Rubber value chain links**



Source: I/O Table 2016, authors calculation.

FIGURE A6.4. **Rubber value-chain segments**

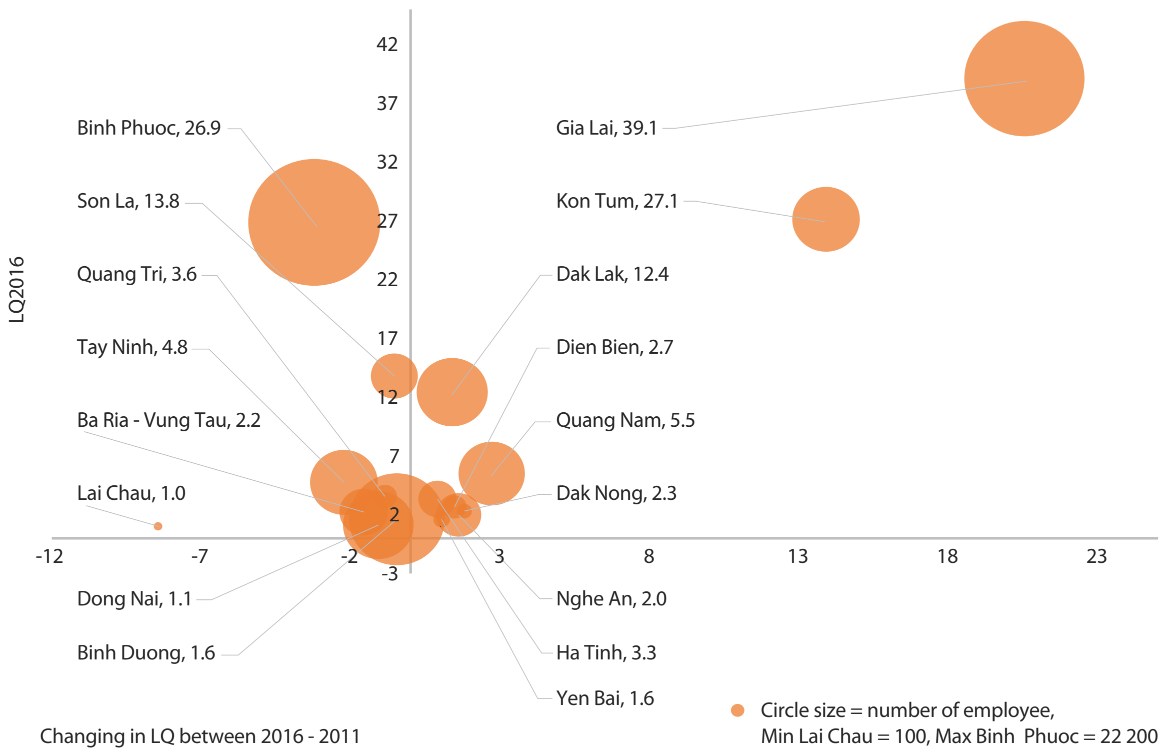


Source: Authors.

A6.3. Spatial structure and value-chain mapping

Figure A6.5 shows the provincial concentration of rubber planting. The circle size indicates the province's labor force in the sector. The horizontal axis indicates the LQ change between 2011 and 2016 and the vertical axis is the 2016 LQ index. Binh Phuoc, Gia Lai, and Binh Duong had a large labor force, with over 10,000 workers. In terms of concentration expressed by 2016 LQ, Binh Phuoc, Gia Lai, and Kon Tum were highly concentrated in rubber tree planting, especially in Kon Tum and Gia Lai, where the 2016 LQ increased sharply from 2011, while the Binh Phuoc LQ decreased slightly. In addition to these three provinces, rubber planting was also highly concentrated in other provinces in mountainous, highland, and southwestern regions.

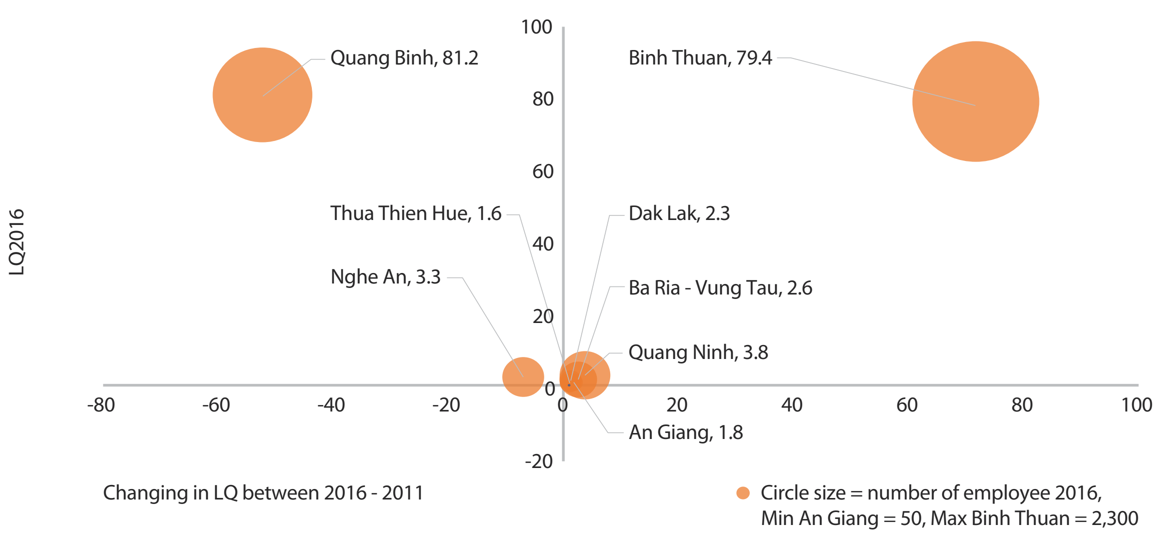
FIGURE A6.5. **Locational distribution of the rubber planting segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Figure A6.6 shows rubber processing concentration across the country. Data from the Enterprise Censuses 2011 and 2016 show rubber processing was mainly concentrated in Binh Thuan and Quang Binh. Between 2011 and 2016, although the LQs of these two provinces were high, their trends were opposite; In Binh Thuan the 2016 LQ increased sharply from 2011, but in Quang Binh it fell sharply.

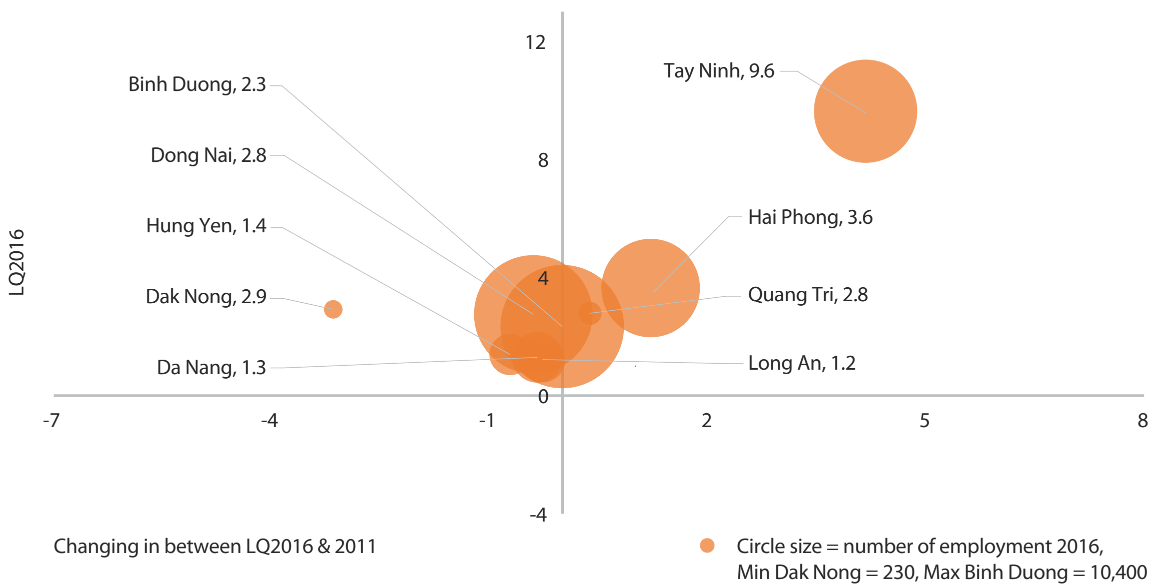
FIGURE A6.6. **Locational distribution of the rubber processing segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Production of rubber products (tires, tubes, and other rubber products) was highly concentrated in Tay Ninh, Hai Phong, Dong Nai, and Binh Duong provinces. These provinces had a large labor force, with over 5,000 employees working in rubber companies. Long An, Da Nang, and Hung Yen had 2016 LQs greater than 1, and a labor size of over 1,000 employees. Notably, the 2016 LQ decreased compared to 2011 in all provinces, yet Tay Ninh, with the highest 2016 LQ, had the largest decrease.

FIGURE A6.7. **Locational distribution of the final rubber products segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

Map A6.1. shows the geographic distribution of each segment in the rubber value chain. Rubber trees are planted mainly in the northwest mountainous provinces of Son La, Dien Bien, Lai Chau, and Yen Bai, and in the highland provinces of Binh Phuoc, Dak Lak, Gia Lai, and Kon Tum. There were fewer provinces concentrated in rubber processing (Binh Thuan, Quang Binh, Nghe An, and Quang Ninh) compared to other segments. Rubber products manufacturing were mainly concentrated in the southern provinces of Tay Ninh, Dong Nai, and Binh Duong. Two provinces in the North, Hai Phong and Hung Yen, also had high concentration in rubber manufacturing.

Most of the big rubber firms in the top ten by revenue are based in the South and only one firm is located in Hai Phong province in the North.

