Backward Linkages from MNCs and Production Capability Accumulation by Recipient Firms: A Comparative Case Study of Kenya and Malaysia

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Transformation of Economic and Social Systems

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Declaration (Erklärung)

Ich erkläre hiermit an Eides Statt, dass ich die vorliegende Arbeit selbstständig und ohne Hilfsmittel angefertigt habe; die aus fremden Quellen (einschließlich elektronischer Quellen, dem Internet und mündlicher Kommunikation) direkt oder inrekt übernommenen Gedanken sind ausnahmslos unter genauer Quellenangabe als solche kenntlich gemacht. Insbesondere habe ich nicht die Hilfe sogenannter Promotionsberaterinnen/ Promotionsberater in Anspruch genommen. Dritte haben von mir weder unmittelbar noch mittelbar Geld oder geldwerte Leistungen für Arbeiten erhalten, die im Zusammenhang mit dem Inhalt der vorgelegten Dissertation stehen. Die Arbeit wurde bisher weder im Inland noch im Ausland in gleicher oder ähnlicher Form einer anderen Prüfungsbehörde vorgelegt.

Bonn, 18.12.2019

Titus Ndunda

Acknowledgements

The idea for my PhD research originated from a global economics seminar in 2015 during my master's degree. I was introduced to the *Atlas of Economic Complexity*, a data visualization tool which allows people to explore global trade flows across markets, track these flows over time, and discover new growth opportunities for countries. One of the central arguments of the authors of the *Atlas of Economic Complexity* is that countries which have less know-how struggle to produce highly complex and competitive products, and that further diversification of products may not be possible or may be very costly when internally driven. As I come from a developing country, this proposition bothered me and therefore, after my master's degree, I embarked on a PhD in 2017 to seek for answers as to how globalization can aid countries to shift to the production of complex goods.

The successful completion of this research work rests on the support and commitment of many people and institutions. I would like to express my appreciation to the following:

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Project Summary

Backward linkages from multinational companies (MNCs) are an economic interaction whereby firms in a host country supply inputs/goods to MNCs. It is possible for a firm to engage in such a relationship while at the same time undergoing production capability accumulation, which is the process by which firms shift from the production of low value-added goods to the production of higher value-added goods. Such a supply of inputs by local firms to their MNC customers has benefits: specifically, local firms increase in innovativeness via learning by interaction. The current research investigates the impact of supplying inputs to MNCs on the ability of local firms to shift up the value chain from low to higher value-added goods. This phenomenon raises a question that fundamentally requires an analysis that goes beyond correlation; namely, a causal analysis.

Drawing from the work of Pearl (2009) on causal Bayesian networks, and applying a mixed method case study, this dissertation implements graphical models and the logic of interventions in order to investigate the causal relationship between backward linkages from MNCs and the production capability of local firms. We find evidence that backward linkages from MNCs have a causal effect on the production capabilities of the suppliers in the host country.

The target sample of local firms has been drawn from the electronics and electricals (E&E) and plastics and chemicals (P&C) sectors of both Kenya and Malaysia. These selected sectors are among those that have a potential for growth as well as world market advantages, thereby making them good candidates for analysis. Additionally, both countries have a long history of reliance on foreign direct investment (FDI) in their economic development and of engaging in very close bilateral relationships in various spheres. This research is useful in two ways: first, it contributes to the literature surrounding the causal connection between backward linkages from MNCs and the production capability accumulation of local firms. In particular, this research fills in the gap concerning backward linkages research in Kenya and Malaysia. For the current state of research surrounding backward linkages, *see* Ndemo and Smallbone (2015); Phelps et al. (2009) and Loke and Tham (2017) for Kenya and Malaysia, respectively. Second, this research can potentially aid in national trade policy formulation.

Chapter 1: Introduction

The current study investigates the causal effect of backward linkages from MNCs on production capability accumulation of firms in the host country. Our focus is based on a firm level analysis. This study is relevant in the framework of technology-driven growth, an important aspect of development strategies depending on accumulation of production capabilities as a major factor of economic growth (See, Hidalgo and Hausmann 2009; Hausmann and Hidalgo 2011; Hausmann et al. 2014; Hausmann 2016).

1.1 The Path to Production Capability

The existing studies analysing backward linkages from MNCs on the host economy or firms mainly use term knowledge spillover. Researchers studying a knowledge spillover often attempt to address the following key questions: why foreign production? How do MNCs affect the host country? What is the spillover? How does spillover occur? What affects spillover? What are the ultimate outcomes of spillover? (Abebe and Begum 2016).

According to Blomström and Kokko (1999), knowledge spillover from MNCs involves having an understanding of product and process technologies that improve product quality and productivity. As argued by Alfaro and Chen (2013), productivity gains are frequently attributed to knowledge spillover from MNCs to domestic firms. Furthermore, according to Fracasso and Marzetti (2015), one would expect international knowledge spillovers to have a greater impact on local productivity growth in those countries where human capital is more abundant.

Pioneering research on technology spillover that is, knowledge spillover that concerns specifically technical knowledge, was performed by Arrow (1971). Arrow maintains that technology diffusion involves the interaction between agents and often takes place through learning processes. Often, MNCs are unable to protect their technology from leakage and spillover. For example, Kokko (1994) posits that MNCs appear to be an important channel for the transfer of advanced technology to local firms if appropriate interventions and strategies are made. Empirical studies are generally in agreement that domestic firms supplying inputs to MNCs may be exposed to advanced technology that can, in turn, enable them to upgrade their own production techniques. Narula and Marin (2005) have established that in order for MNCs to run their business under lower costs (for example, costs associated with transportation of inputs), they must interact with local firms. Often, these interactions may result in technological spillover into the rest of the host economy. Most studies find a strong correlation between linkage with MNCs and the productivity of a local firm. For example, Cubillo (2003) finds that the productive linkages established between local firms and MNCs influence the

internationalisation process, suggesting that through their interactions with MNCs, local firms have the opportunity to access foreign markets. Following from this idea, we may then ask how spillovers are reflected.

