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Cambodia in the Electronic and Electrical Global Value Chains

Ven Seyhah and Hing Vutha

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List of acronyms

ASEAN	Association of Southeast Asian Nations
CAGR	compound average growth rate
CDC	Council for the Development of Cambodia
CDRI	Cambodia Development Resource Institute
CIB	Cambodian Investment Board
E&E	electronic and electrical
EMS	electronics manufacturing services
FDI	foreign direct investment
GVC	global value chain
HS	harmonised system
ICT	information communication technology
IC	integrated circuit
IDP	Industrial Development Policy
ITC	International Trade Centre
MNC	multinational corporation
MNE	multinational enterprise
ODM	original design manufacturing
PCB	printed circuit board
PPSEZ	Phnom Penh Special Economic Zone
R&D	research and design

Abstract

This paper maps Cambodia's participation in Electronic and Electrical (E&E) value chains using trade statistics. It also conducts SWOT analysis based on both qualitative and quantitative data from a E&E firm survey, from which three major conclusions are drawn.

This paper argues that E&E production in Cambodia has expanded rapidly with countries in different development levels featuring coordinated and complex production networks. Companies in Cambodia have joined E&E value chains since 2005; yet the scale, scope, and depth of production are so far beyond most comparable countries in East and Southeast Asia. The country's E&E sector has yet to achieve competitive advantages but recent export trends are promising.

Findings from the E&E firm survey support overall private sector perspectives, in that Cambodia is an attractive production location due to its low labour costs, generous investment incentives given by the government to investors, and proximity to vibrant manufacturing hubs. However, these location advantages are offset by structural issues such as high costs and unstable energy supply; low education; an overall lack of labour skills; poor infrastructure and transport systems; and limited capacity of domestic enterprises.

The results highlight a greater emphasis on global value chains; seizing the benefits from global value chain (GVC) requires improving connectivity, reduced trade barriers, streamlined customs procedures, an improved investment climate, and investment in education and workforce skills. Building Cambodia's vibrant E&E sector requires smart and efficient policy interventions from the government to address key structural and production obstacles, as well as the country's engagement in regional and global trading architecture to maximise the integration in -- and benefit from -- regional E&E production networks.

1. Introduction

The global electronic and electrical industry (E&E) has grown phenomenally to become an integral sector generating substantial export revenues and employment, as well as an essential supporting element in other economic sectors including communications, education, finance and government. Kawakami and Sturgeon (2010) highlight the rapid international expansion of E&E and the geographical spread of the various production facilities, all under mostly centrally coordinated production networks. Since electronic components and products often have a high value-to-weight ratio, different value chain segments have been outsourced on global scale, due to low transportation costs. As a result, production of E&E has created a complex and interconnected network of E&E value chains. (Kawakami and Sturgeon 2010) (Kawakami and Sturgeon 2010). As well as being a key element in the production and service supply of other sectors, E&E products and systems are a core part of livelihoods worldwide, accounting for USD 2.9 trillion in trade in 2014 (Stacey Frederick and Gereffi 2016); and intermediate E&E goods accounting for the majority trade in top-50 manufactured intermediate products (Kawakami and Sturgeon 2010).

While E&E production networks exist on a global scale, Asian nations have taken a central role in production and assembly. Countries like Japan, and more recently South Korea, have established globally recognised brands in several E&E products such as Japan's Sony, Sharp, Panasonic and Toshiba, and Samsung and LG from South Korea. Taiwan, Hong Kong and mainland China have also developed as capable supply-bases for the design, manufacturing and delivery of E&E parts and components. Emerging economies in Southeast Asia have integrated themselves into E&E networks and transformed into a major source of exports and employment. For example, as of 2014 the Philippines hosted 258 E&E firms with a total of 344,440 jobs and USD 28.8 billion exports or 47 percent of total exports (Frederick and Gereffi 2016). Thailand and Vietnam have also emerged as top 15 suppliers of E&E components with export volume of USD 17.9 billion and USD 11.1 billion, respectively.

For Cambodia, despite a rapid and notable track record in building export sector capacities as the main driver of economic growth over the last two decades, the country has only recently started to expand beyond garments, shoes and bicycle production into regional E&E global value chains. The first E&E company in Cambodia was established in 2005, producing building wire, power cables, overhead electrical aluminium conductors, and telecommunication cables. Investment and production of E&E has boomed since 2011, and by 2018 there were 26 E&E companies operating in Cambodia, mostly in assembly. According to international trade statistics database (UN Comtrade), in 2016, Cambodian E&E component exports were USD 434.2 million, a substantial increase from USD 37.3 million in 2012. However, the value represents merely 4 percent of total exports in 2016, and is far lower than those of neighbouring Vietnam and Thailand. Despite the small export volumes, the growing E&E production network is a promising development for Cambodia, as evidenced in E&E's inclusion in Cambodia's industrial development policy (IDP) 2015-2025, and government efforts to transform the country's industrial structure through better connection with regional and global value chains.

However, little is known about the nature and extent of Cambodian participation in the global E&E GVCs. This study aims to fill this serious knowledge gap by mapping global and Cambodian E&E exports and analysing the sector's SWOT analysis, attempting to answer four key questions:

1. What is the nature and extent of global E&E GVCs?
2. What is the nature and position of Cambodia in global E&E value chains?
3. What are the strengths, weaknesses, opportunities, and threats for Cambodia's E&E sector?
4. What are the future trends of Cambodia's E&E sector?

To answer the above questions, this study employs mixed research methods. By applying the Frederick and Gereffi (2016) GVC analytical framework in to map the global and Cambodian E&E GVC trade, E&E products are grouped into five major segments: R&D and design; inputs; electronic and electrical components; subassemblies used in other markets; and final products. Using trade statistics from UNComtrade at 4-digit HS disaggregation allows the mapping of imports and exports of E&E by different segments and products.

The research team also interviewed 18 E&E firms in Cambodia using a semi-structured questionnaire and extracted both quantitative and qualitative data to provide analysis from the perspective of firms. Firms were asked to evaluate E&E sector strengths, weaknesses, opportunities and threats (SWOT) using a Likert scale (1 for 'strongly disagree', 2 for 'disagree', 3 for 'neither disagree nor agree', 4 for 'agree' and 5 for 'strongly agree'). Several factors are provided for them to score and justifications for their evaluation are also recorded. The higher the scale an indicator has, the higher its validity to be a strength, weakness, opportunity, or threat. Most SWOT indictors were collected from the existing literature and some were added by the authors. Another important aspect in the survey was the perspective on companies' overall performance and on future trends of the E&E sector in Cambodia. Descriptive statistics and qualitative descriptions were used to explain the results of the firm survey and SWOT analysis.

2. Concepts and significances of global value chains

2.1 Key concepts

GVC refers to the sequence of steps in which parts and components are produced in one country and then exported to other countries for further production and/or assembly to produce final goods. For example, the production of Apple iPhone4 involves a series of complex tasks performed in various countries: designed in the United States, software from India, a silicon chip from Singapore and metals mined in Bolivia. Other major countries that supply iPhone parts and components include South Korea, Japan, Germany and France. All components are shipped to China for assembly into final products and then exported to the United States for global marketing and distribution. GVCs are often coordinated by multinational corporations (MNCs), with trade taking place within their networks of affiliates, contractual partners and arm's-length suppliers.

GVC is not a new phenomenon. Since the 1970s retailers in the United States started to seek oversees alternatives to labour-intensive domestic activities overseas (Gereffi 2013). In recent years however, the speed, scale, depth and breadth of global production and exchange has rapidly increased (Deborah Kay Elms et al. 2013). As well as expanding beyond manufacturing sector to services such as accounting, medical procedure and call centres (Cattaneo et al. 2013; De Backer, De Lombaerde, and Lapadre 2018; Gereffi and Sturgeon 2013), value chain activities have spread extensively across various regions. The organisational settings are structured in more complex and multi-layer inter-firm networks across the globe. Such phenomenal rise of GVCs is largely driven by technological progress; advances in transport and logistics sector

lowers costs and times, ; more liberal regional and national policies toward freer trade and investment flows; and the opening up of emerging economies, especially China and India (Amador and Cabral 2016; Athukorala 2011; Baldwin 2012, 2013; De Backer, De Lombaerde, and Lapadre 2018; Humphrey and Schmitz 2002).

Several theoretical frameworks attempt to explain this global production structure. What was initially termed ***'global commodity chains'***, later fine-tuned to ***'global value chains'***, was pioneered by Gereffi and Korzeniewicz (1994) and further crystallised by Gereffi, Humphrey, and Sturgeon (2005); and Gereffi and Fernandez-Stark (2011). This concept defines value chains as 'the full range of activities that firms and workers perform to bring a product from its conception to end use and beyond' (Gereffi and Fernandez-Stark 2011). It discusses three mutually reinforcing dimensions of inter-firm relationship: (1) sequence of activities linking together to produce one commodity; (2) tracing the extent of dispersion of the production and distribution networks across the nation or what Gereffi and his collaborator refer to 'territoriality'; and (3) analysing the internal governance structure of supply chains.

Another key aspect of GVC is industrial upgrading, defined as "the process by which economic actors—nations, firms, and workers—move from low-value to relatively high-value activities in global production networks" (Gereffi 2005). The underlining importance of upgrading is that participating in value chains does not guarantee social and economic developing and thus upgrading is critical to social and economic upgrading (Gereffi, Humphrey, and Sturgeon 2005; Gereffi et al. 2001; Gereffi and Luo 2015). The analysis identifies conditions and trajectories for countries to upgrade value chains and suggests four potential modes of upgrading: product upgrading (moving to a production of more sophisticated or higher value-added goods); process upgrading (a more efficient rearrangement of production networks e.g. via adopting a new technology); functional upgrading (a moving into high-skilled content of production); and chain upgrading (ability to move into new industries) (Gereffi and Fernandez-Stark 2011). The success of upgrading depends on a combination of factors including national government policies and institutions, private sector governance, technological capacities, and worker skills.

The ***'production fragmentation'*** framework pioneered by Jones and Kierzkowski (1988), and Jones (2000), defines fragmentation as "a splitting up of a previously integrated production process into two or more components or fragments" (Jones and Kierzkowski 2001) and stipulates that international fragmentation will happen if two fundamental prerequisites are satisfied:There must be significant difference in productivities and factor prices among production locations; and there must be significant reduction in costs of service links. The former factor is called 'location advantage' and is determined by low wages, availability and quality of human capital, the existence of supporting industries, infrastructure services, and a conducive policy environment; the greater the disparities in productivities and factor prices, the more likely it encourages production fragmentation. Cost of service links, on the other hand, also matter because firms need to coordinate and communicate among production block, as well as move components to other production blocks. Factors attributive to cost of service links include tariff, quality of transport and logistics services, hard and soft infrastructure, quality of trade facilitation, and financial services. This framework implicitly points to the importance of country-specific characteristics including market structure, human capital and labour markets, quality of infrastructure and logistics, along with more liberal policies in favour of cross-border trade and services in helping countries join global value chains.