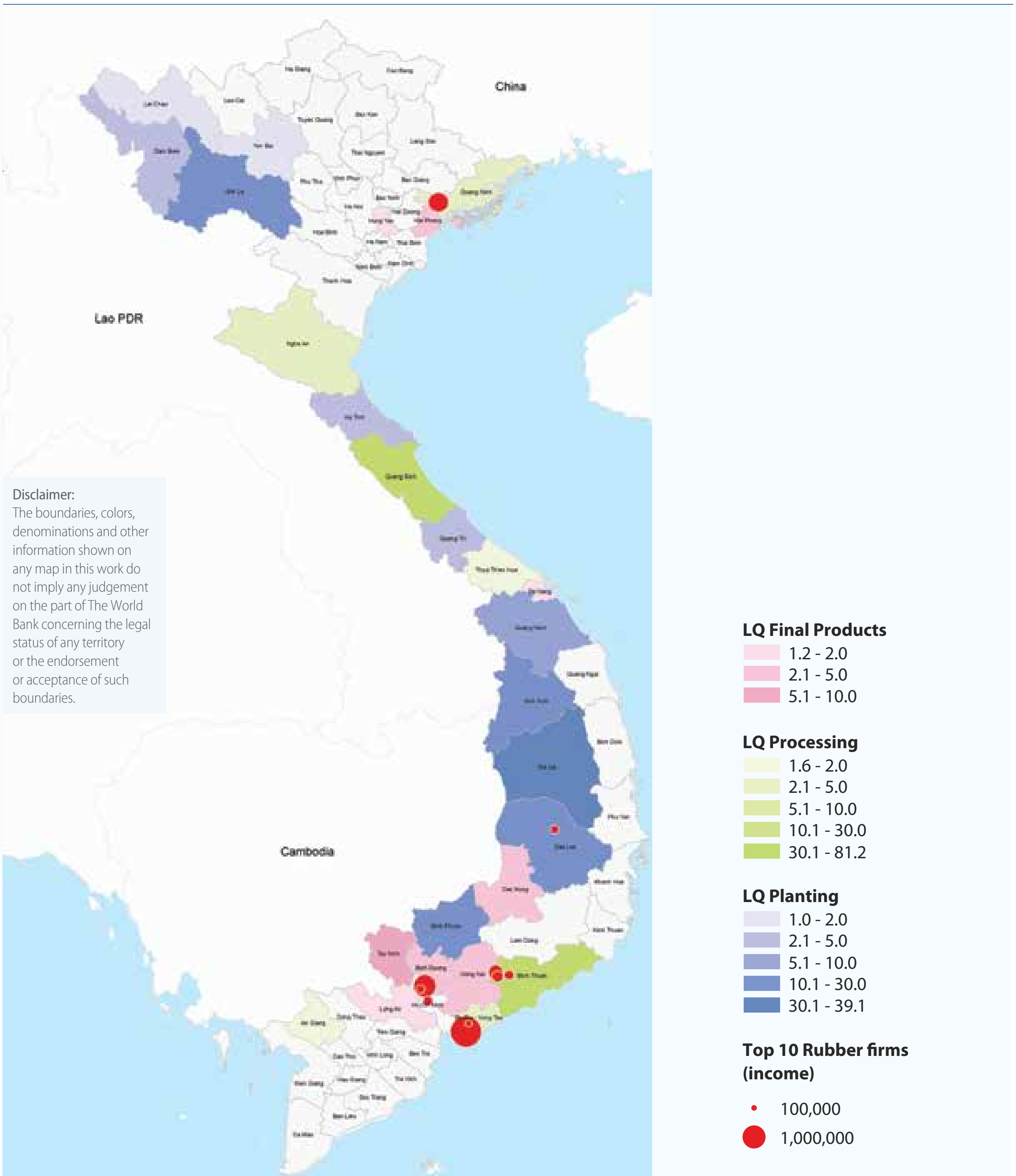
A6.4. Value-chain-based connectivity and key corridors

Map A6.2. demonstrates the connective propensity of the rubber value chain. Each segment uses different corridors for their product transportation. Main corridors of each segment are highlighted below.

- From planting to processing: NR91 (An Giang), NR1 (Ha Noi – Binh Dinh, Binh Thuan – Can Tho), HCMC - Trung Luong – My Thuan expressway, NR51, NR56, HCM – Long Thanh – Dau Giay expressway, NR55, NR28, NR22B, NR22, NR13, NR14, AH17, NR19, PR616 (Kon Tum), PR614 (Kon Tum), NR14E, NR15, HCM road (Hoa Binh – Thanh Hoa), AH13, NR10, NR18, Noi Bai – Lao Cai expressway, NR4D

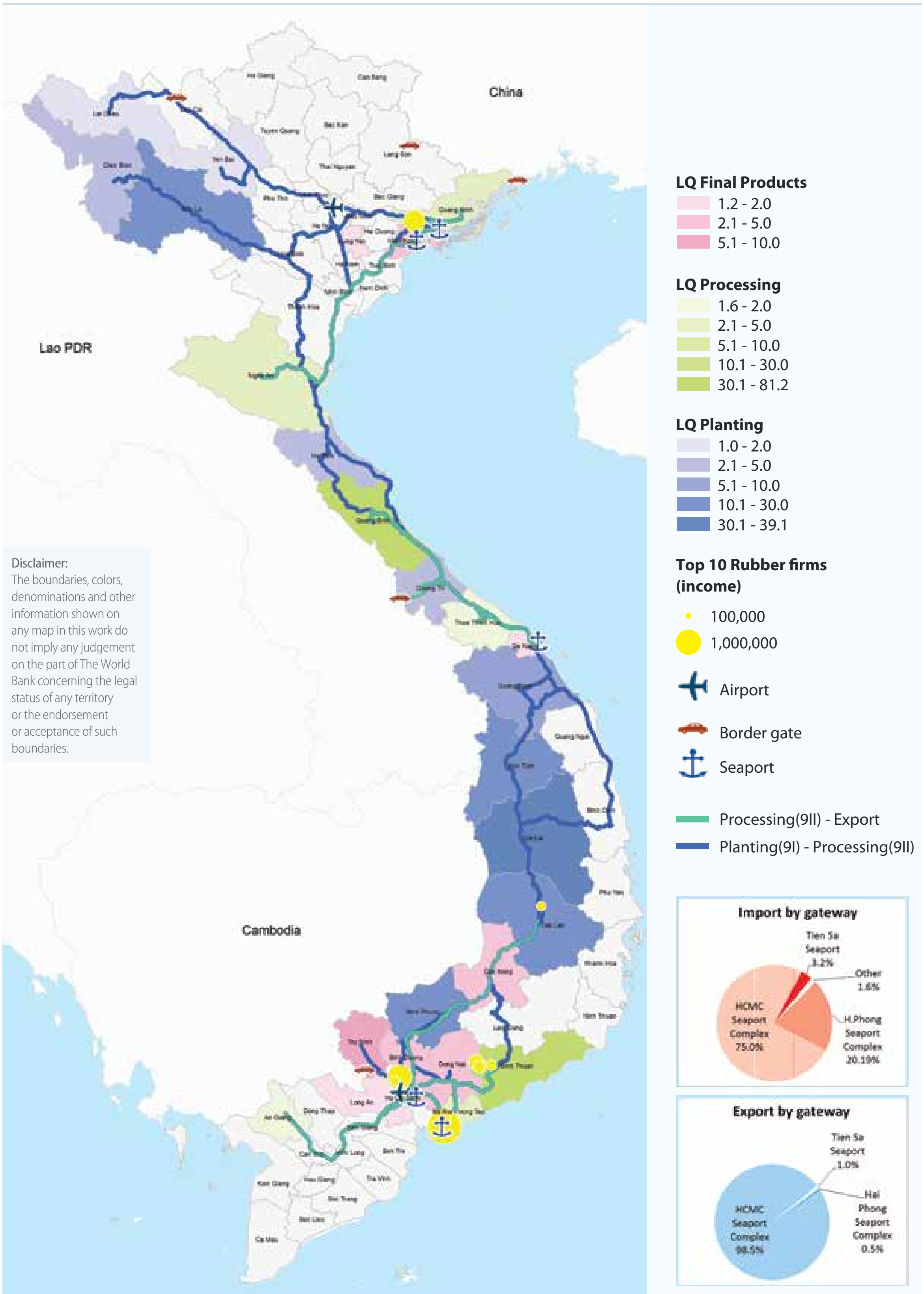
- For exports of rubbers: NR91 (An Giang), NR1 (Quang Binh – Da Nang, Binh Thuan – Can Tho), HCMC - Trung Luong – My Thuan expressway, NR51, NR56, HCM – Long Thanh – Dau Giay expressway, NR55, NR13, NR14, NR9, NR36, NR10, NR18 (Quang Ninh)

MAP A6.1. **Geographic distribution of the rubber value chain**



Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

MAP A6.2. **Connective propensity of the rubber value chain**



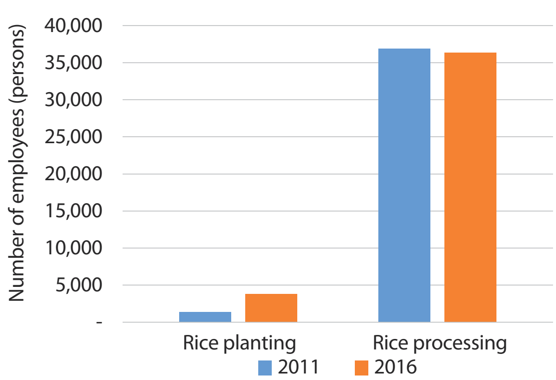
Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

Annex 7

Analysis of the rice value chain

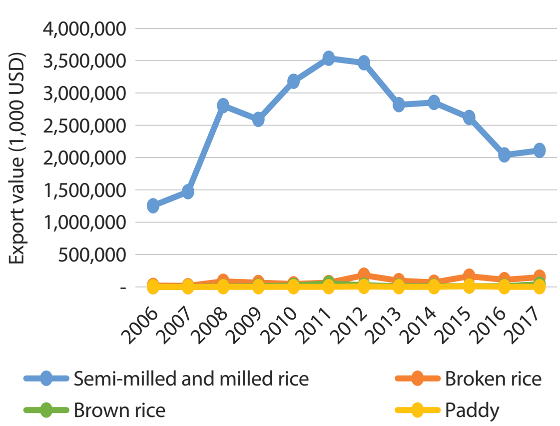
A7.1. Industry overview

FIGURE A7.1. **Employment in the rice sector**



Source: GSO Enterprises Census, 2011, 2016.

FIGURE A7.2. **Rice exports**



Source: ITC Trademap.

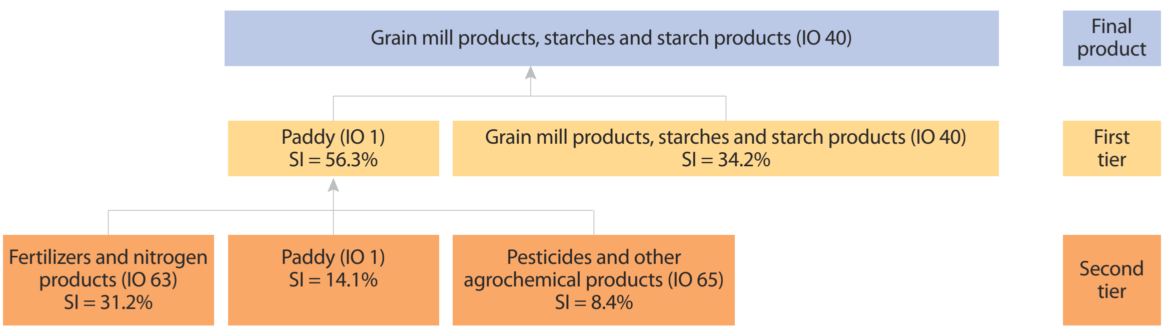
In the rice sector, Enterprise data only cover employment in registered enterprises, not farmers, and households. In 2016, only 200 enterprises registered rice planting activities, employing nearly 4,000 workers; meanwhile, rice processing had more than 1,000 enterprises, and employed more than 36,000 workers. In 2016, more than 100 enterprises participated in rice planting creating about 2,500 more jobs than in 2011. However, rice processing decreased slightly in both the numbers of enterprises and employees. This probably reflects the trend toward industrialization in agricultural, and a labor shift away from agriculture to other economic activities.

Currently, Vietnam ranks third in rice exports, after India and Thailand. The main rice export is semi-milled and milled rice. After a period of continuous growth from 2006 to 2012, export values reached over US$ 3.6 billion in 2013. From 2013 to 2017, export turnover declined sharply due to the decline in global rice prices and demand. Some traditional rice import markets like Bangladesh and Indonesia have pursued self-sufficiency policies limiting the amount of imported rice. China, the world's largest import market, raised technical barriers and set stricter requirements on product quality, which also caused a decline in Vietnamese domestic rice exports. In 2016, Vietnam's export turnover was US$ 2.1 billion, which increased slightly to US$ 2.3 billion in 2017.