One answer to this question is provided by Görg (2008), who argues that in addition to bringing an inflow of hard currency to the host country, MNCs also come with different firm-specific assets that might impact local firms. MNCs are often able to afford the high fixed costs for the acquisition of advanced production technology and the development of logistics infrastructure, which ultimately impact the production and marketing practices of local firms. Indeed, Blomström and Kokko (1999) classified all the externalities resulting from the presence of MNCs as the effect of productivity spillovers and market access spillover.[1]

Productivity spillover is realised when backward linkages with MNCs lead to an increase in the output of local firms, which implies causality. Indeed, there exists a strong relationship between the presence of MNCs and the productivity of local firms. According to Blomström and Kokko (1999), productivity spillovers occur when backward linkages from MNCs lead to productivity or efficiency benefits in the local firms. Blomström et al. (1994) have suggested that spillovers can be measured as the impact of MNCs on productivity in local firms.

One stream of literature has established direct and positive productivity spillovers from MNCs to local firms (for example, see Merlevede and Schoors 2005; Salomon 2006; Resmini et al. 2007; GERŠL 2008). Yet regardless of the evidence of the direct influence of MNCs on local firms via productivity spillover, there is lack of consensus among researchers on whether the interactions between local firms and MNCs generate direct positive production spillover for the former. As such, a stream of literature argues that linkages between local firms and MNCs may be indirect or may not produce significant productivity spillovers on the local firms (for example, see Patibandla and Sanyal 2005; Narula and Guimón 2009; Mishra 2011; Abereijo and Ilori 2012). Moreover, some studies, such as the work by Abereijo and Ilori (2012), have established that the productivity growth of local firms largely depends on their accumulated technological capabilities, which result from continuous learning from the MNCs with which they interact. To that extent, productivity improvement among the local firms results from mechanisms that are rooted in knowledge, technology, and innovation.

[1] Market access spillover effects occur when the networks developed by export-oriented MNCs may spill over and lower the market access and production cost of local firms, thus enhancing the local firms' propensity to export. Since our study primarily aims to investigate the relationships between local firms and MNCs within the host country, we will only focus on the effect of productivity spillovers.

There is unanimity in foreign direct investment (FDI) literature that the presence of MNCs has a positive impact on innovation activity in the host country. For example, Salomon (2006) has established that local firms interacting with MNCs may gain technological knowledge and then, in turn, use this knowledge to improve existing products or invent new ones.

The synthesis of the above literature generates important interrelated themes; namely, the entry of MNCs into the host country, the fixed costs of business, decision making at the firm level, the improvement of products and processes within a firm, firms creating new products and processes, productivity gains by firms, the application of correlation-based analysis of spillovers from MNCs, and inter-firm knowledge acquisition through long-term learning processes.

The pattern emerging from the preceding ideas can be grouped into these six major themes:

Theme One: Entry of MNCs
Theme Two: Decision making at firm level
Theme Three: Fixed costs
Theme Four: Improvements of existing products, creation of new products and processes, and productivity gains
Theme Five: Long-term learning process
Theme Six: Statistical methods of analysis

Of the six themes, we argue that the fourth theme, due to its dynamic nature, is the most critical to any firm. When firms establish themselves in new markets or strive to minimise production costs, for instance, one of the major goals is to maximise theme four.

Using insights from the field of business, some researchers from the field of development economics and industrial development have attempted to deliver a better conceptualisation and understanding of the fourth theme and how it relates to backward linkages with MNCs (see, for example, Andreoni 2011). Their approach to the capability theory of the firm has inspired the theoretical underpinnings of this dissertation.

Following from the theory of the capability theory of the firm, we integrate the concepts of the fourth theme improvements of existing products, the creation of new products and processes, and productivity gains – into what we refer to as production capability, hereby defined as the shift from the production of low value-added goods to the production of higher value-added goods.

1.2 Linking Backward Linkages with Production Capabilities

To link the capability theory of the firm to the theory explaining backward linkages from MNCs, consider the following scenario. MNCs establish themselves in a host country with the main driving force being the low cost of production. These MNCs possess special advantages, such as advanced technology. Aware of the competitive advantages possessed by MNCs, local firms in the same industry as the MNCs decide on the best production strategy, ensuring that they are not forced out of business. The results include reduced production costs and fair prices for their products. The internal strategy adopted by local firms determines their success in a competitive market. In the long-term, the transportation costs incurred by MNCs through import of intermediate goods rise, requiring them to source inputs locally. Competitive local firms in the same industry as the MNCs form supply relationships with MNCs. The local suppliers of MNCs strategise and organise activities into a firm, focusing on economies of scale other than one off-transaction with MNCs. Through long-term learning, the local suppliers can potentially accumulate know-how that facilitates the shift from the production of low value-added to high value-added products.[2]

Our definition of production capability and the link to backward linkages from MNCs establishes a path through which we will investigate these two concepts. To begin with, we have established that the causal effects of backward linkages from MNCs on the accumulation of production capability in the host country firm is not yet well understood in the existing literature and surrounding empirical research. In fact, to the best of our knowledge, there are no studies that address the causal effects of linkages from MNCs on the production capability accumulation of the host firms.

Further, rather than focusing on questions that many previous studies in FDI literature have addressed (for example, what spillover is generated? How is this spillover generated? And what are the determinants of spillovers?), we instead focus on a causal question. We investigate whether any causal effects from backward linkages from MNCs on the production capability accumulation of the local suppliers in the host country exist, and if so, we investigate the size of the causal effect. To address this challenging and complex question, we adopt a mixed methods approach; that is, an approach that is quantitative and qualitative based on an explanatory sequential design. The idea is for us to realise the benefits of both approaches and produce comprehensive results.

[2] The theory informing operations by MNCs is explained in further detail in Chapter 2.

This research faces two main limitations:

1. A focus on the perspective of local firms rather than an inclusive methodology that accounts for the assessment of MNCs. However, by focusing on local firms, our study can better assess the extent to which local firms have benefitted from their supply interactions with the locally-based MNC customers.
2. Challenges encountered during the online survey, which involved ensuring that we establish controls for firm size and the age of the respondents. To ensure that we would not miss numerous responses that would facilitate this project, we distributed our online survey to a wide range of purposefully-selected firms across the two countries studied. However, it turned out that in one country, the survey responses mainly came from more recently-established firms.