Also widely used for value chain analysis is the concept of ***'global production network'*** (or GPN) (Coe, Dicken, and Hess 2008; Henderson et al. 2002). This defines value chains as "the nexus of interconnected functions and operations through which goods and services are produced, distributed and consumed" (Henderson et al. 2002, p. 445). The principal concern of GNP is to understand factors that shape the nature and outcomes of the production networks through three broad elements: value, power and embeddedness. Value is central to social and economic outcomes from the production network, and the creation and capture of value varies according to access to technology, organisational and managerial skills, and inter-firm relationship. The concept of power captures two different layers: Corporate power explains the extent to which lead firms can influence the decision of network arrangement and resource allocation; while institutional power refers to those used by governments and international organisations to influence the configuration of production networks. Social, economic and political contexts can shape the nature and outcomes of the network and these factors, which the framework calls 'territorial embeddedness', include state policy and legal frameworks, public institutions, training and labour systems, and corporate governance.

Additional value chain concepts include 'supply chain systems' by Porter (1985), 'trade in tasks' by Grossman and Rossi-Hansberg (2006) and 'offshoring'. This paper acknowledges diverse conceptual constructs and terminologies of value chains but prefers to use the term 'global value chain' to simply refer to the production and exchange of parts and components among firms from various countries along the established production networks. The paper also uses terms such as global production networks or production fragmentation as inter-changeable with GVCs

2.2. Economic significance and policy implications of GVC

There is a growing recognition that GVC offers a wide range of economic benefits in terms of increasing trade and investment, enhancing greater manufacturing capabilities, business linkages, and skill and technological development – yet consensus is not universal. GVCs allow developing countries to industrialise at lower cost than building whole industrial supply chains themselves. Baldwin (2012) advocates for a 'join-instead-of-build development paradigm', as the ability of countries to foster growth and development depends on their participation in GVC.

Countries with high income tend to have higher participation in GVC (Cattaneo et al. 2013; Deborah Kay Elms et al. 2013; Saito, Ruta, and Turunen 2013), and both Bair (2005) and Gereffi (1999) have attributed the growth trajectories of East Asian economies in the 1980s to their success integrating into GVCs, and the productivity enhancements this brought. Kang et al. (2010) and Miroudot, Lanz, and Ragoussis (2009). Small and medium enterprises (SMEs) in private sectors also provide evidence of performance improvements to meet needs of intermediate goods and services (Cattaneo et al. 2013; De Backer, De Lombaerde, and Lapadre 2018). Key to industrial and economic upgrading is the acquisition of new technology and knowledge to enhance supply competence, and GVC is associated with the transfer of knowledge and technology (Cattaneo et al. 2013; Humphrey and Schmitz 2002) and can push countries to acquire new competency and skills (Sturgeon 2001).

GVCs have shifted development thinking and the way policies are designed. Most countries have embraced the idea that participating in GVCs are key to economic growth. Even international institutions that provided the underpinning for the Washington-Census – the mainstays of western economic policy such as the World Bank, the International Monetary Fund and the World Trade Organisation --as well as major bilateral development agencies have

incorporated GVC frameworks as new models of development (Gereffi 2014; Neilson 2014). In effect, developing countries are advised to open up their economies to international trade and investment, improve infrastructure and logistics services, and strengthen trade facilitation so that they can join GVCs. This has led to widespread adoption of value chain framework as development practice over the last decade. The main policy goal is to achieve maximum benefits from GVC through linking between value chain actors, specialising specific tasks or stages in the GVC, and upgrading value chains.

2.3 Actors in E&E GVC

Actors in E&E production networks can be classified into three levels:

Lead firms establish the production networks and coordinate the production and distribution of final products to end users. Lead firms usually take financial risks on placing orders to contract manufactures, selling the final products and competing in the final markets with other lead firms. Most lead firms no longer produce the products by themselves and this trend has been widespread since the late 1980s (Sturgeon and Kawakami 2010). Examples in the computing sector include Apple and Dell.

Contract manufacturers take the role of providing either original design manufacturing (ODM) or electronics manufacturing services (EMS) to the lead firms. Most ODM firms are based in Taiwan with factories in China, with Vietnam growing as a producing country.

Platform leaders implant technology in the products of other firms. These actors can obtain a huge share of the industry profits. For example, Intel imbeds their hardware and software in most computers (Sturgeon and Kawakami 2010).

2.4 Measuring E&E GVC using trade statistics

This report adopts method of quantitative mapping of E&E GVC from Frederick and Gereffi (2016), which classifies a wide range of materials, components and products into various segments of GVC using 4-digit Harmonised System (HS) codes. As shown in Figure 1, E&E GVC is composed of five major segments: R&D and design; inputs; electronic and electrical components; subassemblies used in other markets; and final products.

- ***The inputs*** for E&E products include a variety of raw materials from silicon and plastics to aluminium and gold.
- ***The component segment*** consists of electronic and electrical components. At the HS 4-digit level, the products in electronic components are resisters (HS 8533), capacitors (HS 8532), circuit boards (HS 8534), tube/valves (HS 8540), discrete/semiconductors (HS8541), and integrated circuits (HS 8542). Semiconductor wafers are intermediate products for integrated circuits and active discrete. Passive IC components, bare circuit boards, integrated circuits and active discrete are intermediate products for assembling printed circuit board (PCB).
- ***The electrical components and subassemblies*** comprise motors/generators parts (HS 8501, 8502, 8503), batteries/ battery waste (HS 8506, HS 8548), transformers (HS 8504), switchgear (HS 8535), electrical apparatus with voltage less than 1,000 (HS 8536), boards and panels (HS 8537), and wire & cable (HS 8544). Other electrical components include electro-magnets (HS 8505), carbon electrodes (HS 8545), and insulators (HS8546, 8547). They are intermediate products for assembling printed circuit boards (PCB). Electronic equipment is defined as an object that has a semiconductor and can store and/or process

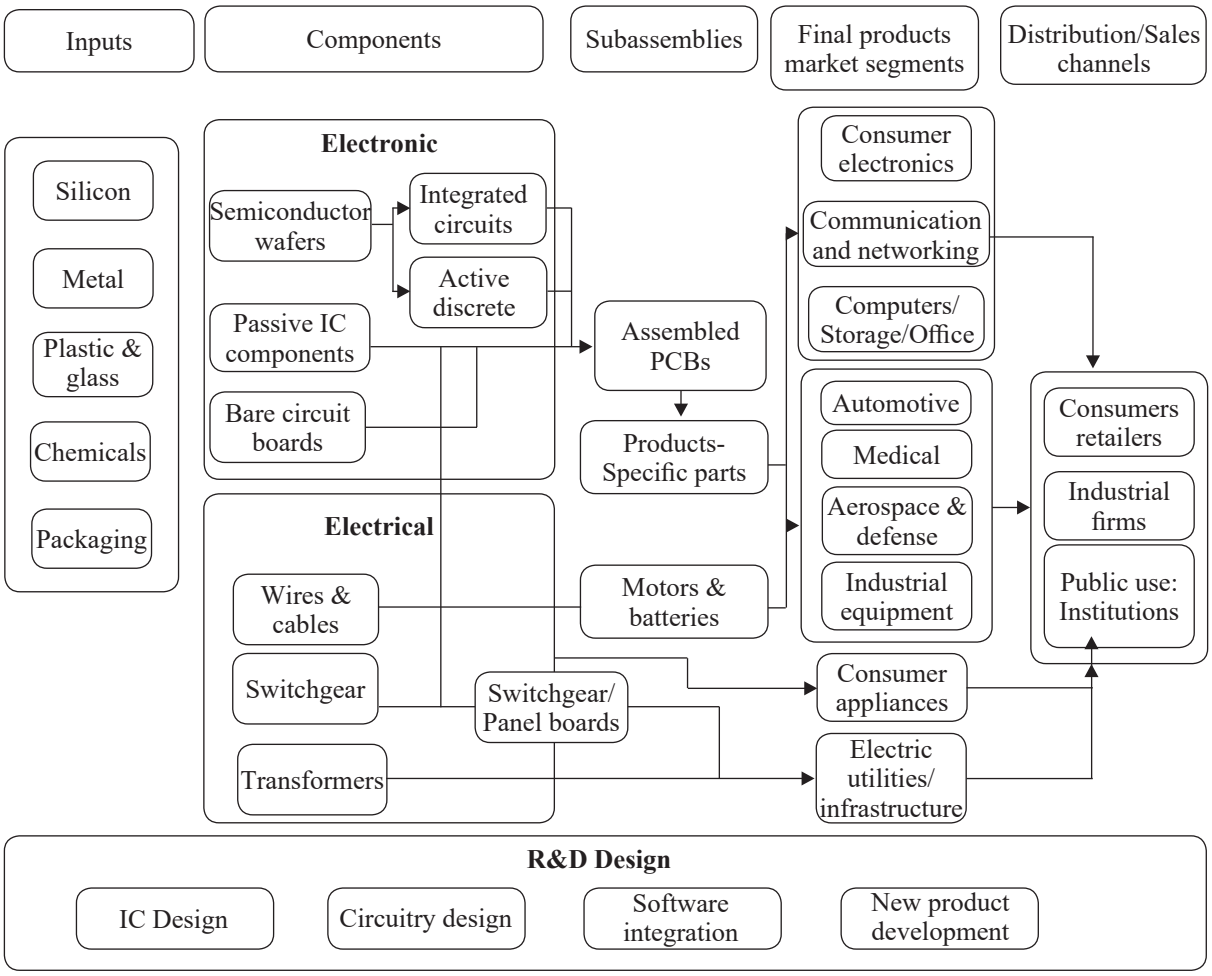
information. An object that generates, distributes, and/or stores electricity is classified as electrical equipment. All final electronic products need electricity to operate, so they can be considered as electrical equipment.

- ***Final electronic products*** are classified into computers/storage/office equipment, consumer electronics, medical, and industrial equipment. The first two categories include three market segments of computers, consumer electronics, and communication and networking, commonly known as "electronics or ICT". Computers and storage devices consist of laptops, desktops, storage devices, (HS8471), typewriters (HS8469), calculating machines (HS8470), printers and scanners (HS8443), parts (HS8473), and other office machines (8472). The consumer electronics category covers a wide range of products including TV/Projectors (Monitors, reception equipment) (HS 8528), Sound/Video (Microphones, Headphones, Amplifiers, Answering Machines, DVD Players) (HS 8518, 8519, 8520, 8521, 8522), Video Games (HS950410), Photographic cameras (9006), Communication (Phones, Fax, Routers) (HS8517), Transmission (TV & Digital)/Radio/Alarm Clocks (HS 8525, 8529, 8527), and Parts. The medical category covers a wide range of capital equipment and therapeutics (partial) which have the following 2002 HS code: 901811, 901812, 901813, 901814, 901819, 901820, 9022, 902140, and 902150. The industrial equipment category covers the products as follows: Microscopes (HS 9012), Navigation Instruments (HS 9014 8526), Balances (HS 9016), Mechanical Testing (HS9024), Calibration (HS9027), Counters (HS 9028), Electricity Measuring Radar/Radio Navigation (HS 9028 9030 9032).