A7.2. Value-chain links

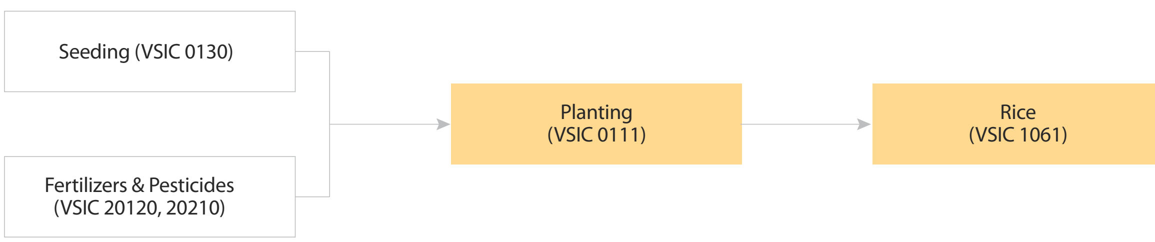
Inter-sectoral links for the rice value chain are identified from the 2016 I/O table, and graphed in Figure A7.3. The links show a simple ecosystem in rice production with three main input sources for rice planting including fertilizers and nitrogen products (31%), paddy (14%), and agrichemicals (14%). Because sectors in the I/O table are not disaggregated at 4- or 5-digit VSIC codes, the links show grain mill products are inputs for itself (34%), beside the main input of paddy (56%). Therefore, the sector's value chain is refined simply in Figure A7.4. into two segments: planting (VSIC 0111) and final rice products (VSIC 1061).

FIGURE A7.3. **Rice value-chain links**



Source: I/O Table 2016, authors calculation.

FIGURE A7.4. **Rice processing value-chain segments**

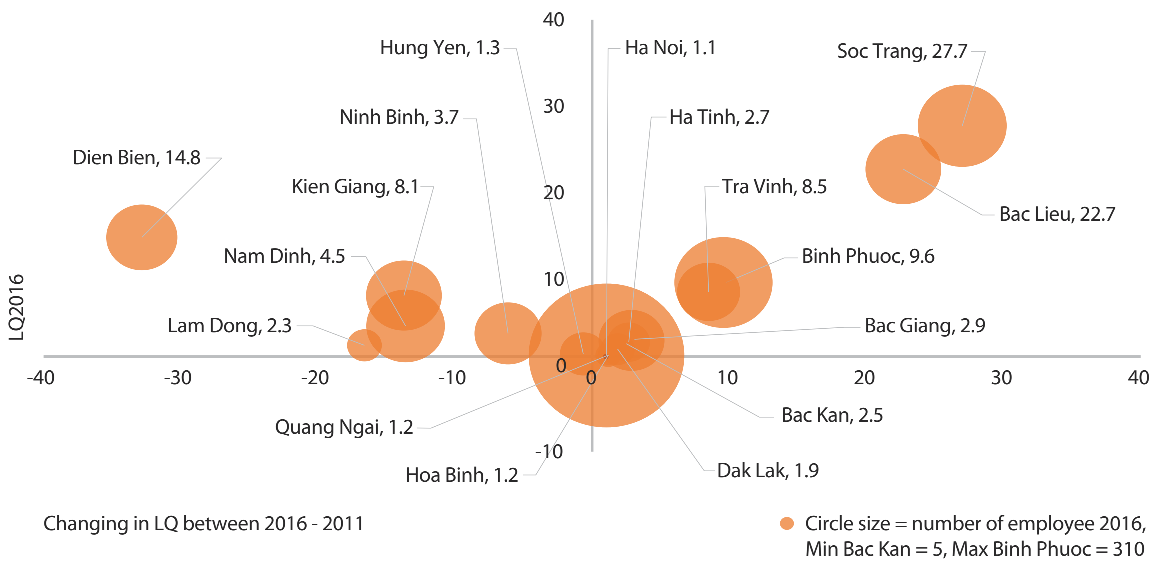


Source: Authors.

A7.3. Spatial structure and value-chain mapping

As an agricultural country, rice-growing has been a key economic activity in Vietnam for a long time, especially in rural areas. Enterprise data showed rice planting was highly concentrated in Soc Trang, Bac Lieu, Binh Phuoc, Tra Vinh, and Dien Bien, with high 2016 LQs. The increase in LQs between 2011 and 2016 shows rice cultivation was still the main economic activity in the Mekong Delta Region. As shown in Figure A7.5., Hanoi Province had the largest labor scale in rice cultivation in 2016, but its LQ in 2016 was small and did not change much from 2011. After expanding capital to neighboring provinces, Hanoi has a larger suburban area where the main activity is growing rice. Because the Enterprise data only consider labor in registered enterprises, and do not include farmers and households, it is more likely that Hanoi's high LQ and labor scale over other provinces is attributed to the higher number of enterprises registered there.

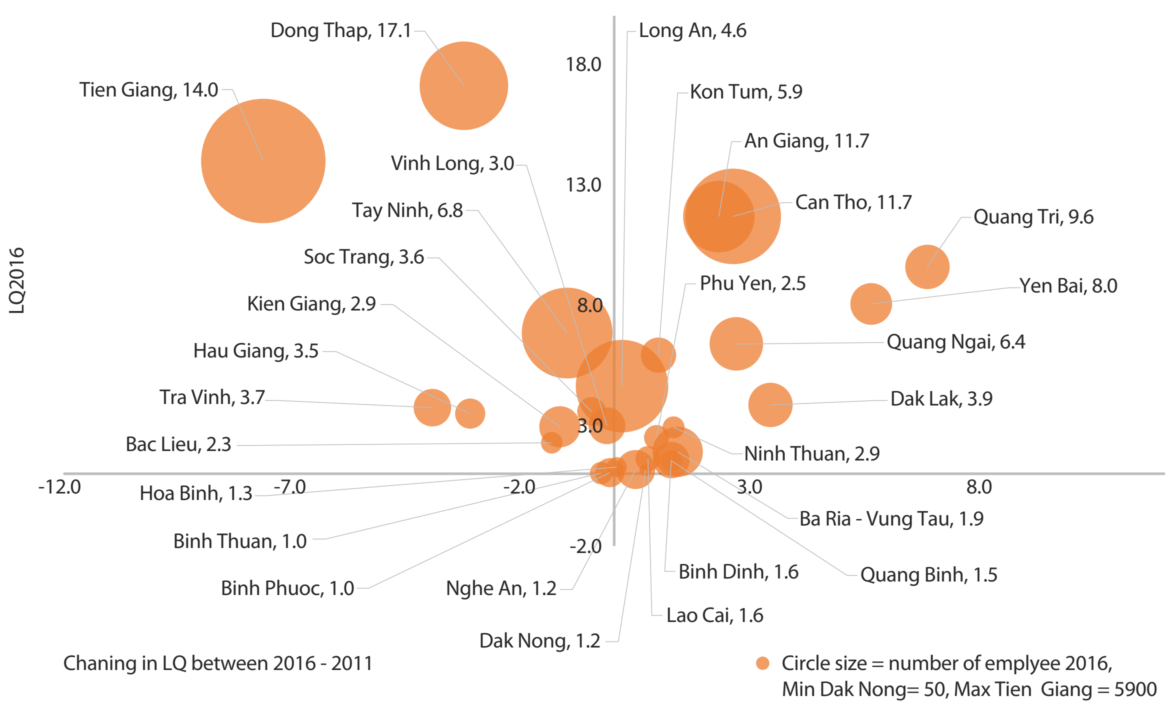
FIGURE A7.5. **Locational distribution of the rice planting segment**



Source: Enterprise Census 2011 and 2016 and calculation by authors.

Figure A7.6 illustrates rice processing concentration across the country. This activity took place mainly in the southern provinces of Tien Giang, Dong Thap, An Giang, Can Tho, Long An, and Tay Ninh. The provinces in the upper-right quadrant had a high LQ in 2016, which increased from 2011, showing they are increasingly strong in rice processing.

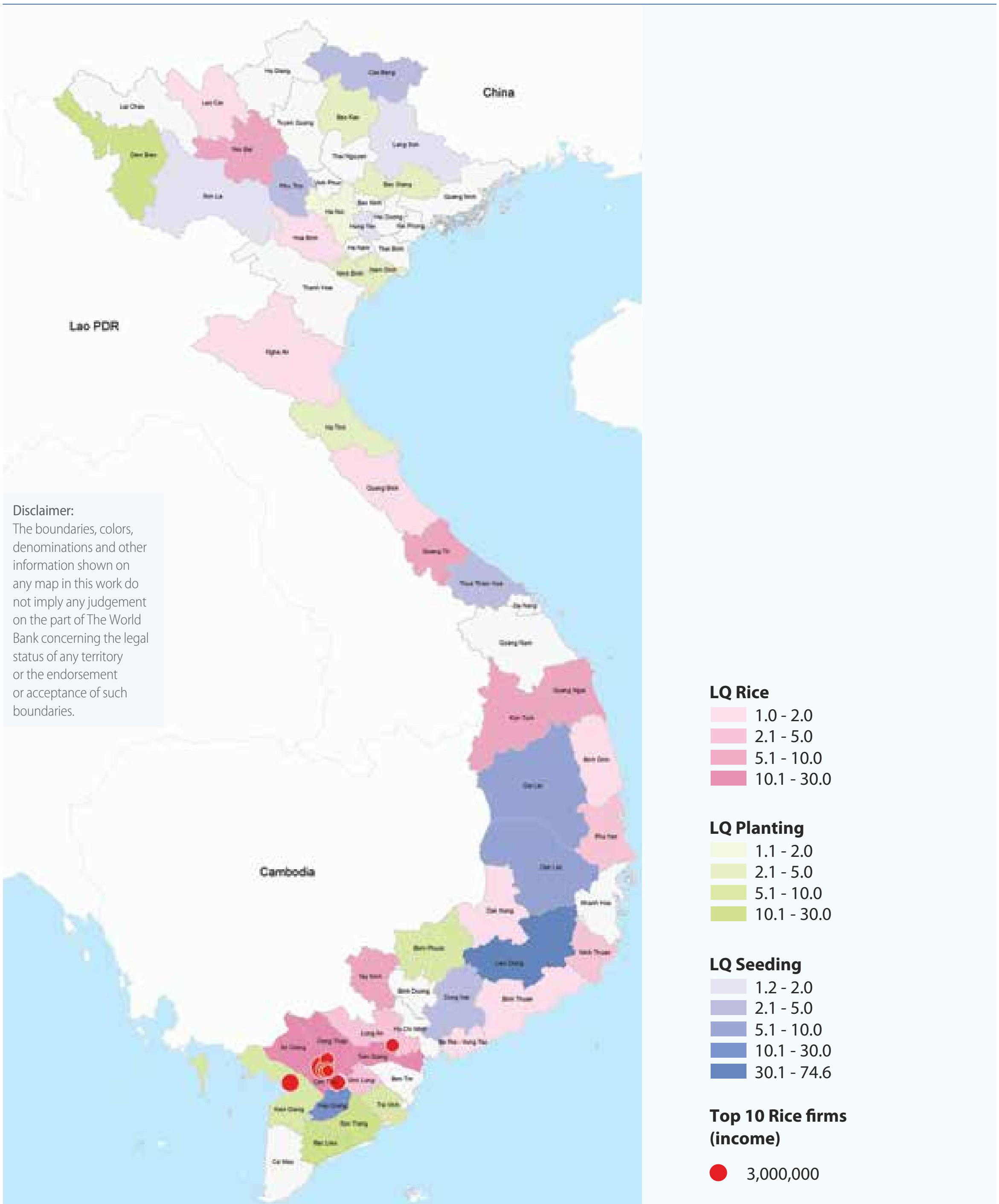
FIGURE A7.6. **Locational distribution of the rice processing segment**



Source: Enterprise Census 2011 and 2016, calculation by authors.