1.3 Outline of the Research

This dissertation is divided into eight chapters. Chapter 2 is conceptual, aiming to establish a detailed theoretical link between backward linkages from MNCs and the accumulation of production capability by local firms in the host country. While linkages exist in different forms, there is a need to reflect on all of them and establish how backward linkages can be identified within broader linkages. Moreover, there is a stronger need to identify which sectors of the economy can maximise the effects of backward linkages from MNCs. This will allow the research to demonstrate: 1) a new trade theory to adequately explain the strategies of backward linkages from MNCs, and 2) that stronger backward linkages are formed in the manufacturing sector. It will also set the stage for us to couple the concept of backward linkages with that of production capability. As such, we propose a causal model for the accumulation of production capabilities.

After we identify and connect backward linkages from MNCs with production capability accumulation, Chapter 3 discusses the case selection criteria and investigates, from the existing studies, the nature and impact of backward linkages from MNCs on the electronics and electricals (E&E) and plastics and chemicals (P&C) manufacturing subsectors in Kenya and Malaysia. We establish that both countries heavily rely on FDI and that in Malaysia in particular, backward linkages from MNCs have substantially contributed to the diversification of E&E subsector.

Chapter 4 is the methodology chapter, and we position the causal model proposed in Chapter 2 in the context of causal Bayesian networks.[3] In order to implement the model, there is need for both data and a framework for obtaining the data. We adopt a mixed methods approach based on explanatory sequential design. As such, we collect quantitative data through an online survey instrument, SurveyMonkey, within the subsectors and countries investigated in Chapter 3.

Chapter 5 addresses the research question in quantitative terms. Our research question is: do backward linkages from MNCs have a causal effect on the production capability accumulation of the suppliers in the host firm? This chapter answers this question in the affirmative, using the causal Bayesian network, and raises a new question for qualitative investigation: what explains the variation in the levels of production capabilities among firms supplying inputs to locally-based MNCs?

One of the survey questions asks respondents if they would be willing to participate in the second round of interviews if their results turn out to be interesting. Through continued study of these firms, Chapter 6 sets out to explain the quantitative results. Eight firms, four from Kenya and four from Malaysia, who offered an affirmative response to the questions were selected based on a set criteria, and guided face-to-face interviews were administered. This establishes the finding that local firms that are involved in joint design activities by their MNCs register higher production capabilities than local firms that do not.

Chapter 7 integrates both quantitative and qualitative results and synthesises the results from Chapters 5 and 6, explaining the quantitative results. This chapter establishes that local firms involved in joint design activities by their MNCs, in turn, register higher production capabilities than local firms that do not. This answers the question of what explains the variation in the levels of production capabilities among local host firms supplying inputs to locally-based MNCs.

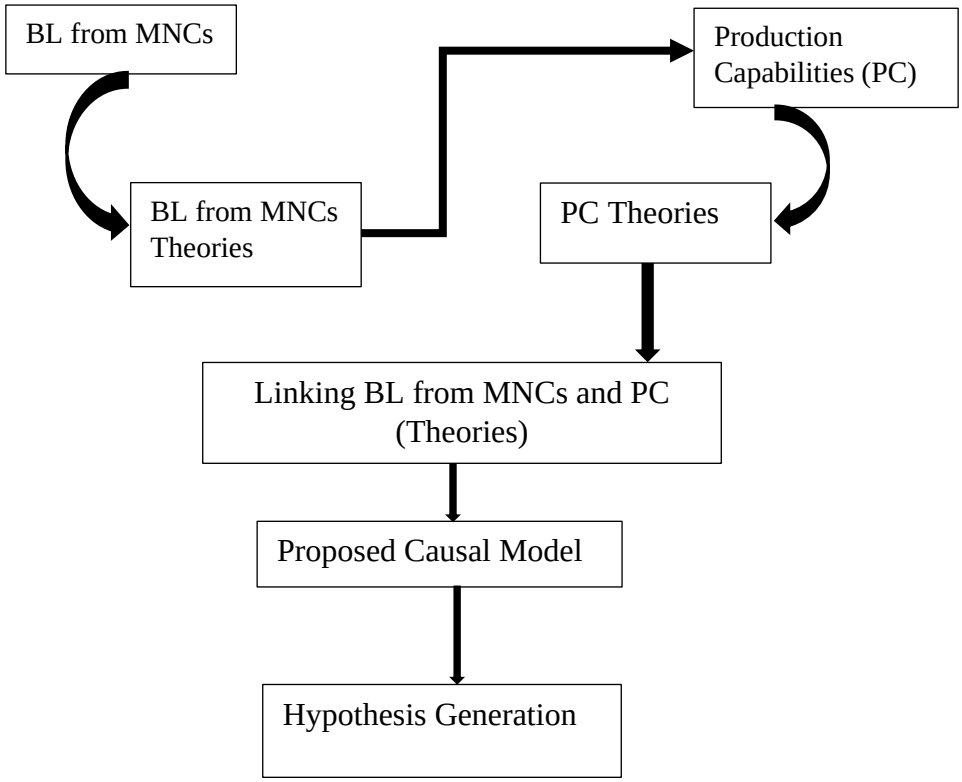
Finally, Chapter 8 is devoted to a discussion of the major issues addressed throughout the preceding chapters. This chapter also makes suggestions for future researchers conducting a firm-level analysis in the field of FDI and knowledge transfer. Moreover, some recommendations are also made in this chapter.

[3] Causal Bayesian networks are causal networks with the strength of the causal links represented as conditional probabilities.

Chapter 2: Literature Discussion

This chapter provides a discussion of the literature exploring the concepts of backward linkages (BL) from multinational corporations (MNCs) and production capabilities (PC). Moreover, this chapter establishes the link between the two concepts. The chapter structure is outlined in **Figure 1.**

Figure 1: Literature Review Structure



2.1 Backward Linkages from Multinational Corporations (MNCs)

2.1.1 The Concept and Context of Backward Linkages

While the discourse concerning backward linkages is not a new subject, the meaning of the term has evolved in recent years as the international economic context has transformed considerably. To understand this study's discussion on backward linkages, a review of the ways in which this concept has changed and the surrounding context is important.