The final electrical products and parts include consumer and industrial electrical appliances. Consumer electrical appliances are those for use in the kitchen (food preparation, preservation, cleaning, and cooking), laundry, personal care, household comfort, floor clean-up and other. The products examples for major appliances include compressors (HS 841430), refrigerators and freezers (HS 8418), dish washing machines (HS 842211), stove and oven (HS 732111, 732112, 732113); Dryers, (HS 842112), Washing Machines (HS 842191, 8450). Those of minor appliances are shavers and hair clippers (HS 8510); Fans (HS 841451); Air Conditioners (HS 8415); Lamps, Lamps/Lights (HS 8513, 9405); Grinders, Mixers, Extractors, Vacuums, Floor polishers, Waste disposers, Other, Parts (HS 8509); Irons, Heating Resistors, Hair Dryers, Coffee/tea makers, Toasters Radiators, Heaters, Microwaves, Parts (HS 8516).

The industrial electrical appliances comprise manufacturing and signalling equipment and others. The product examples for manufacturing equipment are industrial/lab furnaces and ovens (HS8514); Machines for: brazing/soldering; resistance welding of metal; arc (incl. plasma) welding of metals; other (HS 8515). The product examples for signalling equipment are electrical signalling, safety or traffic control equipment, other than HS8608 (HS 8530); electric sound or visual signalling, other (HS 8531). Other industrial equipment includes particle accelerators, signal generators machines for electroplating, electrolysis, electrophoresis electric fence energisers parts (HS8534).

Figure 1: Mapping the Electronics and Electrical Equipment Global Value Chain



Source: Frederick and Gereffi (2016)

3. Mapping global E&E value chains

3.1 World E&E exports

Global export of E&E reached USD 2,907.5 billion in 2016. Final electronic products as show in Table 1 represent the largest proportion of total exports accounting for 47 percent, followed by the electronic components (24.7%), electrical components (17.5%) and final electrical products (10.9%). During 2012-2016, the export value of final electronic products fluctuated around its average of USD 1,413.7 billion. The export of the electronic components varied around the average of USD 689.1 billion during the same period. Its annual growth rate decreased from 10.3 percent during 2012-2013 to -0.5 during 2014-2015, but it rose to a growth of 2.4 during 2015-2016. Global electrical components were around the average of USD 525.8 billion, but recorded a decline in growth. The export of final electrical parts was the smallest proportion of E&E global exports at an average of USD 319.2 billion, a declining growth rate.

Table 1: Global E&E exports, 2012-2016

	2012	2013	2014	2015	2016
			Export (in Billion USD)		
Final electronic parts	1,389.8	1,430.5	1,482.0	1,401.6	1,364.8
Electronic components	628.0	692.8	705.1	701.4	718.0
Electrical components	517.0	535.9	55.3	513.0	507.9
Final electrical parts	301.3	321.6	334.1	321.9	316.9
Total E&E exports	**2,836.1**	**2,980.7**	**2,576.6**	**2,937.9**	**2,907.5**
			Share of total (%)		
Final electronic parts	49.0%	48.0%	57.5%	47.7%	46.9%
Electronic components	22.1%	23.2%	27.4%	23.9%	24.7%
Electrical components	18.2%	18.0%	2.1%	17.5%	17.5%
Final electrical parts	10.6%	10.8%	13.0%	11.0%	10.9%
Total E&E exports	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Authors' calculation based on ITC's trade map

E&E final products

Table 2 shows global exports of E&E final products during 2012-2016. It is evidence that consumer electronics accounted for the largest share of E&E final product export. The average export value was USD 752.7 billion, accoutring for an average share of 53.3 percent. The second largest export was Computers/Storage/Office equipment, with an average value of USD 467.3 billion -- equivalent to 33.1 percent of total final electronics product exports. Among the global exports of final electrical products, export of consumer electrical appliances was the largest proportion at between USD 216.8 billion and USD 235.6 billion, 73.5 percent of final electrical exports. The export of industrial electrical equipment was only 36.1 percent on average.

Table 2: Global export of E&E final products, 2012-2016

Final Products	Export (in Billion USD)			Share of total (%)		
	2012	2014	2016	2012	2014	2016
Total export of final products	**1691.1**	**1816.1**	**1681.6**			
Final electronic	1389.8	1482.0	1364.8	49.0	48.2	46.9
Computers/Storage/Office equipment	488.6	498.4	415.0	35.2	33.6	30.4
Consumer electronics	711.7	787.5	758.8	145.7	158.0	182.8
Industrial equipment	137.6	143.9	141.5	19.3	18.3	18.7
Final electrical	301.3	334.1	316.9	10.6	10.9	10.9
Consumer electrical appliances	216.8	247.8	235.6	72.0	74.2	74.4
Industrial electrical equipment	84.5	86.2	81.2	39.0	34.8	34.5

Source: Authors' calculation based on ITC's trade map

China was the largest exporter of final E&E products with volume of USD 558.2 billion (33 %) in 2012, USD 624.3 billion (34.4 %) in 2014, and USD 575.9 billion (34.2 %) in 2016, with the compound average growth rate (CAGR) during this period was 0.8 percent. Mexico was the second largest exporter, with values around USD 150 billion over the same period and a global share of some 9 percent and a CAGR of 0.9 percent. The third largest exporter was Hong Kong, ahead of the USA, Germany, Netherlands, France, Vietnam, Japan, and Singapore.

Table 3: Top-10 exporters of final E&E products, 2012-2016

Exporter	Export in billion USD			World Market Share (%)			CAGR (%)
	2012	2014	2016	2012	2014	2016	2012-16
World	**1691.1**	**1816.1**	**1681.6**				-0.1
China	558.2	624.3	575.9	33.0	34.4	34.2	0.8
Mexico	154.2	163.9	159.9	9.1	9.0	9.5	0.9
Hong Kong	142.6	152.9	148.8	8.4	8.4	8.8	1.1
USA	149.5	153.0	145.7	8.8	8.4	8.7	-0.6
Germany	98.6	101.2	94.3	5.8	5.6	5.6	-1.1
Netherlands	65.5	69.2	57.0	3.9	3.8	3.4	-3.4
France	55.6	55.3	49.4	3.3	3.0	2.9	-2.9
Vietnam	20.9	36.3	45.8	1.2	2.0	2.7	21.6
Japan	59.2	47.5	44.3	3.5	2.6	2.6	-7.0
Singapore	44.7	41.9	40.4	2.6	2.3	2.4	-2.5
Thailand	40.2	39.5	36.6	2.4	2.2	2.2	-2.3
Malaysia	37.4	35.0	29.9	2.2	1.9	1.8	-5.5
Philippines	9.2	9.3	9.8	0.5	0.5	0.6	1.7

Source: Authors' calculation based on ITC's trade map and UN Comtrade

E&E components

Table 4 illustrates the disaggregation of world exports of E&E components for the 2012-2016 period. The statistics suggest that integrated circuits captured the largest share of the electronic component exports amounted to between USD 440.7 billion and USD 531.8 billion, and up to 71.9 percent of total exports of electronic components. The export of Actives was the second largest (16.1%), followed by Printed circuits and Passive. Among global exports of the electrical components, the exports of switchgear were the largest proportion, valued at between USD 182.5 billion to USD 191.4 billion and accounting for an average of 36.5 percent of total global exports of the electrical components. The second largest proportion was the exports of wire & cable, around 21.4 percent of total exports of the electrical components.

China was the largest exporter of E&E components with an export volume of USD 187.1 billion in 2012, USD 217.9 billion in 2014, and USD 202.4 in 2016, or around 16 percent of total world exports. The CAGR was 2.0 percent during this period. Hong Kong was the second largest exporters of these products. Its exports were recorded at USD 111.9 billion in 2012, USD 135.2 billion in 2014, and USD 153.0 billion in 2016, making up of 9.8 percent in 2012 to 12.5 percent in 2016. Its CAGR during the period was 8.1 percent. The USA was the third largest exporters, followed by Singapore, Germany, Japan, Mexico, France, Malaysia, and the Philippines. For Cambodia's neighbours, Thailand was the 11th largest exports of E&E components at 1.5 percent of 2016 total, and a CAGR of 4.5 percent. Vietnam ranked 13th with 0.9 percent of the total.

Table 4: Global exports of E&E components, 2012-2016

E&E components	Export (in Billion USD)			Share of total (%)		
	2012	2014	2016	2012	2014	2016
Total exports of components	**1145.0**	**1260.5**	**1225.9**			
Electronic components	**628.0**	**705.1**	**718.0**	**54.8**	**55.9**	**58.6**
Active	107.2	113.5	108.7	17.1	16.1	15.1
Integrated Circuits	440.7	504.3	531.8	70.2	71.5	74.1
Passive	32.9	39.2	33.0	5.25	5.55	4.6
Printed circuits	47.1	48.1	44.5	7.5	6.82	6.19
Electrical components	**517.0**	**555.3**	**507.9**	**45.2**	**44.1**	**41.4**
Batteries/Battery waste	12.9	14.7	13.1	2.49	2.66	2.59
Motors/Generators	98.5	98.5	85.9	19.1	17.7	16.9
Other electrical	23.2	21.6	19.4	4.5	3.9	3.82
Switchgear	182.5	202.3	191.4	35.3	36.4	37.7
Transformers	93.1	97.4	87.5	18	17.5	17.2
Wire & Cable	106.8	120.8	110.4	20.7	21.8	21.7

Source: Authors' calculation based on ITC's trade map

Table 5: Top-10 exporters of E&E components, 2012-2016

Exporter	Export in billion USD			World Market Share (%)			CAGR (%)
	2012	2014	2016	2012	2014	2016	2012-16
World	**1145.0**	**1260.5**	**1225.9**				1.7
China	187.1	217.9	202.4	16.3	17.3	16.5	2.0
Hong Kong	111.9	135.2	153.0	9.8	10.7	12.5	8.1
USA	91.3	96.4	92.5	8.0	7.6	7.5	0.3
Singapore	94.6	103.5	91.5	8.3	8.2	7.5	-0.8
Germany	83.3	89.1	81.4	7.3	7.1	6.6	-0.6
Japan	84.7	71.7	67.1	7.4	5.7	5.5	-5.7
Mexico	52.7	63.1	61.3	4.6	5.0	5.0	3.9
France	54.5	53.9	46.8	4.8	4.3	3.8	-3.7
Malaysia	42.2	47.7	42.3	3.7	3.8	3.5	0.1
Philippines	17.8	21.5	23.0	1.6	1.7	1.9	6.7
Thailand	15.0	17.4	17.9	1.3	1.4	1.5	4.5
Netherlands	14.6	15.9	14.2	1.3	1.3	1.2	-0.7
Vietnam	6.9	8.2	11.1	0.6	0.7	0.9	12.7

Source: Authors' calculation based on ITC's trade map and UN Comtrade

3.2 World E&E imports

Tables 6 and 7 show the top ten importers of intermediate electronics and final electronics, between 2012 and2016. For intermediate electronics, China and Hong Kong were by far the largest importers with a combined share at around 40 percent of imports. In 2012, China imported intermediate electronics valued at USD 250.2 billion or an equivalent of 27.7 percent of total intermediate electronics imports. The value rose to USD 264.5 billion in 2014 but fell to USD185.7 billion in 2016. The other major importers of intermediate electronics were the United States, Singapore, South Korea, Mexico, Germany, Vietnam, and Malaysia. It is interesting to note that most countries in East Asia are engaged in both exports and imports of E&E intermediate products. Such a pattern has proven that E&E production networks have concentrated in the East Asia region with China and Hong Kong being hubs of manufacturing.