As the third largest exporter of rice globally, seeing rice activity throughout the country is expected. However, Map A7.1 shows seeding is concentrated in Hau Giang and Lam Dong, planting is concentrated in the Mekong and Red River Deltas, and, while rice processing is spreading in every province, it is still quite focused in the Mekong Delta provinces of Tien Giang, Dong Thap, Can Tho, and An Giang.

MAP A7.1. **Geographic distribution of the rice value chain**



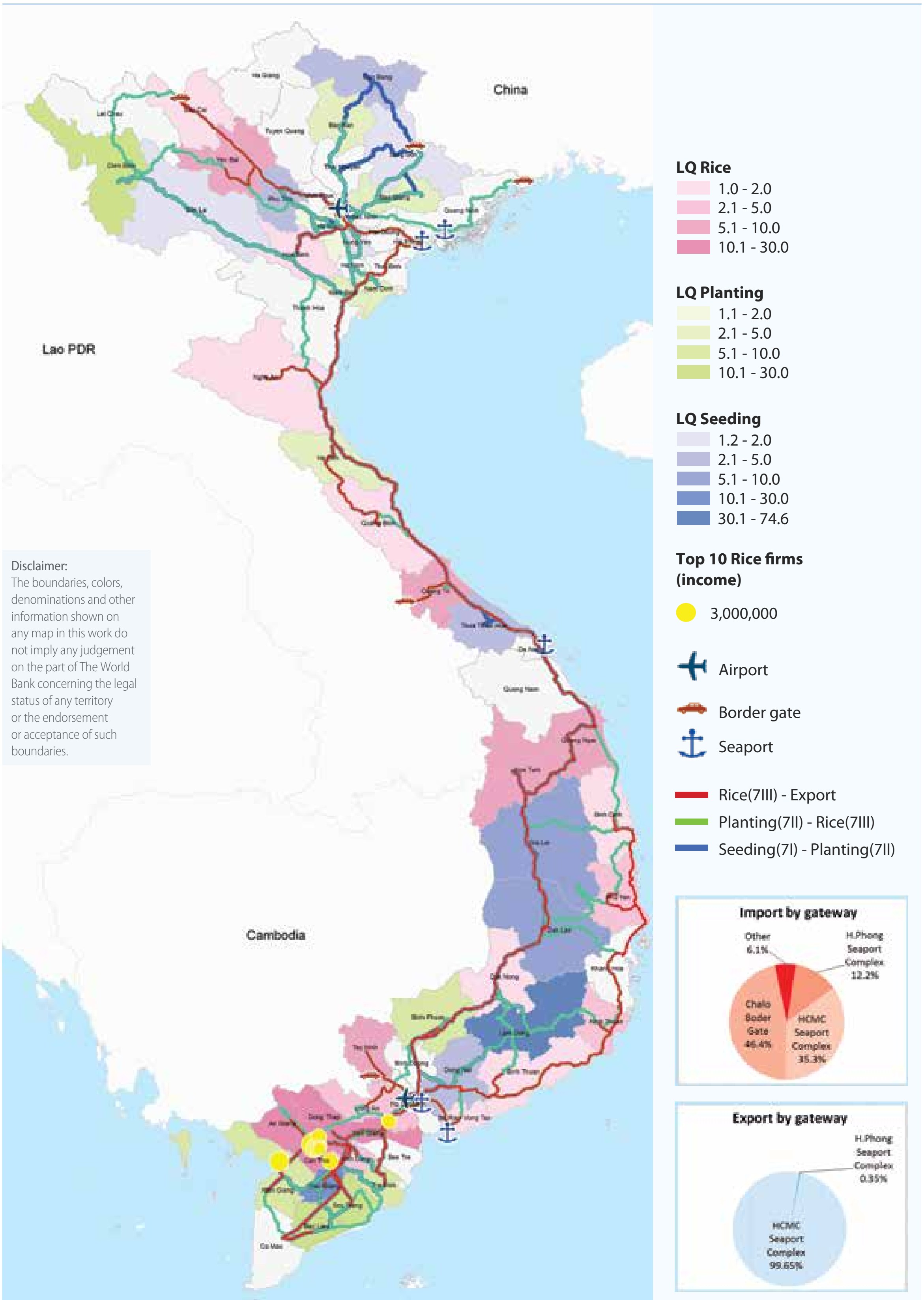
Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

A7.4. Value-chain-based connectivity and key corridors

Map A7.2 demonstrates the connective propensity of the rice value chain. Each segment in the value chain utilizes different transportation corridors, which are highlighted below.

- From seeding to planting: Quan Lo – Phung Hiep expressway, NR91, NR1 (Lang Son – Quang Ngai, HCM – Ca Mau), NR80, NR53, NR13, NR14, HCM – Long Thanh – Dau Giay expressway, HCMC - Trung Luong – My Thuan expressway, NR20, NR28, NR24, NR24B, NR12B, AH13, Phap Van – Cau Gie – Ninh Binh expressway, NR21A, NR3, Noi Bai – Lao Cai expressway (Phu Tho), NR32, Ha Noi – Bac Giang expressway, NR37, NR39A, NR4A, NR1B
- From planting to rice processing: Quan Lo – Phung Hiep expressway, NR91, NR1 (Lang Son – Binh Dinh, HCM – Ca Mau), NR63, NR80, NR60, NR62, NRN2, NR22B, NR51, NR56, NR53, NR13, NR14, NR55, HCM – Long Thanh – Dau Giay expressway, HCMC - Trung Luong – My Thuan expressway, NR20, NR27, NR26, NR29, NR19C, NR19, NR9, HCM road (Hoa Binh – Thanh Hoa), NR12, NR4D, NR279 (Dien Bien), NR28, NR24, NR24B, NR12B, AH13, Phap Van – Cau Gie – Ninh Binh expressway, NR21A, NR3, Noi Bai – Lao Cai expressway (to Yen Bai), NR32, Ha Noi – Bac Giang expressway, NR37, NR39A, NR18
- For rice exports: Quan Lo – Phung Hiep expressway, NR80, NR91, NR1 (Ha Noi – Ca Mau), NR60, NR30, NRN2, NR22B, NR51, HCMC - Trung Luong – My Thuan expressway, HCM – Long Thanh – Dau Giay expressway, NR13, NR14, AH17, NR24, NR24B, NR9, NR15, NR10, AH14, Noi Bai – Lao Cai expressway, AH13 (Hoa Binh)

MAP A7.2. **Connective propensity of the rice value chain**



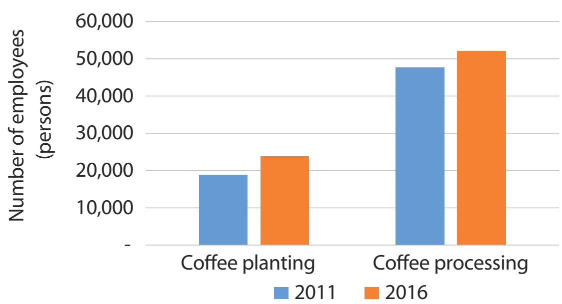
Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

Annex 8

Analysis of the coffee value chain

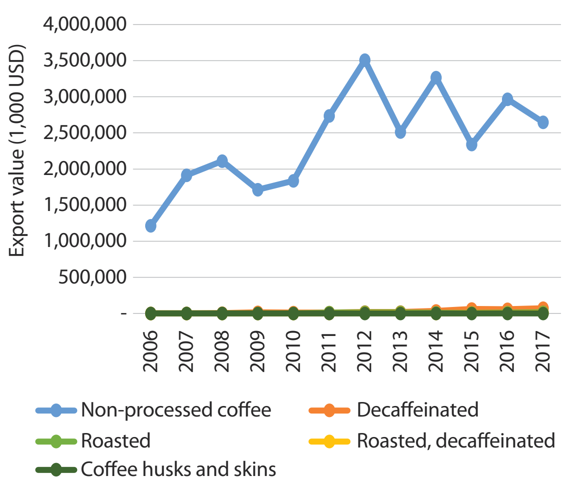
A8.1. Industry overview

FIGURE A8.1. **Employment in the coffee industry**



Source: GSO Enterprises surveys, 2011, 2016.

FIGURE A8.2. **Coffee exports**



Source: ITC Trademap.

Labor in the coffee sector includes workers employed in planting and processing enterprises as indicated in Figure 8.1. Between 2011 and 2016, employment increased in both activities, from 18,785 employees in planting and 47,703 workers in processing in 2011 to 23,728 and 52,053 employees in 2016, respectively.

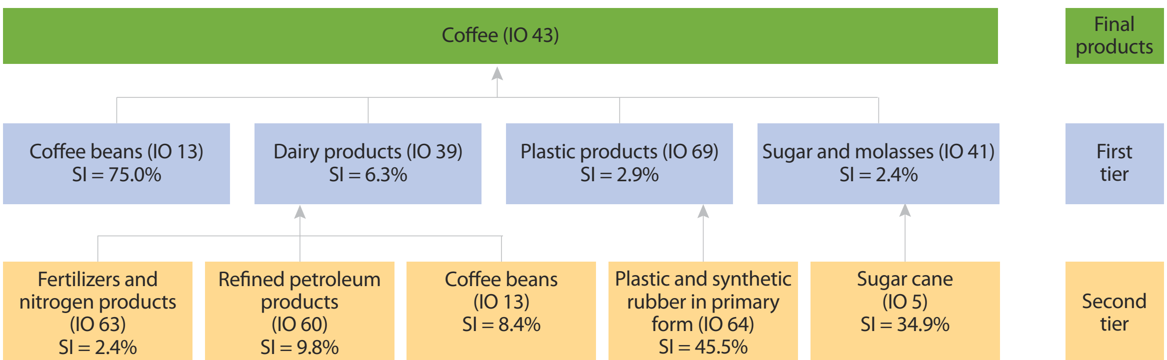
Vietnam ranks second in the world for coffee exports. Exported coffee items include unprocessed coffee, decaffeinated coffee, roasted coffee, roasted decaffeinated coffee, and coffee husks and skins. The main coffee export of Vietnam is unprocessed coffee, accounting for over 90 percent of the total coffee export turnover, as shown in Figure 8.2.

From 2006 to 2012, coffee exports increased steadily, except in 2009. From 2012 to 2017, export turnover fluctuated around US$ 3 billion, with a margin of about US$ 0.5 billion mainly because of instability of global coffee demand and prices.

A8.2. Value-chain links

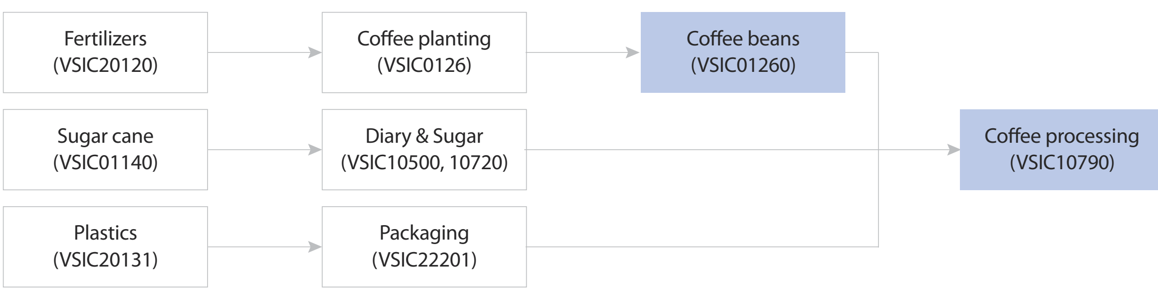
Figure A8.3 shows inter-sectoral links identified from the I/O Table 2016. The links determine the inputs used to produce the final coffee products. For instance, instant coffee is produced mainly from coffee beans (75%), dairy products (6.3%), sugar (2.4%), and packaging (2.9%). Inputs for coffee beans include fertilizers (60%), coffee seeds (8.4%), and gasoline (9.8%). The I/O table data do not indicate which source is a direct input (like coffee raw material), and which source is an indirect input (like fertilizer, gasoline). Therefore, the coffee value chain is refined in Figure A8.4 into two segments: coffee beans and coffee processing.