2.1.2 Definition of Backward Linkages

Previously, the term "backward linkages" was defined in various ways by different researchers. Some still use it in a very broad sense to apply to the entire effect of FDI on the economy of a country through its impact on the country's income, balance of payments, industrial infrastructure, and other sectors through spillovers.[4]

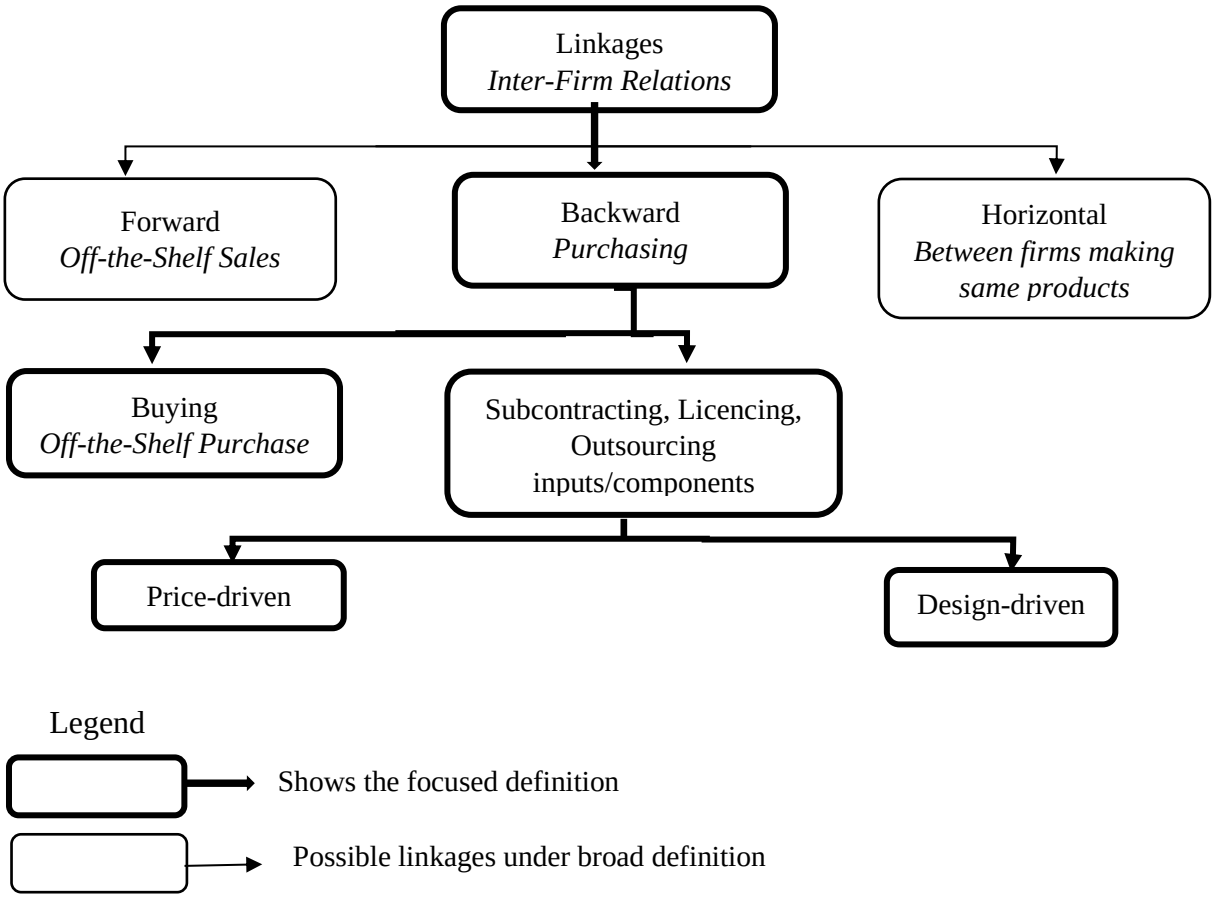
However, today the term is more commonly applied in a narrower sense to refer to inter-firm relationships, in which a firm purchases goods and services as its production inputs on a regular basis from one or more other firms in the production chain.[5] Among industrialists, entrepreneurs, and policymakers, the discourses on backward linkages are frequently marked by the use of such alternative terms as "procurement," "subcontracting" and "local sourcing", whereby each may refer to a different form of backward linkages (Battat et al. 1996; Rugraff and Hansen 2011). Figure 2 differentiates backward linkages from other firms' relationships and indicates the different forms that backward linkages may take. As demonstrated in the figure, a firm links itself with others via various important relationships. Linkages can be *backward* to suppliers and subcontractors (*upstream),* and they are can also be *forward* to distributors, agents or franchise holders (*downstream*). To these two forms, *horizontal* linkages can be added between firms operating within similar activities, such as strategic alliances between competitors and technology partners (Rugraff and Hansen 2011).

When purchasing inputs, a manufacturing firm may buy existing products "off-the-shelf", or it may enter into contractual arrangements with the producers of specialised inputs. Additionally, depending on the buyer firm's corporate strategy and its product's characteristics, sub-contracting can be either price-driven or design-driven.[6] In the former, the buyer firm prepares specifications for the parts and components it needs and sends its specifications to a list of subcontractors, who in turn submit bids to supply the requested items, mainly on the basis of price. However, rapid changes in design and technology have necessitated more frequent

[4] For example, see the work of Lall and Streeten (1977).
[5] For example, see Hansen et al. (2009); Rugraff and Hansen (2011); He and Zhu (2016).
[6] A decades-old study by Best (1990) offers a first-hand and detailed discussion on "price-driven" and "design-driven" subcontracting.

modifications of inputs and components at all stages of production and, as such, subcontracting based on long-term consultative or networked relationships has become more attractive. See **Figure 2** for the definition of backward linkages by activities.