Table 6: Top ten importers of intermediate electronics, 2012-2016

Importers	Imports in billion USD			Share of the total (%)		
	2012	2014	2016	2012	2014	2016
China	250.2	264.5	185.7	27.7	26.3	20.4
China	144.8	167.3	178.8	16.0	16.7	19.6
United States	77.2	82.4	88.2	8.5	8.2	9.7
Singapore	55.5	53.3	52.3	6.1	5.3	5.7
South Korea	32.8	38.9	38.7	3.6	3.9	4.3
Mexico	36.8	39.8	36.6	4.1	4.0	4.0
Germany	40.8	40.5	36.6	4.5	4.0	4.0
Vietnam	15.4	22.9	32.4	1.7	2.3	3.6
Malaysia	34.1	35.9	29.2	3.8	3.6	3.2
Japan	33.6	33.8	29.0	3.7	3.4	3.2

Source: WITS

For final electronics, the United States was the largest market with import value at USD 272.0 billion in 2012 and USD 290.6 billlion in 2016. On average, the US market represented around 21 percent of world final electronics imports during the years in question.

Table 7: Top ten importers of final electronics

Importers	Imports in billion USD			Share of total			CAGR 2012-2016
	2012	2014	2016	2012	2014	2016	
United States	272.0	287.9	290.6	21.3	20.6	22.8	1.7
Hong Kong	81.7	87.9	86.6	6.4	6.3	6.8	1.4
Germany	84.1	89.0	86.3	6.6	6.4	6.8	0.6
China	98.2	95.9	65.7	7.7	6.9	5.2	-9.6
Japan	68.9	68.3	61.0	5.4	4.9	4.8	-3.0
Netherlands	57.0	61.7	52.3	4.5	4.4	4.1	-2.1
United Kingdom	51.2	54.9	50.7	4.0	3.9	4.0	-0.2
France	44.7	44.4	41.3	3.5	3.2	3.2	-2.0
Mexico	32.4	35.3	38.0	2.5	2.5	3.0	4.0

Source: WITS

4. Cambodia in E&E GVC

4.1 Investment projects in E&E sector

Cambodia started production of E&E in 2005. The first E&E company was a cables producer from South Korea. Since then, investment has gradual flowed to projects in the E&E sector. However, a larger wave of foreign direct investment (FDI) in E&E assembly started in 2011 during which Japanese multinational corporations (MNCs) sought to minimise production risks through the 'Thailand Plus One Strategy', which saw production units open in Cambodia, Laos and Myanmar to mitigate against risks such as floods or political instability.

According to investment project statistics from the Council for Development of Cambodia (CDC), total accrued E&E investment capital in Cambodia as of December 2017 was USD 226.7 million. Investment in electronic parts assembly had the largest invested capital of USD 102.8 million, 18.1 percent of the total. Investment in electronic parts accounted for almost half of total E&E investment in Cambodia by December 2017 with registered capital of USD 102.8 million. Investment in the assembly of small-size motors was the second largest investment at USD 54.9 million, equal to 9.7 percent of the total capital. This investment is the largest investment by a single firm. No other firms invested in the assembly of small-size motor, yet. Investment in the assembly of wire harness at USD 35.2 million and other investments were allocated to the assembly of Motor Assembly, Wire Cables, Lamps & Lights, Lighting Poles, Lighters, Motors, Computer Parts, and Electrical Box.

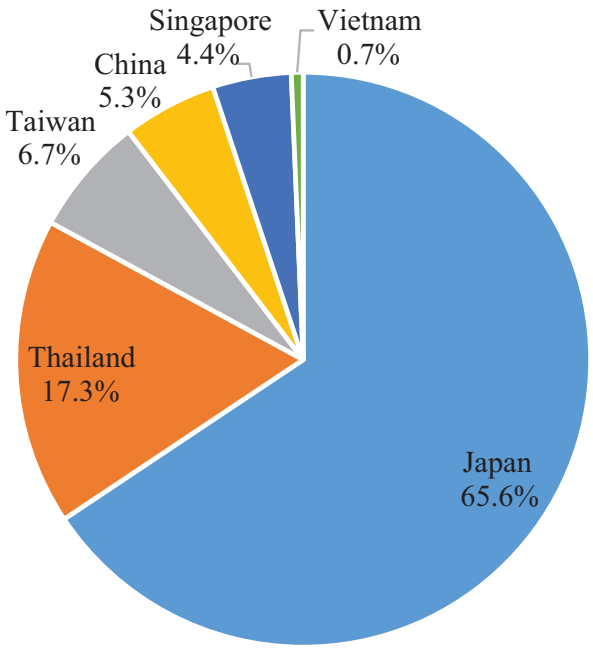
Investors in Cambodia's E&E sector are all from East Asian countries. As shown in Figure 2, Japanese firms dominate Cambodia's E&E investment with 65.6 percent of total investment, followed by Thailand (17.3%), Taiwan (6.7%), China (5.3%), Singapore (4.4%), and Vietnam (0.7%).

Table 8: Investment projects in E&E assembly in SEZ, as of December 2017

Products	Inv. Capital (US Dollars)	% of total Inv. Capital	Land size
Electronic Parts	102,865,342	45.4	279,984
Small-size motor	54,885,417	24.2	200,000
Wire Harness	35,213,135	15.5	133,205
Motor Assembly	10,000,000	4.4	37,000
Wire Cable	8,906,570	3.9	41,440
Lamp & Light	5,000,000	2.2	15,000
Lighting Poles	4,585,876	2	51,200
Lighter	2,000,000	0.9	11,481
Motor	1,230,390	0.5	5,372
Computer Parts	1,010,900	0.4	5,178
Electrical Box	1,000,000	0.4	-
Total	226,697,630	100	779,860

Source: Author's calculation based the data from the CDC's CIB

Figure 2: Source of investment, as of December 2017



Source: Author's calculation based the data from the CDC's CIB

E&E contributes to job creation in Cambodia, despite not being as substantial as the dominant garment and footwear sectors which account for some 800,000 workers. Investment projects for the assembly of E&E components are estimated to employ some 37,000 workers. The investment in the assembly of wire harnesses provided the most employment, about 5,000 Cambodians (and 33 expatriates) of which 79.4 percent are women. It should be noted that some investment projects reported had zero employment, due to projects being postponed or still planned.

Table 9: Employments in investment projects in E&E assembly, as of December 2017

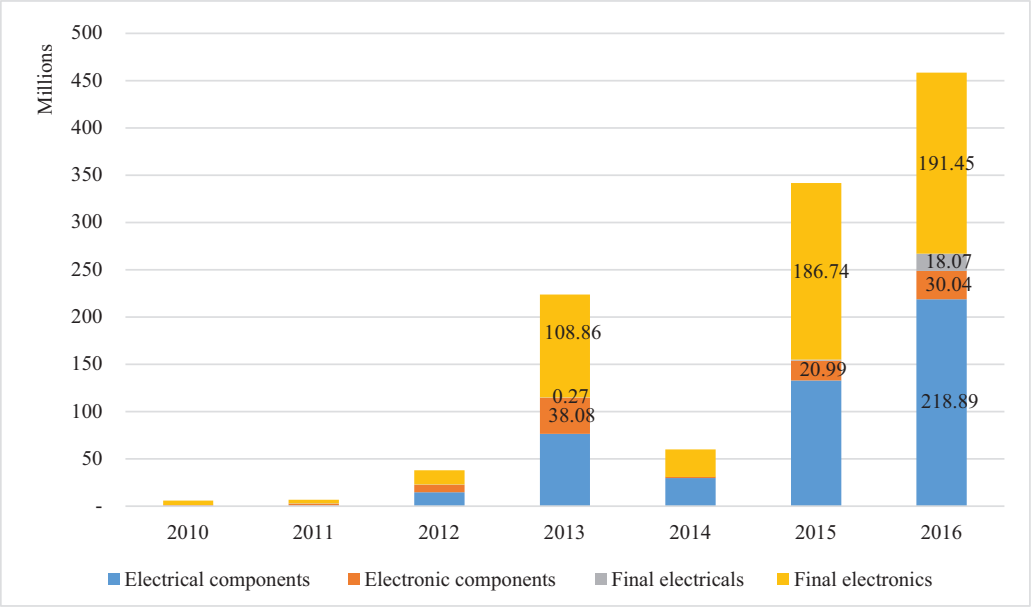
Products	**Cambodian Workers**		**Foreign workers**		**Total**
	Female	Total	Female	Total	
Wire Harness	4,032	5,078	13	33	5,111
Small-size motor	4,196	4,546	19	38	4,584
Electronic Parts	1,257	1,938	18	103	2,041
Lighting Poles	676	1,063	7	17	1,080
Lamp & Light	147	208	0	3	211
Lighter	58	85	0	2	87
Wire Cable	8	47	0	7	54
Motor Assembly	0	0	0	0	0
Motor	0	0	0	0	0
Computer Parts	0	0	0	0	0
Electrical Box	0	0	0	0	0
Grand Total	10,374	12,965	57	203	13,168

Source: Author's calculation based the data from the CDC's CIB

4.2 Mapping Cambodia's E&E exports and value chains

Cambodia's E&E exports have increased sharply from USD 5 million in 2010 to USD 15.2 million in 2012 and USD 458 million in 2016. Aggregated by stage of products, electrical components had the largest value in 2016 at USD 218.89 million, or 48 percent of the total E&E exports. Final electronics was the second largest export at USD 191.45 million, followed by electronic components (USD 30.04 million) and electricals (USD 18.07 million).

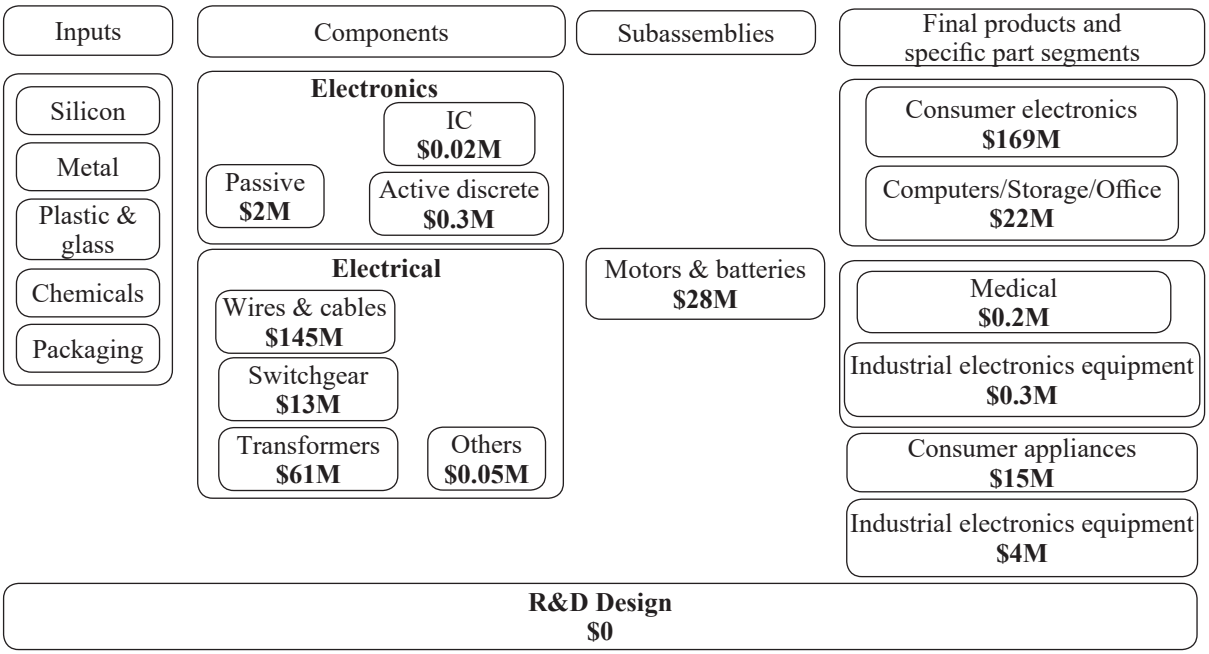
Figure 3: Cambodia's E&E exports, by industry and stage, 2010-2016



Source: Authors' calculation based on UN COMTRADE

Using Frederick and Gereffi's (2016) classification of E&E categorical mapping, Figure 4 shows export values and destination markets for key products under each product segment.