FIGURE A8.3. **Coffee value-chain links**



Source: I/O Table 2016, calculation by authors.

FIGURE A8.4. **Coffee processing value-chain segments**

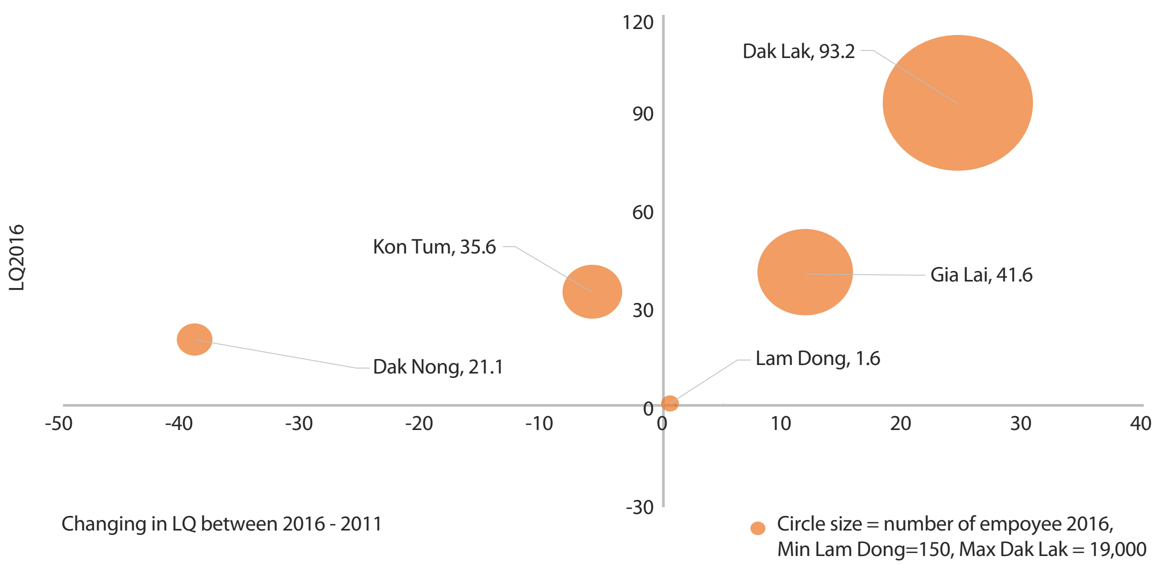


Source: Authors.

A8.3. Spatial structure and value-chain mapping

Figure A8.5 shows coffee growing in Vietnam, was mainly in the Central Highlands provinces, including Dak Lak, Gia Lai, Kon Tum, Dak Nong, and Lam Dong, and the concentration in these provinces was quite high. Between 2011 and 2016, coffee growing strengthened in Dak Lak and Gia Lai, which had the highest 2016 LQs, increased from their 2011 LQs. In Kon Tum and Dak Nong, although their 2016 LQs were high, they decreased from 2011. Possibly new economic activities emerged recently in these provinces, attracting labor from coffee growing, resulting in the sharp decline in LQs between 2011 and 2016.

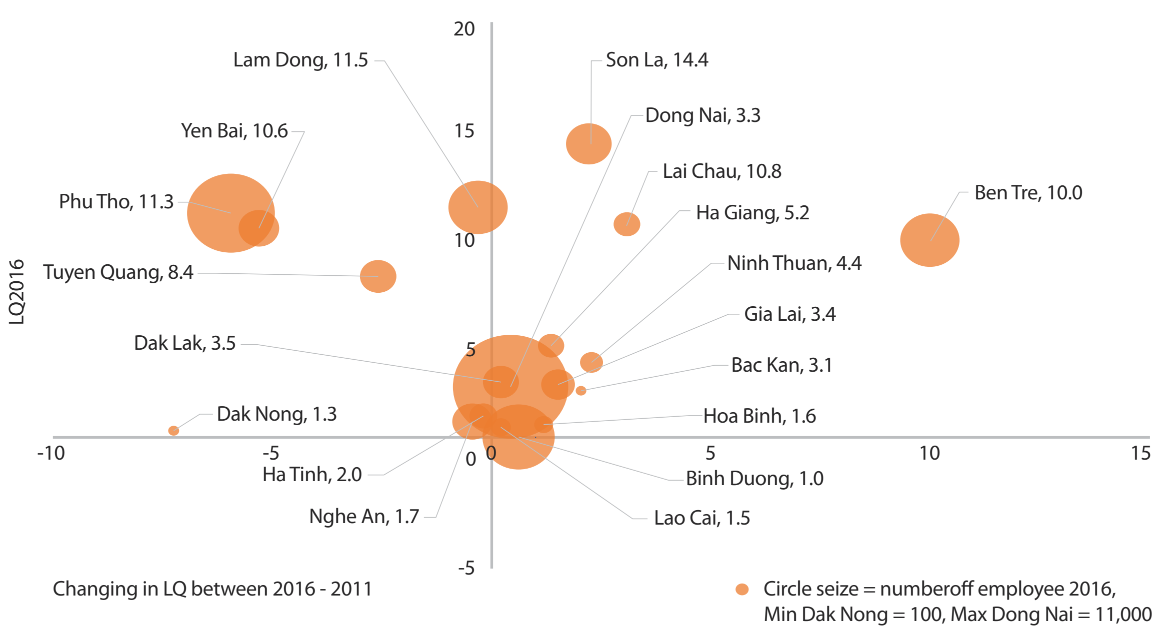
FIGURE A8.5. **Locational distribution of the coffee planting segment**



Source: Enterprise Census 2011 and 2016 and calculation by authors.

Figure A8.6 shows coffee processing concentration. In addition to the Central Highlands, northern mountainous provinces like Son La, Lao Cai, Bac Kan, Phu Tho, Yen Bai, Tuyen Quang, Hoa Binh, and Ha Giang have a tradition of growing and processing arabica coffee from the French colonial period, but on a smaller scale. In addition, Binh Duong, Dong Nai, and Ben Tre are not suitable for coffee growing but employ many in processing activities. Provinces in the upper-right quadrant, including Son La, Lai Chau, and Ben Tre had high processing concentration, and this activity is on the rise, reflected by the higher concentration compared to 2011.

FIGURE A8.6. **Locational distribution of the coffee processing segment**



Source: Enterprise Census 2011 and 2016 and calculation by authors.

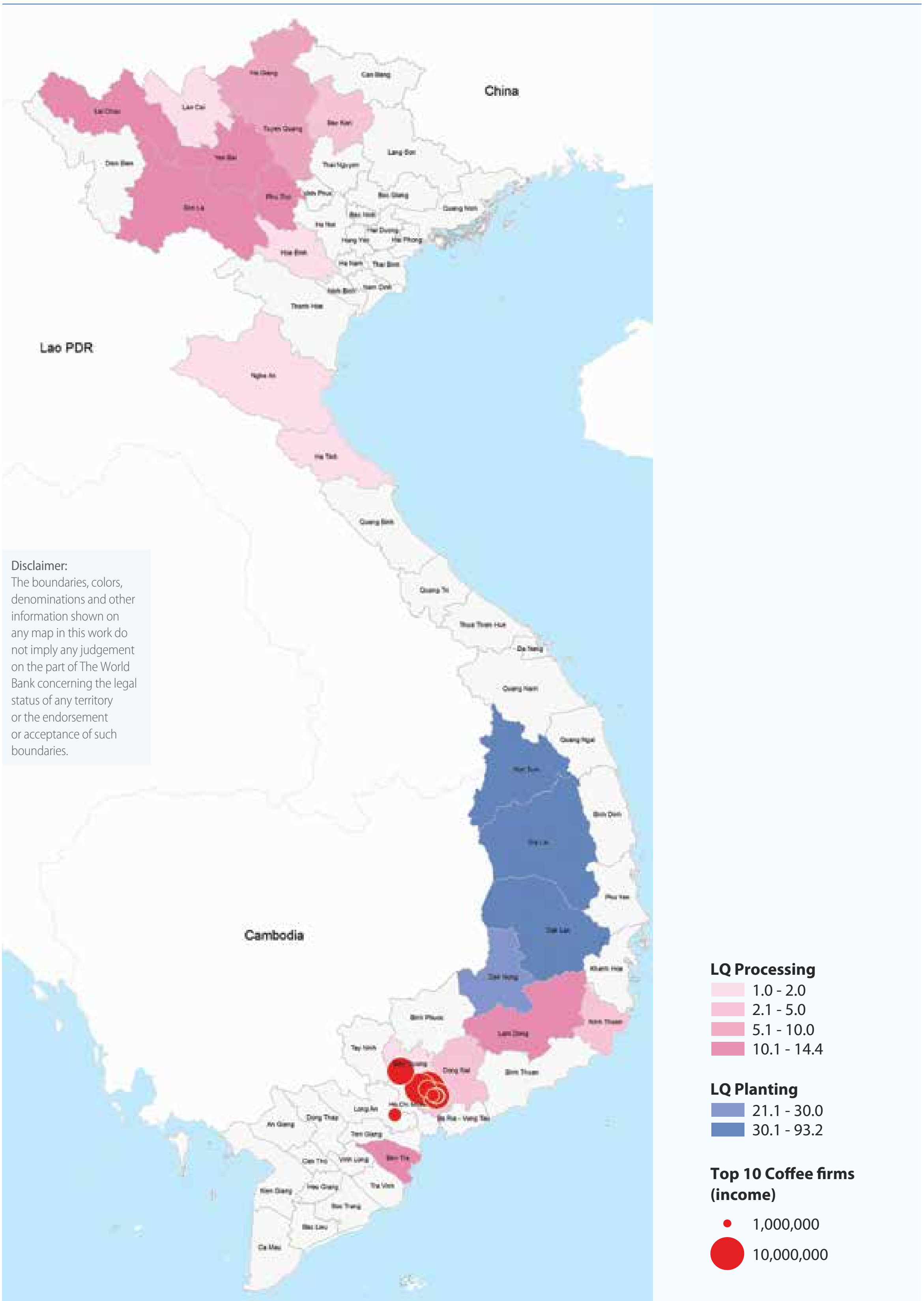
The coffee value chain is simple with only two segments: planting and processing. Coffee tree planting was mainly in the highlands: Kon Tum, Gia Lai, Dak Lak, and Dak Nong. Coffee processing was also concentrated in the highlands, in Lam Dong. Some northern provinces concentrated in both (Lai Chau, Son La, Yen Bai, Phu Tho) as well as some southern provinces (Ben Tre, Dong Nai, Binh Duong, Ninh Thuan), but all big coffee processing firms are located in the South.