Figure 2:Defining Backward Linkages by Activities



Source: Modified from Battat et al. (1996)

A design-driven form of backward linkages is particularly interesting to developing countries since it makes the relationship between the suppliers of inputs/goods and the firm purchasing the inputs more stable than the relationship between suppliers of off-the-shelf goods and the buyers of such goods. This kind of stability helps supply firms to make better planning and technological decisions (Battat et al. 1996). At that extent, the relationship typically requires intensive interchange between customer firms and supplier firms, thus encouraging technology transfers, managerial training, and the sharing of market information between suppliers and customers. However, in the context of the current study, the consideration of the price-driven aspect of backward linkages is not trivial. Indeed, if suppliers can keep to, among other things,

the design standards, quality, efficiency, and timely delivery required by their customers, then the suppliers can, over a long period of time, potentially enhance their production process capabilities. Thus, the current study investigates both the price-driven and design-driven forms of backward linkages. In fact, this premise is informed by Alterburg's argument that buyers, especially MNCs, need a broad range of competitive, high-quality inputs delivered on time (2000).

It is worth noting that backward linkages exist in almost all trade activities; however, they are particularly common in manufacturing sectors (see van Gorp et al. 2006).

The probability of backward linkages has been shown to be strongest when the final product requires several manufactured components, such as the metal, plastic, rubber, and glass products required to assemble automobiles, or involves specific manufacturing skills and/or technologies, such as casting, machining, plastic injection, plating or metal or plastic printing. When the in-house production of such components is difficult or costly, dependence on outsourcing becomes inevitable.

Empirical studies demonstrate that industries, where the opportunities for backward linkages are the greatest, include the automobile industry, the manufacture of machinery and precision instruments involving primarily assembly activities, and the consumer electronics industries. Thus, the automobile industry represents a significant level of the overall manufacturing activities in terms of output and employment. Moreover, industries that generate upstream linkages include textiles and pharmaceuticals. In contrast, industries that process raw materials, such as metallurgical and petrochemical industries, rank among the lowest in terms of backward linkages.[7]

When discussing backward linkages, it is important to recall the discourse present at the origin of the concept. In fact, an adequate analytical treatment of sectorial interdependencies in developing economies was provided by Albert Hirschman, who is credited with having coined the terms "backward" and "forward" linkage. Hirschman assigned more importance to backward than to forward linkages, principally emphasising that derived demand is an inducement mechanism for supplying through domestic production the inputs needed in non-primary economic activities. Additionally, he illustratively ranked various sectors of an economy in terms of the strength of their interdependencies, thereby relying on input-output

[7] The discourse on the economic sectors that matter for backward linkages, spanning several decades, seem to have reached a consensus among scholars; for examples, see Halbach and others (1989), Battat et al. (1996), Altenburg (2000), van Gorp et al. (2006) Rugraff and Hansen (2011).

relationships constructed for developed countries by Chenery and Watanabe (1958).[8] On the basis of a measure of the backward linkages for each sector based on the proportion of inter-industry purchases to total production, Hirschman confirmed the thesis by Singer (1950) of low backward linkages in primary production and high backward linkages in manufacturing (Hirschman 1958).[9] By emphasising both weak backward linkages and declining terms of trade in the production of primary materials, a compelling argument was made in the development literature of the 1950s for a strategy of economic development that encouraged manufacturing. This perspective was reinforced by the conviction that only in manufacturing could producers experience high-demand elasticities with respect to both price and income as well as increasing returns to scale in production. As stated by Rostow and cited by Hirschman, only by learning the tricks of manufacture "can that old demon, diminishing returns, be held at bay" (Hirschman 1958:48).

In sum, backward linkages refer to the inter-firm relationships involving the purchase of goods or inputs on a regular basis. Stronger linkages are formed in manufacturing industries. Moreover, these linkages can be either price-driven or design-driven, all of which can potentially lead to long-term consultative engagements between the suppliers and the buyers. On the supplier side, the consultation is a learning process and leads to, among other things, the proper planning of supplies, improved technical designs, and managerial training. Both the supplier and the buyer also benefit from sharing marketing information. See the section summary in **Table 1** below.

[8] Input-output measures describe the sale and purchase relationships between producers and consumers within an economy.

[9] Singer posited that only FDI in manufacturing could present the stimulus for other industries in the production chain as well as increased technical knowledge, urban education, and the dynamism and resilience that goes with urban civilisation (Singer 1950).

Table 1: Summary Table: Defining Backward Linkages

Backward Linkages					
Definition	**Form**	**Effect/Impact**			**Industry/Sector**
		Supplier	Buyer	Process	Manufacturing
Interfirm relationship involving the purchase of goods or inputs on a regular basis	Price-driven Design-driven	Planning supplies Improving technical designs Managerial training Market information	Market information	Learning	*Strong* Metals, plastics, rubber, glass, electrical components *Weak* Apparel, petrochemicals

Source: Author's compilation, 2019.

The dynamics of international trade and investment have led to a more integrated world market. The belief in independence has been gradually replaced in most countries by a realisation that current economic patterns strongly favour interdependence among the nations of the world. An extension of this section is covered below, where we will explore the backward linkages associated with MNCs.

2.1.3 Defining Backward Linkages from MNCs

Based on the discussion above, we define backward linkages from MNCs as the purchasing of goods and inputs from locally owned suppliers by firms controlled by foreign companies. This definition will be used throughout the current research.

As production becomes globalised, companies are choosing procedures for each separate operation in a supply chain at the most advantageous location, whether in firms of their own affiliates or in firms owned by subcontractors or independent suppliers globally. Therefore, in order to become successful suppliers to MNCs operating within their national borders, local suppliers of the host country must now compete with suppliers abroad. As international competition intensifies, domestic firms must dare to seek out international exposures in order to win international opportunities (see, for example, Battat et al. 1996; Dimitratos et al. 2010; Yeung and Coe 2015).

2.1.4 The Theory on Backward Linkages from MNCs

The theory on backward linkages from MNCs is informed by the three following economic traditions: 1) trade economics, 2) industrial organisation, and 3) international business, all of which will be further outlined below.