Figure 4: Category of Cambodia's E&E products, 2016



Source: Authors' calculation based on Frederick and Gereffi's (2016) classification.
Note: Values are total 2016 exports in category (USD million)

Final electronic products and specific parts

Among the exports of final electronic products and specific parts, consumer electronics exports made up of the largest share, 89.2 percent on average during 2012-2016. During the same period, the export values increased from USD 14.8 million in 2012 to USD 168.9 million in 2016, at the CAGR of 62.7 percent. The most exported products were telephone sets (HS 8517) and microphones (HS 8518).

Computers/Storage/Office equipment exports were minimal during 2012-2014, but significantly increased by 2016. Export volume was recorded at USD 22.1 million in 2016, up from USD 0.1 million in 2012. The 2012-2016 CAGR was 189.5. The exports of other commodities in this category were still trivial.

Table 10: Cambodia's exports of final electronic products and specific parts, 2012-2016

Product category	Export Value (million USD)					CAGR
	2012	2013	2014	2015	2016	2012-16
Consumer electronics	14.8	106.8	22.2	160.5	168.9	62.7%
	97.7%	98.1%	76.2%	85.9%	88.2%	
Computers/Storage/Office equipment	0.1	0.7	6.8	25.4	22.1	189.5%
	0.7%	0.7%	23.5%	13.6%	11.5%	
Industrial equipment	0.2	1.3	0.1	0.7	0.3	15.5%
	1.1%	1.2%	0.3%	0.4%	0.2%	
Medical	0.1	0.0	0.0	0.2	0.2	19.5%
	0.5%	0.0%	0.0%	0.1%	0.1%	
Final electronics Total	15.2	108.9	29.1	186.7	191.5	66.0%

Source: Authors' calculation based on UN COMTRADE

Top-five export destinations for Cambodia's final electronic parts during 2012-2016 were Thailand, China, Hong Kong, Philippines, and Vietnam (Table 11). The largest share of the exports went to Thailand however Thai exports fluctuated greatly between USD 6.8 million in 2014 to USD 103.2 million in 2015, with a 2012-2016 CAGR of 33.2 percent. This indicates that Cambodia's E&E production is strongly aligned with 'Thailand-Plus-One' framework supported by Japanese MNEs.

Table 11: Top-five export destinations for Cambodia's final electronic parts, 2012-2016

Partners	Export value (million USD)					CAGR
	2012	2013	2014	2015	2016	2012-16
Thailand	11.58	97.36	6.77	103.24	48.49	33.17%
	76.25%	89.44%	23.28%	55.29%	25.33%	
China	0.69	2.74	2.74	52.25	57.48	141.98%
	4.56%	2.52%	9.43%	27.98%	30.02%	
China, Hong Kong SAR	0.46	0.18	0.14	9.69	56.23	161.85%
	3.01%	0.16%	0.47%	5.19%	29.37%	
Philippines	0.02	0.01	0.01	4.71	11.58	270.96%
	0.11%	0.01%	0.03%	2.52%	6.05%	
Vietnam	0.81	0.60	0.65	3.65	5.40	46.16%
	5.33%	0.55%	2.23%	1.96%	2.82%	

Source: Authors' calculation based on UN COMTRADE

The second largest share of the exports of final electronic parts went to China. The export values increased from 0.7 million USD in 2012 to 57.5 million USD in 2016 at a 2012-2016 CAGR of 142.0 percent. The exports to the Philippines and Vietnam were less than 6.5 percent of the total export of final electronic parts during the period.

Electronic components

Cambodia's exports of electronic components remain small because manufacturing or assembly of electronic components (including semiconductor wafers, integrated circuits, active discrete, passive IC components, and bare circuit boards) requires high technical skills and relatively advanced technology. During 2012 and 2016, Cambodia produced and exported small volumes of passive IC components, active discrete, and integrated circuits, but not produced semiconductor wafers and bare circuit boards. Passive IC components were the largest export commodities capturing 81% of total electronic component exports. The annual exports of active discrete were a relatively small USD 0.32 million, or 17.6 percent of total electronic component exports.

Table 12: Cambodia's exports of electronic components, 2012-2016

Product category	Export Value (million USD)					CAGR
	2012	2013	2014	2015	2016	2012-16
Passive	0	3,580	0	255,982	1,502,187	234.6%
	0.0%	6.1%	0.0%	31.5%	81.3%	
Active	0	18,092	329,802	463,844	326,531	78.4%
	0.0%	30.9%	100.0%	57.2%	17.7%	
Integrated Circuits	100	36,857	0	91,528	20,045	188.7%
	100.0%	63.0%	0.0%	11.3%	1.1%	
Total	100	58,529	329,806	811,354	1,848,763	613.5%

Source: Authors' calculation based on UN COMTRADE

The top five export destinations for Cambodia's electronic components were China, Belgium, the Philippines, Thailand, and Hong Kong. Before 2015, most of these countries did not import electronic components from Cambodia. In 2016, the export to China accounted for 84.4 percent of total electronic component exports, followed by Belgium (10.9 percent), the Philippines (3.9 percent), Thailand (0.3 percent), and Hong Kong (0.02 percent).

Table 13: Top-5 export destinations for Cambodia's electronic components, 2012-2016

Partners	Export value (USD)					CAGR
	2012	2013	2014	2015	2016	2012-16
China	0	40,437	0	60,122	1,560,334	107.6%
	0.0%	69.1%	0.0%	7.4%	84.4%	
Belgium	0	0	0	403,218	201,550	-13.0%
	0.0%	0.0%	0.0%	49.7%	10.9%	
Philippines	0	0	201	63,191	71,727	224.0%
	0.0%	0.0%	0.1%	7.8%	3.9%	
Thailand	100	0		253,789	8,928	145.6%
	0.0%	0.0%	0.0%	2.5%	0.3%	
Hong Kong	0	0	0	20,056	5,916	-21.7%
	0.0%	0.0%	0.0%	1.2%	0.02%	

Source: Authors' calculation based on UN COMTRADE

Final electrical products and specific parts

The export of consumer electrical appliances increased sharply from USD 18,800 in 2012 to USD 145,000 in 2016, at a CAGR of 278 percent (Table 5). In 2016 they made up of 80.3 percent of total Cambodia's exports of final electrical products. The exports of industrial electrical equipment also increased significantly during the same period, from USD 96,600 in 2012 to USD 356,000 in 2016, at a CAGR of 105.7 percent.

Table 14: Cambodia's exports of final electrical products, 2012-2016

Product category	Export value (thousand USD)					CAGR
	2012	2013	2014	2015	2016	2012-16
Consumer electrical appliances	18.8 16.3%	245.4 89.9%	183.8 93.0%	306.1 30.3%	14,505.9 80.3%	278.0%
Industrial electrical equipment	96.6 83.7%	27.6 10.1%	13.8 7.0%	703.5 69.7%	3,560.3 19.7%	105.7%
Final electrical Total	115.4	273.0	197.6	1,009.6	18,066.2	174.7%

Source: Authors' calculation based on UN COMTRADE

In 2016, the USA was the largest importer of Cambodia's exports of final electrical products atUSD1.5million, 80.7 percent of the total. This marked a significant growth, from zero exports in 2015. Other importers of Cambodia's final electrical products were Japan, China, Hong Kong and Thailand.

Table 15: Cambodia's top-5 export destinations for final electrical products, 2012-2016

Partner	Export value (thousands USD)					CAGR
	2012	2013	2014	2015	2016	2012-16
USA	- 0.0%	- 0.0%	- 0.0%	- 0.0%	14,586.6 80.7%	
Japan	23.0 19.9%	7.1 2.6%	7.2 3.6%	455.3 45.1%	2,538.3 14.0%	156.2%
Hong Kong	- -	- -	- -	- -	295.3 1.6%	
Thailand	6.6 5.7%	16.7 6.1%	- 0.0%	26.6 2.6%	142.9 0.8%	85.0%
China	- -	7.6 2.8%	8.6 4.3%	25.7 2.5%	83.4 0.5%	

Source: Authors' calculation based on UN COMTRADE

Electrical components and subassemblies

Among the electrical components and specific parts, wires and cables were the most exported products, and their export value increase steadily at a CAGR of 58.3 percent. The exports of these products rose from USD 14.6 million in 2012 to USD 145.5 million in 2016. They had an average share of 71.4 percent of total exports of electrical components and specific parts during this period. The exports of transformers were small during 2012 to 2014, but in 2015 and 2016 they increased to USD 16.2 million (10.6 percent) and USD 60.8 million (24.6 percent) respectively.

Table 16: Cambodia's exports of electrical components and Subassemblies, 2012-2016

Product category	Export value (million USD)					CAGR
	2012	2013	2014	2015	2016	2012-16
Wire & Cable	14.6	74.4	29.5	110.4	145.5	58.3%
	64.2%	65.0%	96.7%	72.1%	58.9%	
Transformers	0.0	0.4	0.0	16.2	60.8	488.6%
	0.0%	0.3%	0.0%	10.6%	24.6%	
Motors/Generators	7.9	38.0	0.8	20.1	27.9	28.7%
	34.8%	33.2%	2.7%	13.1%	11.3%	
Switchgear	0.2	1.7	0.2	6.2	12.6	139.1%
	0.7%	1.5%	0.6%	4.0%	5.1%	
Batteries/Battery waste	0.0	0.0	0.0	0.1	0.3	40.8%
	0.2%	0.0%	0.0%	0.1%	0.1%	
Other electrical	0.0	0.0	0.0	0.1	0.0	52.2%
	0.0%	0.0%	0.0%	0.1%	0.0%	
Total	22.7	114.6	30.5	153.1	247.1	61.1%

Source: Authors' calculation based on UN COMTRADE

Table 17: Cambodia's top-5 export destinations for electrical components, 2012-2016

Partner	Million USD					CAGR
	2012	2013	2014	2015	2016	2012-16
Thailand	9.0	45.1	6.5	64.5	94.8	16.0%
	39.6%	39.4%	21.2%	42.1%	38.4%	
Hong Kong	1.4	9.8	6.1	31.1	50.1	38.7%
	6.3%	8.5%	20.1%	20.3%	20.3%	
Japan	7.1	32.6	0.6	20.3	41.4	4.9%
	31.1%	28.4%	1.9%	13.3%	16.7%	
China	1.5	1.2	0.1	4.1	32.5	92.2%
	6.4%	1.1%	0.3%	2.7%	13.1%	
South Korea	1.6	5.5	6.8	12.6	12.6	18.0%
	6.9%	4.8%	22.2%	8.2%	5.1%	

Source: Authors' calculation based on UN COMTRADE

Markets for electrical component exports concentrate in East Asia. As show in Table 17, Thailand was the largest partner for Cambodia's exports of electrical components during 2012-2016. The average share of the exports to Thailand was 36.1 percent of the total of electrical components, and increased from USD 9 million in 2012 to USD 94.8 million in 2016, at a CAGR of 16.0 percent. The second largest partner was Japan, whose average share was 18.3 percent.