A8.4. Value-chain-based connectivity and key corridors

Map A7.2 demonstrates the connective propensity of the coffee value chain. Pie-charts show the HCMC seaport complex is the main gate for coffee trading, which covers more than 50 percent of coffee imports and 90 percent of coffee exports. Considering inland coffee transportation, the main corridors used for each segment are highlighted as follows:

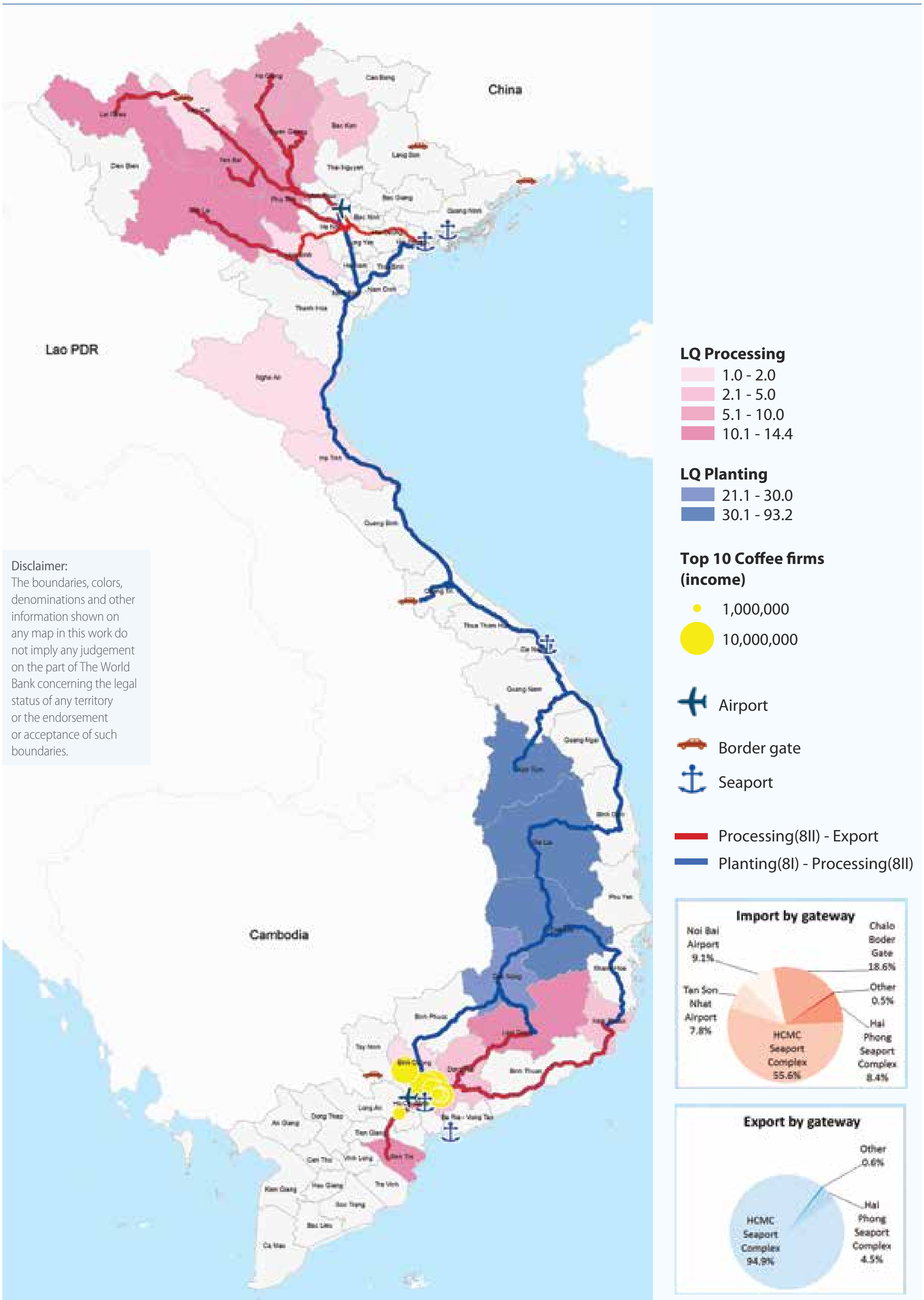
- From planting to processing: NR13, NR14, AH17, NR19, NR28, NR26, NR1 (Ha Noi – Binh Dinh, Khanh Hoa – Ninh Thuan), PR616 (Kon Tum), NR9, AH13 (Hoa Binh – Son La), NR12B, NR10, Phap Van – Cau Gie – Ninh Binh expressway, NR32, Noi Bai – Lao Cai expressway, NR4D, NR2
- For coffee exports: NR60 (Ben Tre), NR1 (Ninh Thuan – Tien Giang), HCMC - Trung Luong expressway, NR20, AH13, AH14, NR32, Noi Bai – Lao Cai expressway, NR4D, NR2

MAP A8.1. **Geographic distribution of the coffee value chain**



Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

MAP A8.2. **Connective propensity of the coffee value chain**



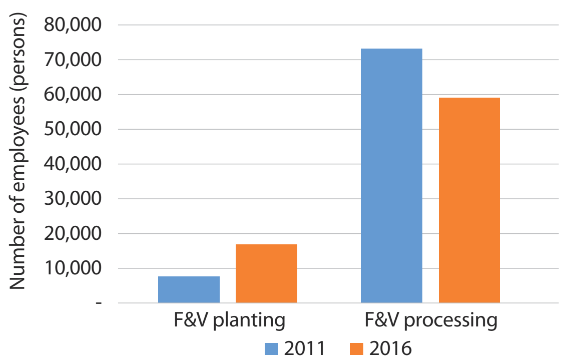
Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

Annex 9

Analysis of the fruit and vegetable value chain

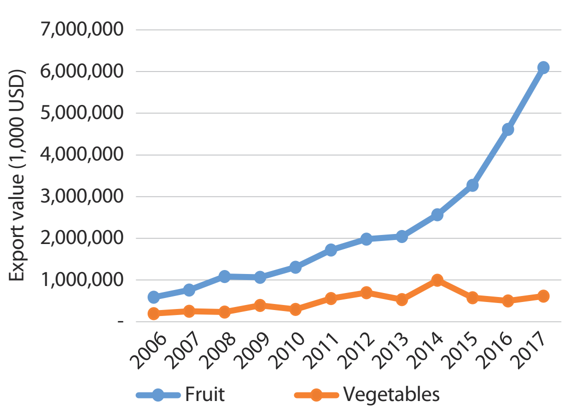
A9.1. Industry overview

FIGURE A9.1. **Employment in the fruit and vegetable sector**



Source: GSO Enterprises surveys, 2011, 2016.

FIGURE A9.2. **Fruit and vegetable exports**



Source: ITC Trademap.

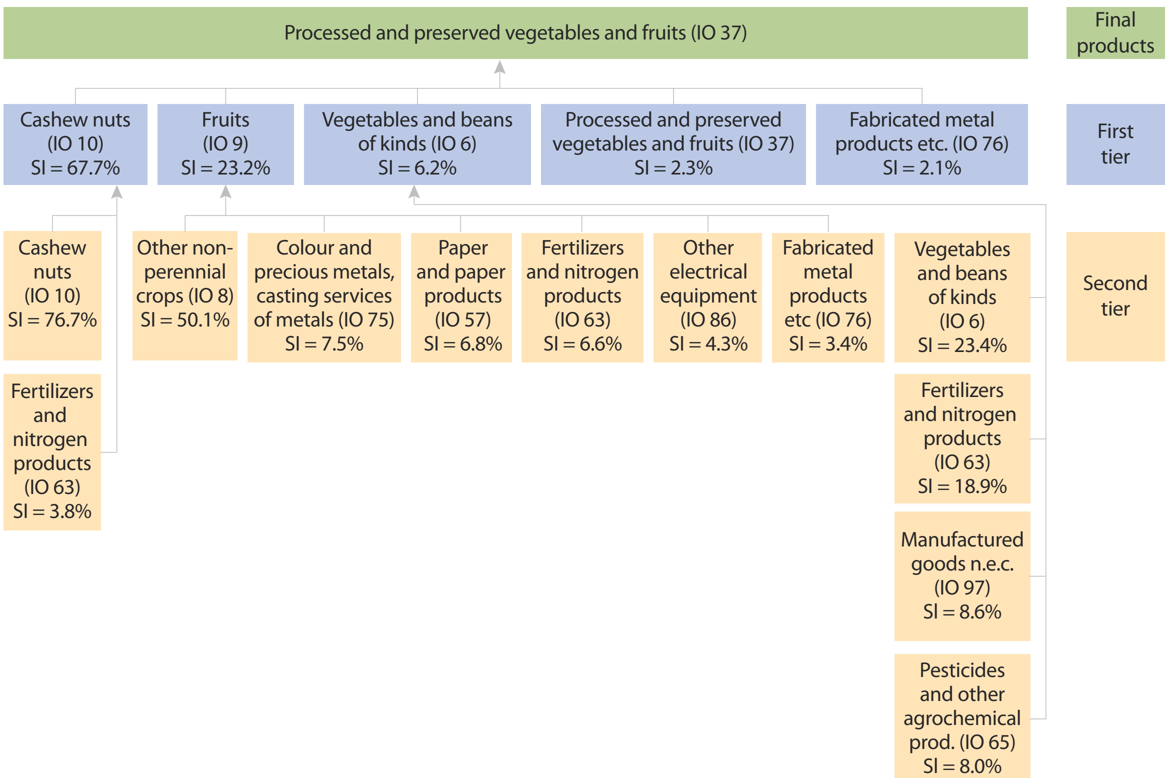
Figure A9.1 shows the number of employees in enterprises in fruit and vegetable (F&V) cultivation and processing. Enterprise data only reflect employees in registered enterprises, which is less common in agriculture. With more than 40 percent working in the rural sector, the actual number of practical workers in farming should be very high. Employment in F&V planting reflected in the Enterprise data was just over 7,000 employees in 2011, increasing to more than 16,000 in 2016. There were more laborers in F&V processing, with over 73,000 people in 2011 and nearly 60,000 in 2016.

Fruit export turnover of Vietnam increased continuously in recent years as indicated in Figure A9.2. During more than 10 years from 2006 to 2017, fruit export value increased continuously, from US$ 0.5 billion in 2006, to more than US$ 6 billion in 2017. Vegetables have not yet been an advantage for Vietnamese exports, with an annual export of just several hundred million (US$).