2.1.4.1 Trade Economics

Initially, this theory emphasised the comparative advantage of nations and held the opinion that production factors were immobile. At a later stage, advances made to the theory allowed for the inclusion of capital movement into the model. In that way, capital could move from capital-rich countries to capital-poor countries. A major flaw of this early model was its view of MNCs as part of the theory of portfolio capital flows, considering the effects of FDI as being equal to those of other forms of capital.

Further advances were incorporated into the model, giving rise to the new trade economics. The refined model paved the way for economies-of-scale and product differentiation (Helpman 1984; Helpman and Krugman 1985; Markusen 1984). As such, this enabled an understanding of MNCs in equilibrium models. The new trade theory materialised into two frameworks: 1) vertical MNCs, where MNCs separate stages of production geographically and localize labour-intensive activities in developing and emerging markets in order to take advantage of a relatively abundant, inexpensive, and unskilled workforce; 2) horizontal MNCs, in which MNCs duplicate the same production or services in different locations (Markusen 1984). The new trade theory predicted that MNCs produce both crowding-in effects and crowding-out effects (Markusen and Venables 1999). As MNCs possess special advantages over the indigenous host-country rivals, such as advanced technology or lower costs due to economies of scale, they may initially cause the crowding-out of local firms. On the other hand, in the long term, MNCs may crowd-in due to high transportation costs, which force them to source locally, creating a catalyst effect on local companies in the intermediate goods industry. The catalyst effects result from the demand of MNCs for a wider variety of intermediate goods and a rise in the quantities supplied, which stimulates economies-of-scale. An emerging equilibrium, therefore, depends on the effect of both opposing effects.

Critiques of the new economic theory often argue that it remains in the body of neoclassical theory and that, although it may be effective in addressing problems of resource allocation and equilibrium due to its prize- and quantity-based adjustment mechanisms, it is inadequate in conceptualising the variations and complexity in MNCs' strategies and effects.

2.1.4.2 Industrial Organization

The aim of this theory is to study the consequences of the "entry into a national industry of a firm established in a foreign market" (Caves 1971:1). This theory perceives the market as full of imperfections of the structural type, such as proprietary technology, privileged access to inputs, economies-of-scale, control of distribution channels, and product differentiation. It posits that these imperfections can be used by a firm in order to increase monopoly power and to internationalise.

The theory is built on the idea that the characteristics of the industry fundamentally impact the strategy and performance of companies on the one hand and the effects that MNCs may have on host nations on the other hand. Moreover, industrial organisation theory concludes that industry characteristics may impact whether or not MNCs crowd-in or crowd-out local companies, transfer technology and knowledge from parent to affiliates, foster linkages to local suppliers, and suppress or foster competition in the host country (Nunnenkamp et al. 2003).

2.1.4.3 International Business

This theory is based on the microeconomic literature on MNCs. The international business literature in line with the industrial organisation "Structure-Conduct-Performance paradigms" claims that MNCs possesses special assets in comparison to local companies that allow them to overcome the barrier of foreignness (Hymer 1976). Arguably, these special assets are the firm-specific know-how, its knowledge-capital, and its technological assets.

This theory is built on the notion that internationalisation reinforces the MNCs' advantages by providing opportunities to disperse marketing risks through slicing up the value chain in territories' comparative advantages and by providing access to new assets and resources. Moreover, the MNC ownership advantage is often reinforced by their ability to access finance, internationally and in the host economy, compared to local companies, which are more often financially constrained.

Later advances to the international business theory focused more on the ability to organise cross-border transactions in the face of market imperfection (Buckley and Casson 1976), leverage resources across borders (Peteraf 1993) or coordinate knowledge diffusion and development across borders (Kogut and Zander 2003). All these understandings of MNCs were integrated by Dunning (1988, 2001) in what is now called the "eclectic" OLI framework, which has become dominant in the international business literature.

The international business theory was primarily focused on understanding the existence, conduct, and performance of firms involved in cross-border business transactions, and thus the efficiency or welfare of these transactions received less attention. Indeed, welfare issues largely remained the domain of trade economists and industrial economists, and to some degree political scientists, analysing the role played by MNCs in policy formulation at the national and international levels (see, for example, Moran 2004). The analysis of spillovers in international business was mainly restricted to the context of finding effective controlled strategies to avoid spillovers. In fact, to many International Business theorists, the main aim was to avoid knowledge and technology being spilled over to other firms.

However, as asserted by Forsgren (2002), the international business theory embodies some straightforward assumptions and predictions regarding MNCs and their effects on host countries. In fact, according to Hymer (1976), MNCs were extensions of market power in foreign locations.[10] Thus, by implication, MNCs would crowd out local firms and reduce consumer welfare by hindering competition. Furthermore, firms in host countries would face difficulties matching the bargaining power of MNCs, leading them to strike unfavourable deals. Several scholars challenged this critical perspective and posited that MNCs existed primarily to bridge market imperfections in cross-border markets for intermediate goods, such as transaction costs. Essentially, MNCs were expressions of efficiency and were, therefore, welfare enhancing (Rugman 1981). About two decades ago, resource-based perspectives Peteraf (1993) and knowledge-based views Kogut and Zander (2003) perceived MNCs as superior agents for cross-border knowledge and resource transfers, and thus as potentially benefiting host countries. It is true that the international business theory presents little about the degree to which MNCs produce spillovers for local firms. However, it can be inferred from the view of market power that if MNCs are about extending market power to foreign countries, local companies may be harmed. And if MNCs are about the effective transfer of advanced technology and knowledge to subsidiaries, they may have a greater potential for producing demonstration and competition effects. Additionally, as recognised in the modern international business theory, as MNC boundaries are becoming increasingly blurry (Cantwell and Narula 2001) and as they are increasingly locating the development and exploitation of their ownership-specific advantages in business networks and strategies (Ghoshal and Bartlett 1990), new opportunities for the acquisition of technology, knowledge, and market access for local

[10] Market power refers to the ability of firms, acting singly or in collusion, to dominate their respective market. This power can be acquired only under conditions of imperfect competition, according to Lall (1976).

companies in developing and emerging economies are being presented. **Table 2** summarises the discussed theories.