4.3 E&E export growth and international demands

Cambodia's E&E sector growth has been impressive in terms of speed and economic significance. In the five years between 2012 and 2016, E&E grew to become the fourth largest export commodity. In 2018, Cambodia recorded total exports of USD 18.98 billion, a 12

percent growth from 2014 and 2018. Besides apparel and clothing (HS 61 & 62), footwear (HS 64), and handbags (HS 42) which dominate the country's export baskets, E&E sector captured 3 percent share of total exports. Important to the E&E export trajectory is its rapid expansion of exports and the high growth of international demands. Between 2017 and 2018, E&E exports grew at 18 percent. During the same period, world imports of E&E products registered notably high growth at 8 percent.

Despite rapid progress in production and exports, Cambodia's E&E sector has not yet been competitive compared to other backbone export sectors in Cambodia. According to the International Trade Centre's Balassa Index, which is calculated as the ratio of the industry's share in the country's exports relative to its share in world trade, (the value of more than 1 means that an industry has competitive advantage in world markets), the index for Cambodia's E&E sector was 0.3. Major E&E exporting countries including China, Vietnam, Malaysia and the Philippines have higher values on the Balassa Index (1.8 for China, 2.4 for Vietnam, 2.1 for Malaysia, and 3.1 for Philippines).

5. Perspectives of E&E firms in Cambodia

5.1 Characteristics of E&E firms

Firm survey forms an important part of this work analysis to complement general trade statistics analysis. The research team interviewed 19 E&E firms; one is a platform leader, six offer electronics manufacturing services, and 12 are assembly factories. Thirteen companies produce semi-finished goods used as inputs by other companies; four companies made finished products for sale to final consumers; and two firms produced mostly finished goods and some semi-finished goods. Most of productions are destined for exports.

Table 18: Origin of material inputs or supplies

Number of firms	Percentage of Material inputs or supplies of domestic origin (%)	Percentage of Material inputs or supplies of foreign origin (%)
13	0	100
1	1	99
1	10	90
1	20	80
2	50	50
Total: 18		

Source: Firm survey, 2018

Most of the companies used inputs of foreign origin, mostly from China, Japan, and Thailand. Very few companies sourced material inputs from domestic suppliers (Table 18). The main reason for the lack of domestic sourcing is the difficulty to meet product quality standards demanded by the buyers. Limited linkage of domestic enterprises in E&E value chains indicates severe weaknesses of domestic production and supply capacities. This not only results in limited domestic value-added in E&E GVC but also wasted opportunities to maximise the benefits from GVCs.

There are at least ten E&E factories in the Japanese-dominated Phnom Penh Special Economic Zones (PPSEZ). Many firms prefer to locate near the Cambodian capital due to the availability of supporting infrastructure and workers as well as very housing options for

foreign investors. There are also two industrial border zones with neighbouring Thailand and Vietnam. More E&E factories are concentrated near the border with Vietnam (Bavet City, Svay Rieng Province) than that of Thailand due to transport infrastructure. There are eight E&E firms based there, one in Hi Park SEZ, five in Manhattan, and two in the Tai Seng Bavet SEZ. The investors of most E&E firms in the industrial zone near the border with Vietnam are Taiwanese.

At the time of our survey, we interviewed E&E firms in two SEZs located the along the borders with Thailand in Poipet City in Banteay Meanchey Province and in Neak Kok, Koh Kong Province. The emergence of these firms along the border with Thailand is the natural response by Japanese MNCs in Thailand to rising wages, a shortage of unskilled labour and flooding risks in Bangkok. Six E&E firms are in the Sihanoukville SEZ (SSEZ), which is managed by Chinese investors.

5.2 Occupations and wages in E&E sector

The majority of workers in E&E production section are Cambodian. Table 19 shows that unskilled workers dominate the labour force (76.1%) Production skilled workers account for 16.7 percent followed by much smaller numbers of technicians, administrative staff, production engineers, and production managers. Most foreign employees perform administration and production management tasks.

Table 19: Labor structure in E&E firms in Cambodia, 2018

Occupation	Percentage by occupation category		Average gross salary of Cambodian workers
	Cambodian	Foreign	
Administration Manager	0.1	26.8	1178.6
Administration Supervisor	0.4	9.8	768.0
Administration staff	1.9	0.8	388.1
Production Manager/Section head	1.1	42.3	790.2
Production Engineer	1.7	14.6	450.0
Production Team Leader	0.1	1.6	392.5
Production Technician	2.3	2.4	275.0
Production Skilled worker	16.7	1.6	250.0
Production Unskilled worker	76.1	0.0	222.4
Total	100	100	

Source: Author's estimation, based on data from E&E firm survey 2018

Wages varies notably across different occupations. For example, the average gross salary for production unskilled workers was USD 222, slightly lower than that of production skilled employees (USD 250). The earnings are comparable to that of garment workers since most E&E firms follow labour regulations applied in the garments industry, which set a minimum wage of USD 174 in 2018. Production leaders and engineers earn considerably higher, with production managers and administrative supervisors earning some USD 800 per month and administrative managers almost USD 1200 per month.

Table 20: Education level of the Cambodia Labour in E&E firms in Cambodia, 2018

	Education level	Average years of education	Specialisation
Administration manager	Bachelor degree	16	Management, Accounting, BBA
Administration supervisor	Bachelor degree	16	Management, Accounting, BBA
Administration staff	Above high school	13.3	Management, Accounting, BBA
Production manager	Above high school	13.3	Management, Accounting, BBA
Production Engineer	Bachelor degree	15.2	Electronic and Electrical engineering
Production Technician	High diploma	14	Electronic and Electrical engineering
Production Leader	Grade 8	8	None
Production Skilled workers	Grade 8	8	None
Production Unskilled worker	Grade 7	7.6	None

Source: Author's estimation, based on data from E&E firm survey 2018

Employees working in E&E firms possess varied education and skills (Table 20). As expected, production workers and production leader had the lowest education with an average of eight years of school. as well as no specific technical skills. Technicians hold higher diplomas in electronics and electrical engineering with two-year technical training. The production engineering staff hold bachelor degrees in electronics and electrical engineering while administrative supervisors and managers are trained in management, accounting, and business administration.

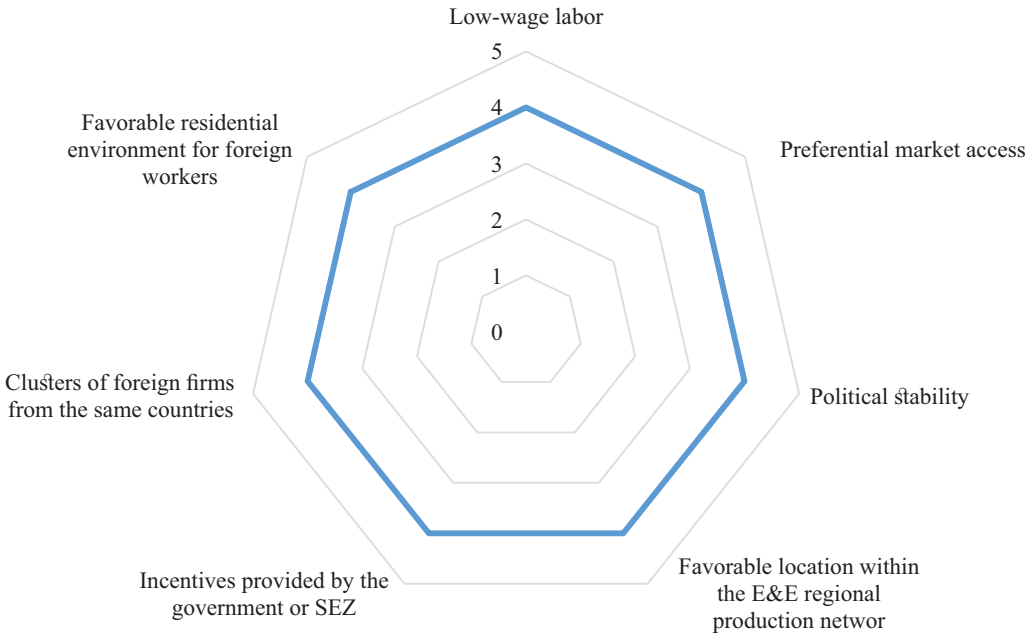
5.3 SWOT analysis

Respondents were asked to evaluate a given indicators using a Likert scale from 1 to 5 (1=strongly disagree, 2 =disagree, 3 =neither disagree nor agree, 4 =agree, and 5=strongly agree). The higher the scale an indicator has, the higher its validity to be a strength, weakness, opportunity, or threat.

Strengths

Figure 5 displays the radar graph of the median scores of the strength indicators. The overall median score of each indicator is 4, indicating that on average respondents agreed that all these indicators were the strengths for Cambodia's E&E sector.

Figure 5: Medium score of strength factors



Source: Firm survey 2018

- *Low-wage labour:* Cambodia's low wage costs serve as an important cost incentive to attract labour-intensive components of E&E. Although some representatives expressed concerns about the rapid rise of wages and lingering low labour productivity, the wage gap is significant enough to offset rising production cost. Nevertheless, wages should be set to increase at an anticipated rate while productivity should be boosted or else Cambodia's cost competitiveness across all manufacturing sectors will be jeopardised.

- *Preferential market access:* E&E firms perceived market access as a strength for Cambodia's E&E sector. The benefits mostly arise from low cost of trade in E&E components and parts with countries along the production networks. Unlike the garment and footwear sectors which heavily rely on free-trade agreements with the USA and the EU, preferential market access to these two major markets is less relevant for the E&E sector, possibly due to Cambodia producing most of parts and components and supplies to countries in East Asia.

- *Government incentives:* Many firms agreed that the incentives provided by the government are a strength for the E&E sector. The Qualified Investment Project (QIP) is given to any investment project that aims to produce products for export or produce intermediate products, equipment, and construction materials to be used in the production of export goods. Although QIP status is not specific for the E&E sector, firms can receive profit tax exemption, a tax holiday, 40% special depreciation allowance on the value of the new or used tangible properties used in the production or processing, and duty-free import of production equipment and construction materials.