A9.2. Value-chain links

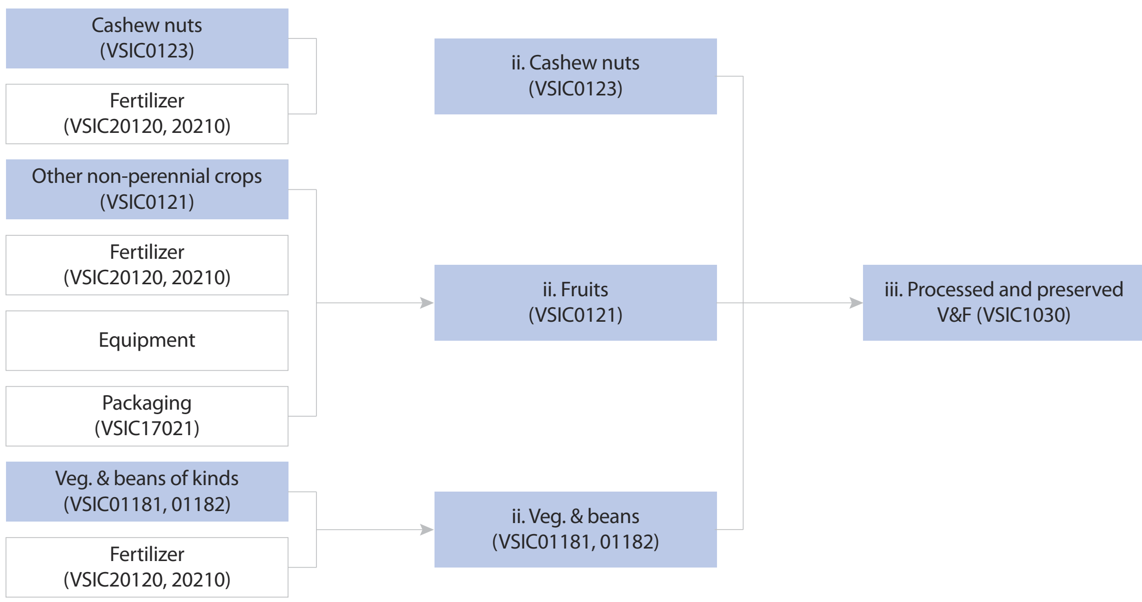
Inter-sectoral links for the F&V value chain are identified from the 2016 I/O table, and graphed in Figure A9.3. The links show sources for F&V processing with many inputs, including cashew nut (67%), fruits (23.2%), vegetable and bean (6.2%), etc. Because sectors in the I/O table are not disaggregated at 4- or 5-digit VSIC codes, the links show processed and preserved F&V inputs to its own sector (2.3%). The sector's value chain is refined simply in Figure 9.4 into two segments: F&V planting (VSIC 0121, 0123, 01181, 01182) and processed and preserved products (VSIC 1030).

FIGURE A9.3. **Fruit and vegetable value-chain links**



Source: I/O Table 2016, calculation by authors.

FIGURE A9.4. **Fruit and vegetable processing value-chain segments**

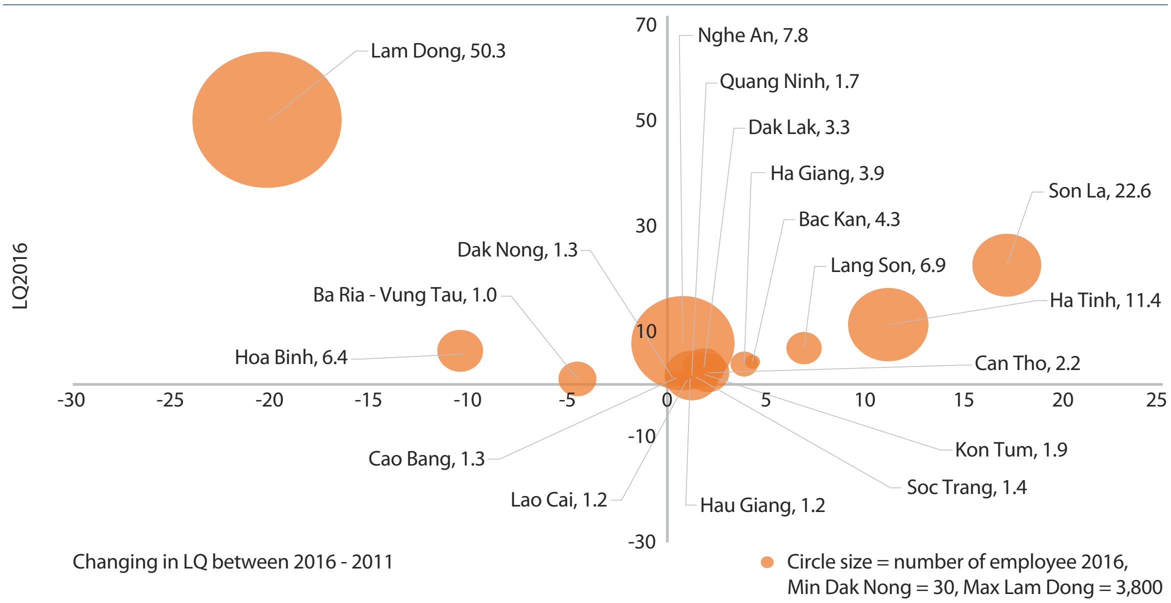


Source: Authors.

A9.3. Spatial structure and value-chain mapping

As shown in Figure A9.5, F&V planting was most concentrated in Lam Dong and Nghe An with a labor size over 1,000 workers in those provinces. However, the concentration in Lam Dong decreased recently, reflected in the decreased LQ between 2011 and 2016. The provinces in the upper-right quadrant, including Son La, Ha Tinh, and Lang Son. had a high concentration of F&V planting and a greater LQ in 2016 than 2011.

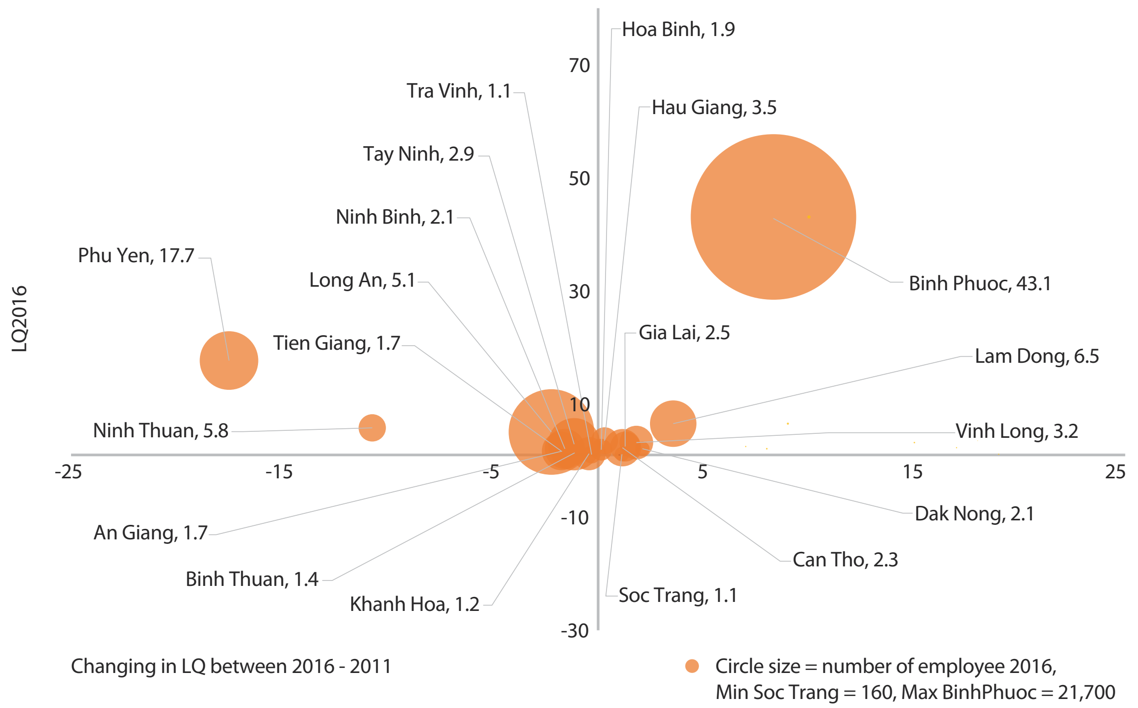
FIGURE A9.5. **Locational distribution of the fruit and vegetable planting segment**



Source: Enterprise Census 2011 and 2016 and calculation by authors.

Figure A9.6 shows the provincial concentration of F&V processing. Binh Phuoc had the largest labor force of more than 21,000 employees. This province also had the highest LQ in 2016, increased from 2011. Besides Binh Phuoc, other provinces with high 2016 LQs, like Lam Dong, Soc Trang, Can Tho, and Hau Giang are located in tropical climate regions, which is an advantage in F&V planting and processing.

FIGURE A9.6. **Locational distribution of the fruit and vegetable processing segment**



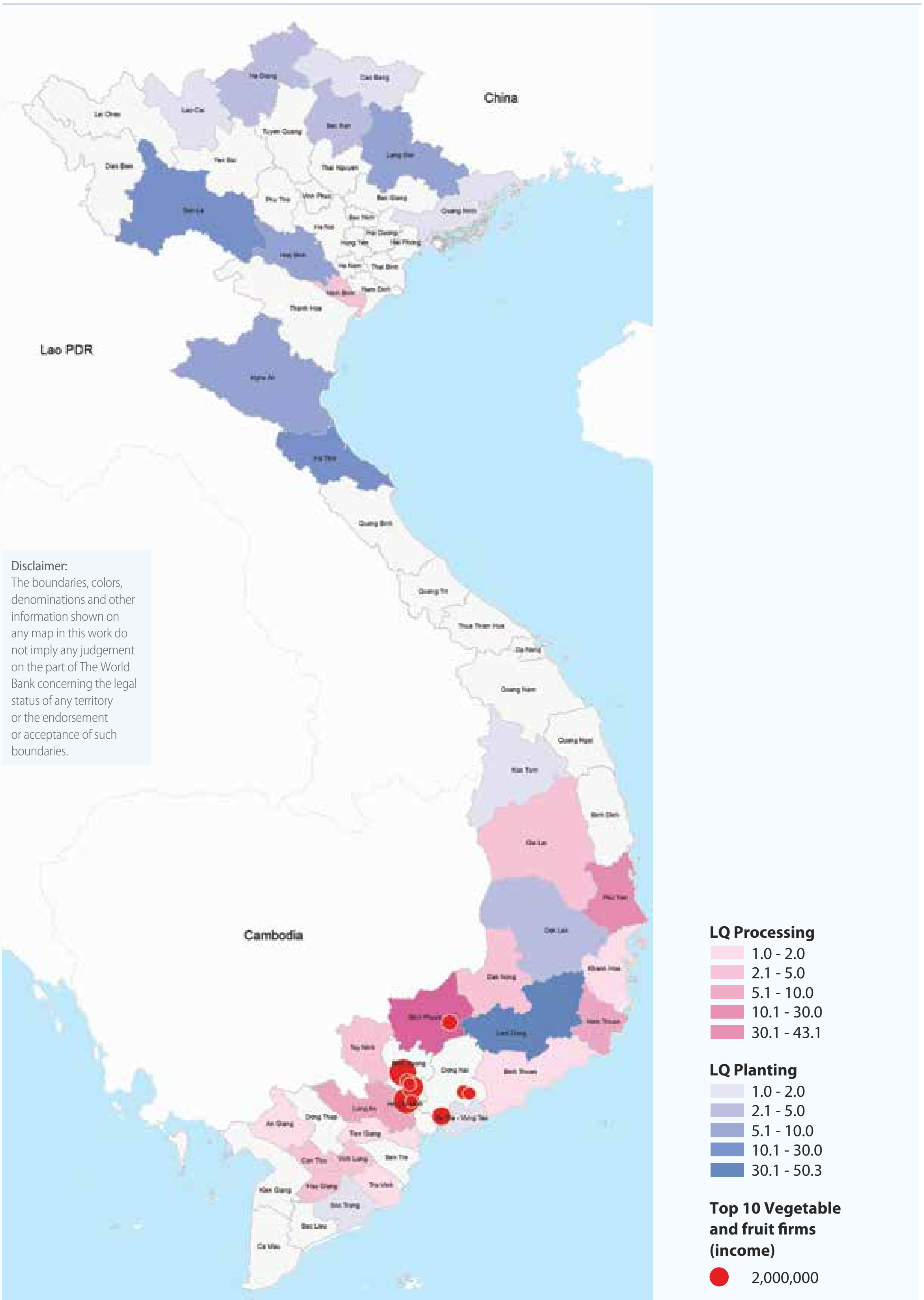
Source: Enterprise Census 2011 and 2016 and calculation by authors.