Table 2: Summary of Theory on Backward Linkages from MNCs

Theory	Major Advances	Strength	Weakness	Comment
Trade Economics	New trade theory (*vertical and horizontal MNCs*)	Adequately addresses problem of resource allocation and equilibrium	Inadequate in conceptualising the variations in MNCs' strategies and effects	There is a need to distinguish between horizontal and vertical MNCs
Industrial Organization		Favourable industrial characteristics may lead to a positive impact of MNCs	Unfavourable industrial characteristics may lead to a negative impact of MNCs	Some market imperfections may have a very severe impact on MNCs.
International Business	OLI framework Resource-based view Knowledge-based view	MNCs with effective transfer of advanced technology and knowledge to subsidiaries can potentially produce demonstration and competition effects	MNCs extending market powers to host countries may harm local firms	Market power may be limited by host country policy on MNCs

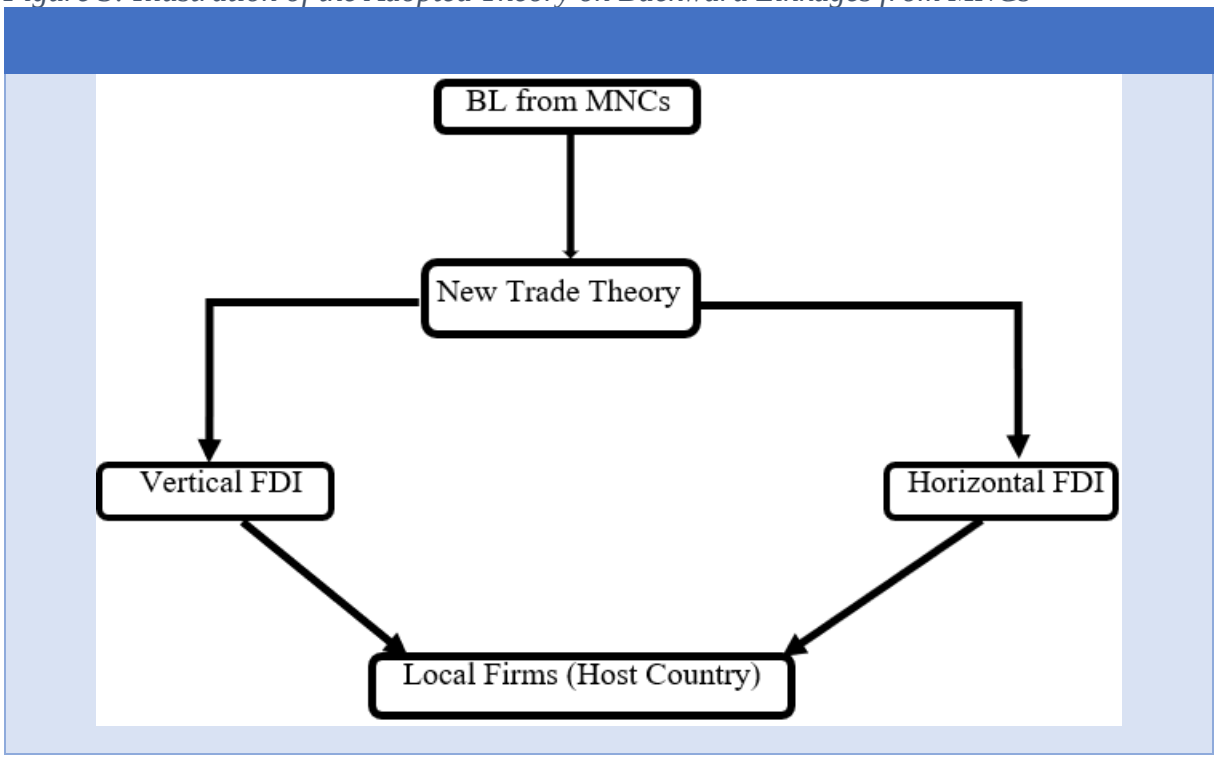
Source: Author's compilation, 2019.

Overall, the theory of industrial organisation, as well as that of international business, converge to a considerable extent. Both market imperfection and market power embody a straightforward meaning, wherein MNCs have a potential to exercise monopolistic behaviours in the host country. However, there can exist fears at the headquarters of a MNC that a lack of direct monitoring in a host country increases the likelihood of technology leaking to competitors.[11] Furthermore, MNCs can exploit monopolistic advantages abroad only if the host country's policy allows them to do so.[12] Regarding domestic firms, it is common knowledge that they have an advantageous position in terms of local culture, language, legal systems, and consumer preference. Thus, industrial organisation and international business theory are too broad and inadequate for a comprehensive understanding of the complex variation and impact of MNCs in the host economy.

[11] This type of fear was witnessed amongst the business class in India during the 1950s and early 1960s; see Kidron (2001).
[12] Issues of foreign exchange risks and investor protection in the host country also arise. For example, Antras et al. (2009) established that weak investor protection limits the scale of MNCs' activities.

The proponents of the new trade theory develop two frameworks, namely vertical and horizontal MNCs, that explain how MNCs enter a foreign country. Numerous scholars have analysed these frameworks. For example, in their study, Aizenman and Marion (2004) demonstrated that imperfect competition encourages MNCs to differentiate products and engage in horizontal FDI. Moreover, the new trade economic model was empirically tested, and there was strong support for the horizontal FDI models (see, for example, Brainard 1993a, 1993b; Eaton and Tamura 1994; Ekholm 1998; Faeth 2009). All these findings put forward a strong case for horizontal MNCs, raising the question of whether the current study should focus on horizontal FDI. The answer is straightforward and stems from our earlier definition of backward linkages from MNCs. Indeed, our adopted definition of backward linkages leads to the formulation of a measurement inform of a question: *Does this firm supply inputs/goods to locally based MNCs?* As discussed elsewhere in this research, this question will be asked in a survey administered to selected firms. While the selected local firms my either answer *Yes* or *No* to this question, asking them to further state whether their MNC customers are motivated by horizontal or vertical investment may be not only laborious but also difficult for them to answer. Hence, horizontal and vertical MNCs are not distinguished in this study, thereby paving the way for future research that analyses the two separately. Based on this view, we adopt a new trade theory to analyse the effects of MNCs on their host country. We argue that MNCs source inputs/goods from firms in the host country, and this sourcing has a positive impact on the latter firms and the wider economy. For an illustration of the adopted theory on backward linkages from MNCs, see **Figure 3** below.