- *Clusters of foreign firms:* The majority of E&E firms perceived that having wider range of enterprises from the same countries in special economic zones is favourable and conducive to their business operations including communication, information exchange and joint efforts to solve common problems. This pragmatic thinking is evident in high concentration of firms from specific countries in SEZs managed by investors from the same country. For example, many Japanese firms prefer to locate in PPSEZ (the Japanese-investor-owned SEZ); companies expanded from Thailand tend to gather in SEZs along the Thai border; and

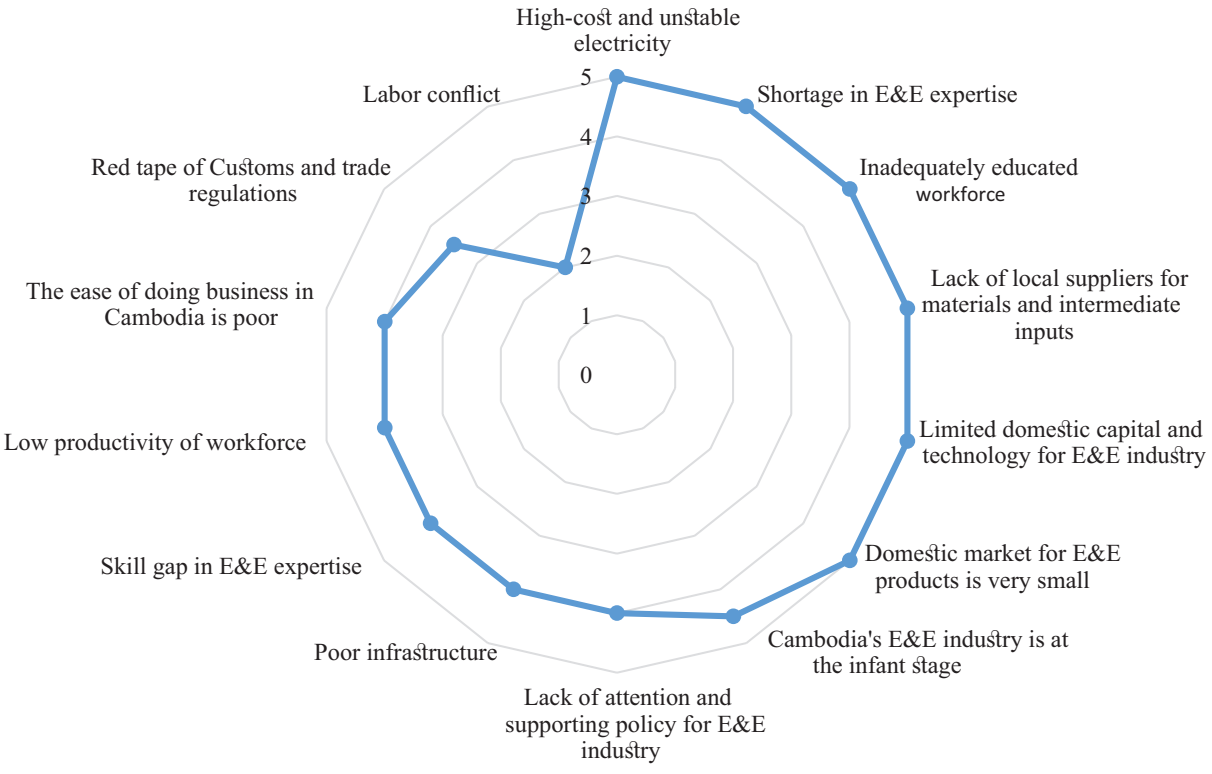
Taiwanese and Chinese E&E Companies are inclined to locate in compatriot-owned SEZs near the border with Vietnam.

- *Cambodia's favourable location within the E&E regional production network:* Being adjacent to countries with vibrant E&E sectors is perceived by E&E firms as strength for Cambodia. The special economic zones near the Vietnam and Thai borders make the movement of parts and components among various production blocs cheaper. Further effort by Cambodia to improve connectivity and transport logistics would contribute to significant increase in cross-border trade of E&E parts and components and thus result in further expansion of production and development of the E&E sector.
- *Favourable residential environment for foreign workers, and political stability:* In addition to political stability and safety, Cambodia is hailed by the majority of foreign workers as a decent place to work and live. However, living environment and facilities vary notably among major cities. Phnom Penh offers higher levels of urban amenities, schools and medical facilities than the rest of Cambodia. Since several E&E production facilities are located in provinces near Vietnam and Thailand, it is important for Cambodia to transform those provinces into tier cities with appropriate urban amenities. City development will also help attract skills and talent as recruitment difficulties is a key challenge for the E&E sector.

Weaknesses

Figure 6 illustrates the radar graph of the median scores of weakness indicators. The most severe weaknesses expressed by E&E firms concern cost and reliability of electricity, education and skills of workforce, capacity of domestic suppliers, and the early stage of the sector development. In contrast, the majority of firms do not appear concerned with labour conflicts and custom procedures.

Figure 6: Medium score of weakness factors



Source: Firm survey 2018

- *High-cost and unstable electricity:* Cost and stability of electricity is a serious weakness for industry in Cambodia. This could cause damage to mechanics and machineries as well as delay in production. In response, many factories have bought generators to back up in case of electricity cuts. The 2016 World Bank's Enterprise Survey precisely suggested that electricity is among top ten obstacles to business environment in Cambodia, with prohibitive regulations concerning rooftop solar production being another factor pushing up prices and susceptibility to power outages, especially in the dry season.

- *Inadequately educated workers:* Poor general knowledge including understanding of simple mathematics and literacy, and low ability to understand job instructions and internal regulation are cited as big challenges to Cambodia's labour force. High absenteeism and a lack of compliance to internal regulations are common among production workers.

- *Skill shortage and skill gaps:* Although there are many vocational training schools, E&E firms expressed severe shortage of applications for various positions especially for medium and high skilled occupations. Such recruitment difficulty incurs extra costs and limits expansion. There are also very few recognised vocational and technical training schools in border provinces to produce a workforce with the skills required by E&E firms. This is especially true in more complicated roles, leading to firms employing expatriates in technician and engineer occupations.

- *Limited supply capacities:* All respondents agreed that domestic capital and technology for the E&E sector is very limited and this results in severe lack of domestic suppliers of inputs. In consequence, E&E firms import most of machines, spare parts and accessories.

- *Early stage of E&E sector:* About 74 percent of the respondents agreed that Cambodia's E&E industry is in its infant stage and therefore it is relatively weak compared to that of neighbouring countries. While it is easier to join E&E production networks, maintaining and moving up E&E value chains remains tough.

- *Low productivity of workforce:* Low education, lack of skills, long travel from home to workplaces and low commitment to work hard are blamed for low productivity. Some companies responded to this by employing foreign supervisors to monitor the production lines About 35 percent of the company representatives noted that suitable training overcame many productivity issues, and highlighted the importance of well-established in-house training programs.

- *Small domestic market:* This perception is consistent with the concept of market thickness which states that size of a domestic market is key for lead firms to decide on production location. Although the investment is initially designed to supply foreign markets, sizable domestic markets could also add extra dimensions for E&E firms to prosper.

- *Poor infrastructure:* Almost all respondents agreed or strongly agreed that transportation infrastructure was still poor. Delay of shipping materials and products, high costs, poor road conditions, traffic jams, old trucks, no public transportation, no large deep-water sea ports; all contribute to the perceived weakness. The finding is consistent with other noted comments concerning a lack of comprehensive and efficient infrastructure and transport system in Cambodia.

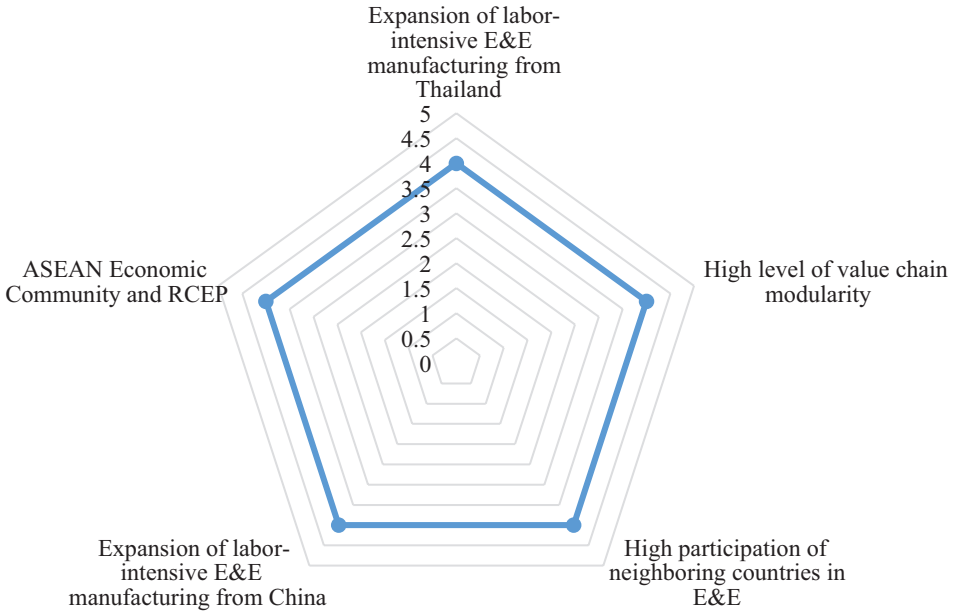
- *Lack of attention and supporting policy for E&E industry:* E&E firms complain about a lack of attention and supporting policy for this sector as compared to that given to the garment sector, and advocate for similar intervention and policy support.

- *Difficulty in doing business in Cambodia:* About 26 percent of respondents neither agreed nor disagreed that it was easy to do business in Cambodia while about 16 percent did not answer and 10 percent disagreed. Forty seven percent strongly agreed or agreed that it is easy to do business in Cambodia.
- *Red tape of customs and trade regulations:* With many surveyed firms outsourcing shipping and custom clearance to forwarding agents, problems in the sector are possibly shifted. It could also be due to much better trade facilitation given to companies located in SEZs compared to other production facilities across the country
- *Labour conflict:* With most of the E&E firms located in secure and self-enclosed SEZs, they are less likely to be negatively affected by labour strikes or demonstrations.

Opportunity

Figure 7 demonstrates the average score of factors perceived by E&E firms as opportunities. It can be broadly interpreted that regional integration as well as changing regional economic structures provide ample opportunities for Cambodia to expand its E&E production and exports. Specifically, the expansion of labour-intensive E&E manufacturing from Thailand under the Thailand Plus One strategy, high level of value chain modularity, high participation of neighbouring countries in E&E, the expansion of labour-intensive E&E manufacturing from China, and the ASEAN Economic Community and Regional Comprehensive Economic Partnership (RCEP) are strongly perceived by the majority of E&E firms as windows of opportunity for Cambodia's E&E sector.