Vietnam's tropical climate produces various fruits and vegetables. Map A9.1 demonstrates the geographic distribution of the F&V value chain. As shown, F&V planting spans the country, but concentration still emerged in the North (Son La, Hoa Binh, Lang Son, Nghe An, and Ha Tinh) and Highlands (Lam Dong, Dak Lak), while F&V processing was concentrated more in the South (Binh Phuoc, Long An, Tay Ninh, Phu Yen, and Ninh Thuan, etc.).

A9.4. Value-chain-based connectivity and key corridors

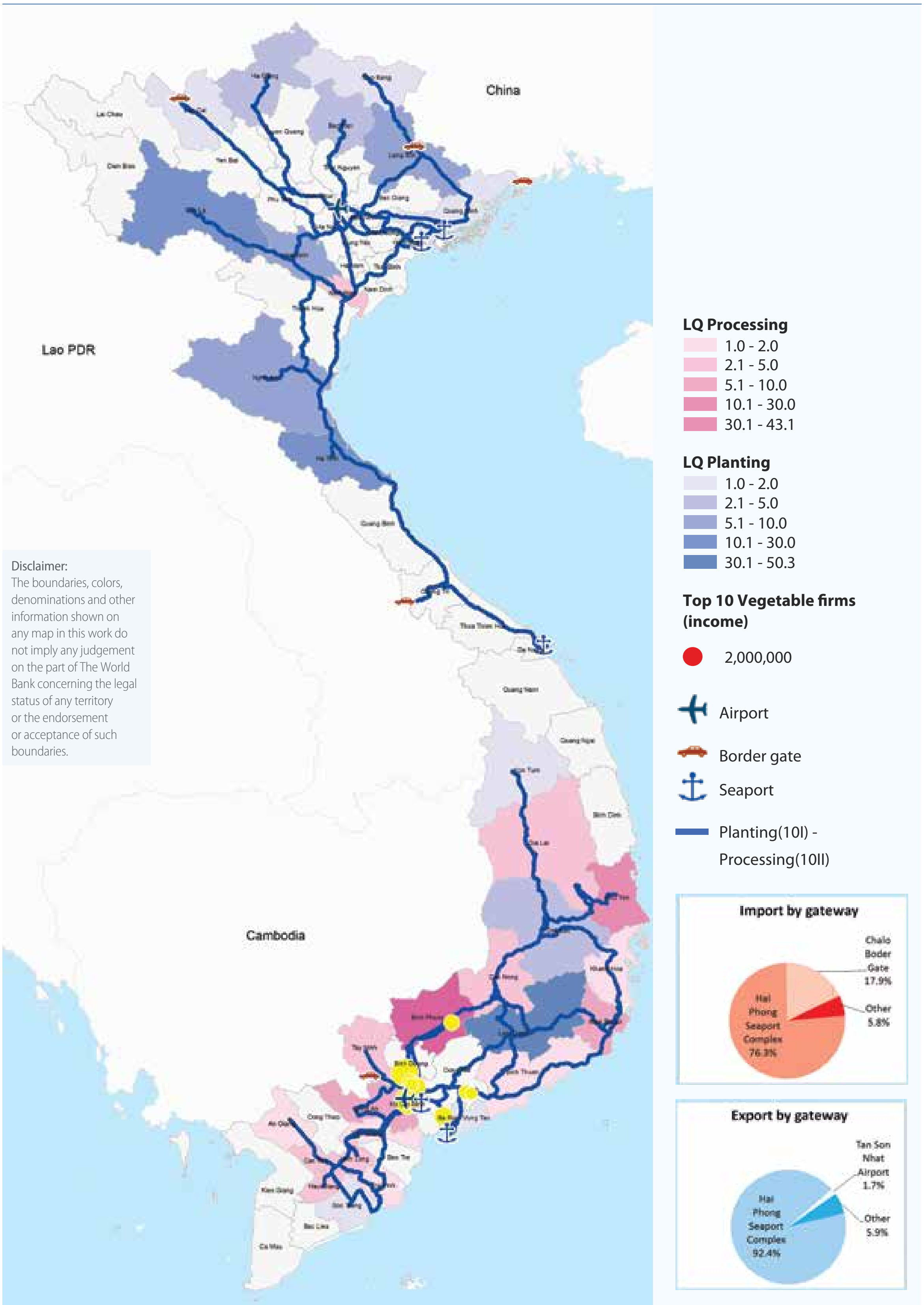
Map A9.2. demonstrates the connective propensity of the F&V value chain. Main transportation corridors for F&V include NR91, NR1 (Lang Son – Da Nang, Khanh Hoa – Hau Giang), NR54, NR60, NR54, NR62, NRN2, NR22, NR22B, NR13, NR14, AH17, NR51, NR56, HCM – Long Thanh – Dau Giay expressway,), HCMC - Trung Luong – My Thuan expressway, NR20, NR55, NR28, NR27, NR26, NR29, NR9, NR36, HCM road (Hoa Binh – Thanh Hoa), NR12B, AH13, Noi Bai – Lao Cai expressway, NR32, NR2, NR3, Ha Noi – Thai Nguyen expressway, AH14, NR18, NR4A, NR4B.

MAP A9.1. **Geographic distribution of the fruit and vegetable value chain**



Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

MAP A9.2. **Connective propensity of the fruit and vegetable value chain**



Source: I/O Table 2016, Enterprise Census 2011 and 2016, Customs, and calculation by authors.

Annex 10

Selected value chains, their segments, and industrial codes

* Purple rows are indirect segments, white rows are direct segments in value chain.

Production chain	VSIC 2018	HS2007			
		(2-digits)	(4-digits)	(6-digits)	(8-digits)
Aquaculture					
Growing maize and other cereals	01120				
Manufacturing starches and starch products	10612, 10620				
i. Animal food	i. 108003				i. 23099032
ii. Breeding	ii. 03230				
iii. Farming (aqua-culturing)	iii. 03210, 03221, 03222				
iv. Nonfarming (fishing)	iv. 03110, 03121, 03122				
v. Processing	v. 1020		v. 0301-09, 1604, 1605		
Textile and garment (T&G)					
Manufacturing plastics and synthetic rubber in primary forms	2013				
Manufacturing of other chemical products	20290				
i. Fibers (materials)	i. 01160		i. 5001-03, 5101-05, 5201-03, 5301-05, 5501-07	i. 140420	
ii. Yarns	ii. 13110, 20300		ii. 5004-06, 5106-10, 5205-07, 5306-08, 5402-06, 5509-11		
iii. Fabric processing (weaving, knitting, finishing)	iii. 13120, 13130, 13910		iii. 5007, 5111-13, 5208-12, 5309-11, 5407-08, 5512-16, 6001-06		
iv. Clothing	iv. 1410, 1430	iv. 61, 62			
v. Other garments	v. 13920, 13930, 13940, 13990	v. 63			

Production chain	VSIC 2018	HS2007			
		(2-digits)	(4-digits)	(6-digits)	(8-digits)
Leather and footwear					
i. Leather	i. 15110		i. 4101-07, 4112-4114, 4115		
Textiles (fabrics)	13220, 13290				
Fabricated metal products	25999				
Plastics	22209				
ii. Leather products	ii. 14200				
iii. Cases and bags	iii. 15120		ii. 4201, 4202, 4205		
iv. Footwear	iv. 15200		iii. 6401-6		
Electronics					
i. Electronic components	i. 2610, 2680		i. 8532, 8533, 8534, 8540, 8541, 8542, 8523		
i. Electrical components	27330				
ii. Subassemblies	--		ii. 8473, 8522, 8529	851770, 900691, 900699, 900890, 844399	
iii. Final products	iii. 2620, 2630, 2640		iii. 8469, 8470, 8471, 8472, 8519, 8521, 8525, 8527, 8528, 8443	851810, 851821, 851822, 851829, 851830, 851840, 851850, 851711, 851712, 851718, 851761, 851762, 851769, 900610, 900630, 900640, 900651, 900652, 900653, 900659	
Automotive					
Manufacturing iron and steel	24100				
Casting iron and steel	24310				
Manufacturing fabricated iron and steel	25999				
Manufacturing wiring devices	27330				
Batteries	27200				
Manufacturing other plastics products	22209				
Manufacturing basic chemicals	20110				

Production chain	VSIC 2018	HS2007			
		(2-digits)	(4-digits)	(6-digits)	(8-digits)
i. Parts and components	i.293		i. 8507, 8511	i. 401110, 401211, 870830, 870870, 870880, 870894, 870710, 700711, 700721, 830230, 870810, 870891, 870892, 842139, 853910, 940120, 870821, 852721, 852729, 910400, 870829, 840991, 840999, 870840, 870850, 870893, 854430, 851220, 851230, 851240, 851290	
ii. Systems - modules	ii. 292		ii. 8706	ii. 840733, 840734, 840820	
iii. Final assembly	iii. 291		iii. 8702, 8703, 8704, 8705		
Wood					
i. Planting and foresting	i. 0125, 021				
ii. Logging	ii. 0221				
iii. Sawmilling	iii. 161		iii. 4403		
iv. Wood products	iv. 1621, 1622, 1623, 1629		iv. 4401, 4402, 4404-21	iv. 940330, 940340, 940350, 940360	
v. Wooden furniture	v. 31001				
Rice					
Fertilizer, pesticide	20120, 20210				
i. Seeding	i. 0130				
ii. Planting	ii. 0111			ii. 100610	
iii. Rice	iii. 1061			iii. 100620, 100630, 100640	
Coffee					
i. Planting	i. 0126			i. 090111, 090112	
Sugar, diary	10720				
Packaging	10500				
Fertilizer	22201				
ii. Processing	ii. 107901			ii. 090121, 090122, 210111, 210112	

Production chain	VSIC 2018	HS2007			
		(2-digits)	(4-digits)	(6-digits)	(8-digits)
Rubber					
Fertilizer, pesticide	20120 20210				
i. Planting	i. 0125			i. 400110	
ii. Rubber processing	ii. 20132			ii. 400121, 400122	
ii. Manufacturing refined petroleum products	19200				
iii. Manufacturing rubber products	22110, 22120				
Fruit and vegetable					
Fertilizer, pesticide	20120, 20210				
i. Planting	i. 01181, 01182, 0121, 01230				
Packaging	17021				
ii. Processing	ii. 1030	ii. 07, 08			
Cement					
i. Quarrying stone, sand, gravel and clay	i. 0810		i. 2505, 2521, 2508		
ii. Manufacturing cement	ii. 23941		ii. 2523		
iii. Wholesale of cement	iii. 46632				
Fertilizer					
i. Coal, gas, fertilizer minerals	i. 05100, 0520, 06200, 08910, 08920, 08930		i. 2701, 2702, 2703, 2711, 2510		
ii. Fertilizers	ii. 20120		ii. 3102, 3103, 3104, 3105		
Steel					
i. Iron ores, coke	i. 071, 191		i. 2601, 2704		
ii. Manufacturing iron and steel	ii. 241, 2431	ii. 72			
iii. Wholesale of iron and steel	iii. 46622				
Oil and gas					
i. Extracting crude petroleum and natural gas	i. 061, 062		i. 2709		
ii. Manufacturing refined petroleum products	ii. 192		ii. 2710, 2711		
iii. Wholesale	iii. 46612, 46613, 46614				

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