Figure 7: Medium score of opportunity factors

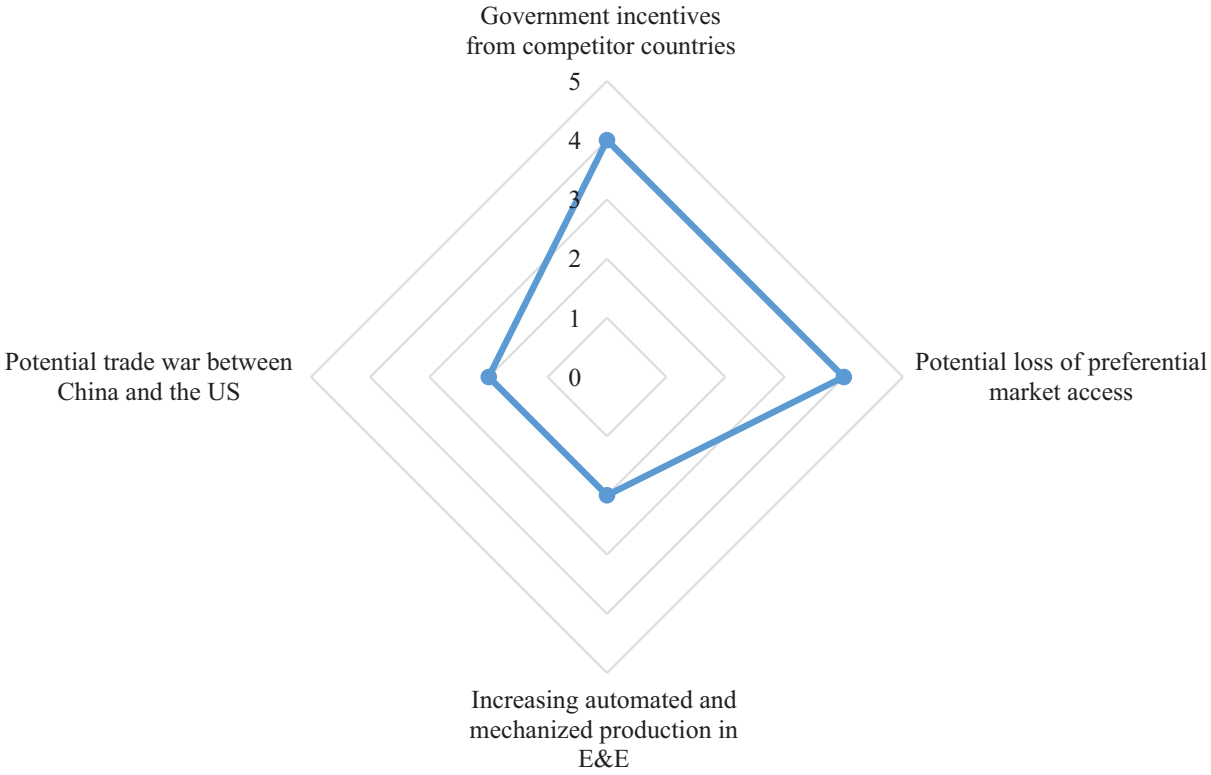


Source: Firm survey 2018

Threats

Figure 8 illustrates the stated threat indicators. The most severe threats perceived by E&E firms concern more intense competition among countries to attract E&E GVCs, and preference erosion. The graph also shows that E&E firms did not see a trade war between China and the US, nor automation as threats.

Figure 8: Medium score of threat factors



Source: Firm survey 2018

- *Incentives from competing countries:* Over half of respondents are concerned with Laos, Myanmar, the Philippines and Vietnam providing substantial fiscal incentives and policy support to attract E&E production. Respondants noted Myanmar's unstable political situation, and the lack of labour productivity in Laos and Myanmar.
- *Potential loss of preferential market access:* Although Cambodia exports much of E&E intermediate and final products to countries in the region, 52.6 percent of respondents still perceive preferential market access as being key to their businesses and therefore preference erosion would be a threat. On the other hand, 31.6 percent of the respondents strongly disagreed and disagreed that this issue was not a threat, while 15.8 percent neither agreed nor disagreed. It is important to note that Cambodia currently receives preferential treatment from many countries including Australia, Canada, the European Union, Iceland, Japan, Kazakhstan, New Zealand, Norway, the Russian Federation, Switzerland, Turkey, the United States, India, Chile, China, Taiwan, Kyrgyzstan, Tajikistan, Thailand, and South Korea. According to the 2018 triennial review, the country remains classified as a Least-Developed Country, but could be graduating within the next three to six years. This would result in loss of preferential market access and increased competition.
- *Potential trade conflict between China and the US:* At the time of our survey in 2018, trade conflict between China and the US was escalating. We asked respondents whether they thought that it was a threat for Cambodia's E&E sector and around 52 percent of respondents disagreed that trade tension China and the US would significantly affects Cambodia's E&E sector. Some company representatives said their value chains were associated with Thailand and Japan but not China; and they exported to Japan and the US so there was no impact. Some even said it is an opportunity because if the US imposes high tariffs on Chinese products, many companies might move from China to Cambodia. Thirty-two percent of

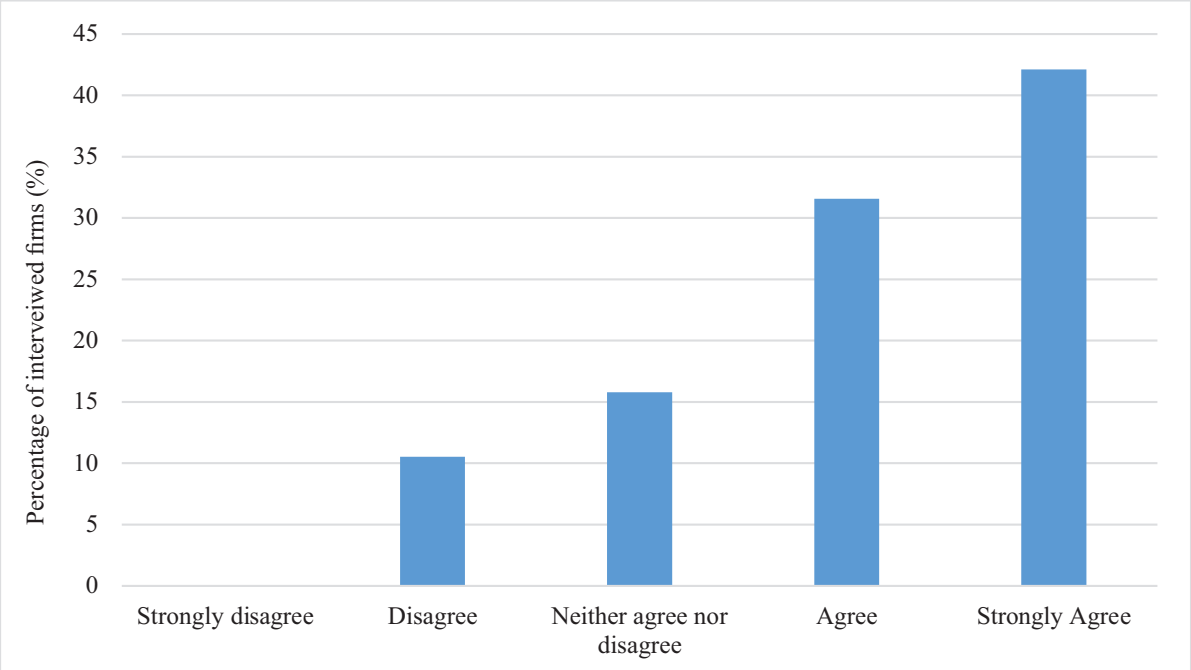
firms regard US-China trade conflict as a threat due to the interconnectedness of parts and components trade and sourcing. Almost 90 percent of materials are imported from China and this risks production stability. Some noted the significant involvement of Chinese investment in Cambodia's economy, and stressed that any economic issues in China would negatively impact Cambodia.

- *Increasing automated and mechanised production:* Almost 60 percent of firms are not concerned about emerging automated production methods. E&E assembly remains a labour-intensive sector and labour costs are still lower than investment in automated and mechanised robots, so there is no reason to replace Cambodian labour with robots. Other respondents said shifting to automated and mechanised production could be possible in the far future, until wage conditions make technology more attractive.

5.4 Health of Cambodia's E&E sector

At the end of SWOT analysis questions, we ask respondents to assess overall health of the E&E sector in Cambodia. Figure 9 highlights the general perception of the sector is predominantly positive. More precisely, 42.1 percent of respondents strongly agreed and 31.6 percent agreed that the sector will expand in the next five years. About 16 percent hesitated to agree or disagree, while 10.5 percent disagreed.

Figure 9: Companies' perspectives on the expansion of E&E assembly in Cambodia



Source: Firm survey, 2018

5.5 Suggestions for policy actions

At the end of survey interview, firms' representatives were asked to propose policy actions to the Cambodian government to enhance sector development. Below are summaries of actions demanded by E&E firms:

- Provide special investment incentives specific to the E&E sector
- Build skills and human capital for the E&E sector that focus on general education, vocational training, and tertiary skills
- Wage increases should be predictable and follow productivity increases
- Improve infrastructure, connectivity and transport logistics
- Provide stable and reliable electricity supply at a reasonable cost
- Reduce unofficial payments and streamline cross-border trade facilitation
- Develop domestic supply capacity with emphasis on quality standard of inputs
- Establish a platform for information sharing and business networking
- Improve the efficiency of public-private dialogue so that specific concerns and suggestion in E&E sector are adequately addressed

6. Conclusion

This paper represents the first scholarly effort to map Cambodia's participation in E&E production and distribution networks. The proceeding analysis allows us to draw three conclusions:

Firstly, global E&E production and export has proliferated rapidly to become the key industry serving ever increasing demands of final consumers and entities. Like other sectors, E&E production configuration has been shifted toward broader geographical fragmentation with extensive involvement from different types of firms from various countries. With E&E production concentrating in East and Southeast Asia, the region is the hub of E&E manufacturing and distribution. Several East and Southeast Asia economies have successfully benefitted from E&E GVC for industrialisation and economic growth. Cambodia is one of those economies. Since 2005, and the first E&E facility in Cambodia, it has taken many years for E&E investment and exports to boom. The country's scale of production measured by export volume and depth, proxied by product complexity and specialisation, remain behind other countries and Cambodia's E&E sector is at an infant stage of development involving labour-intensive component manufacturing.

Secondly, Cambodia's integration in E&E production networks is partly the result of changes to regional corporate strategy to minimise risks by further diversifying production bases in adjacent emerging and low-cost countries. The most known is 'Thailand Plus One', and an example of successful relocation of some E&E component production from Thailand to Cambodia. Cambodia has successfully joined vibrant E&E production networks due to attractive factors including the low cost of labour, generous investment incentives, rapid development of SEZs, proximity to E&E manufacturing hubs and political stability. Opportunities arising from possible greater policy support i.e under the IDP 2015-2025 plan, deeper integration in the ASEAN Economic Community and broader Asian trade architecture, and reallocation of E&E production components from China could further boost Cambodia's E&E production and exports. However, there remain certain critical structural bottlenecks that constrain private sector development. A more coordinated and responsive effort from the government is required, especially with regards to power supply and cost, education and skills, infrastructure and logistics, trade facilitation, domestic supply capacity, and urban amenities.

Thirdly, the results fit the broad story of new development paradigms that stress the need for improving connectivity; reducing trade barriers; streamlining customs procedures and improving investment climate; and investing in education and skills of workforces to seize the benefits from GVCs. Cambodia's E&E growth trajectory heavily relies on government policy reforms as stated and the ability to efficiently build domestic supply capacities and industrial clusters linking with regional E&E production. The evolution of regional economic landscapes and global trade policies might also impact Cambodia's E&E sector. Structural changes toward knowledge-based and high value-added production in economies such as China, Thailand and Vietnam would force some E&E firms to relocate production in Cambodia. Likewise, further reductions in trade costs brought about by a deeper and more comprehensive trade agreement would be more conducive to E&E production networks in general and E&E development in Cambodia in particular. These imply that building a vibrant E&E sector would require not only smart and efficient policy interventions to address key structural and production obstacles, but also meaningfully engage in regional and global trading architecture to maximise the integration in, and benefit from, regional E&E production networks.

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