Figure 3: Illustration of the Adopted Theory on Backward Linkages from MNCs



Source: Author's compilation, 2019.

Since the current study is based on a firm level analysis, an important question concerns the characteristics of the local firms that make them potential suppliers to MNCs. This question will be addressed in the following section.

2.1.5 Research on Backward Linkages from MNCs

While countries can formulate policies promoting the formation of backward linkages between local firms and MNCs, the latter too have a role to play by exploiting their internal strengths and competitiveness.

It is common knowledge that most MNCs now prefer to rely on nearby suppliers in the countries in which they operate if they are assured of the price, technology, and quality control they need. But, in what ways and with what strategies can local firms, particularly in developing/emerging markets, adapt in order to guarantee favourable prices, quality, and supply certainty to their MNCs? To sufficiently address this question, we must think of local firms achieving economies of scale. From a perfect competition perspective, economies of scale refers to the feature of production processes whereby the per-unit cost of producing a product falls as the scale of production rises.[13] This implies that firms adopt different strategies in order to achieve economies of scale. For example, with a strategy to access new inputs and potentially more

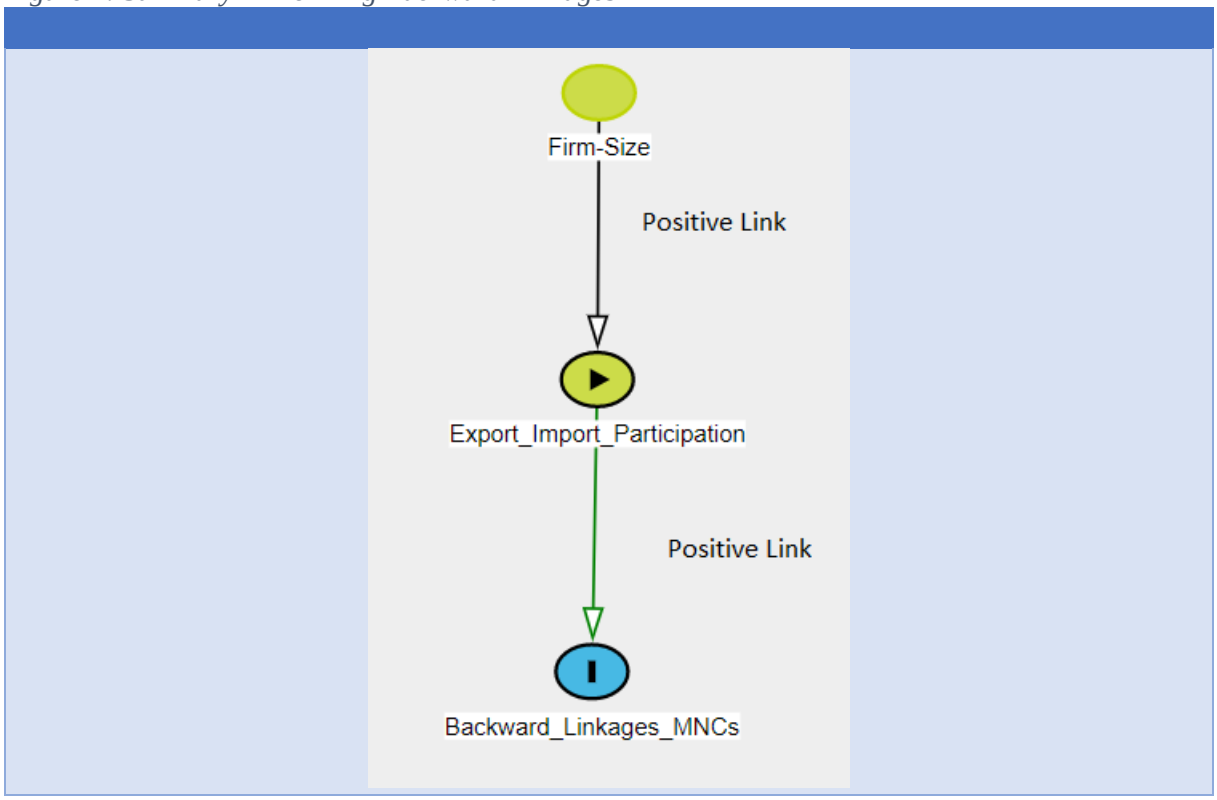
[13] In perfectly competitive markets, firms do not compete with other firms on an individual basis.

profitable markets abroad, firms in developing countries can increase specialization and trade as well as internal productive efficiency. In fact, firm size plays a key role in determining foreign trade interactions, and subsequently, the internal economies of scale. Indeed, Pope (2002) has established that firms, both small and large, export because they want to achieve economies of scale and are afraid of missing out on foreign opportunities. As such, it is logical to conclude that since firms, particularly from developing countries, are now more exposed to international trade competition, they must be more sensitive to technical changes, product standardisation, and managerial improvements.

Overall, for local firms to form backward linkages with MNCs, there is a strong need for them to adopt strategies that can ensure that they can meet the demands of the MNCs both locally and abroad. The size of local firms and foreign trade interactions appear to be important characteristics in fostering the formation of backward linkages with MNCs.

Empirical studies show that MNCs form backward linkages with local firms in the host country; for example, see Aizenman and Marion (2004) and Faeth (2009). Moreover, Wagner (1995) and Majocchi et al. (2005) have established a positive relationship between firm size and export propensity. Furthermore, Loan-Clarke et al. (1999), Kotey and Slade (2005), Kotey and Folker (2007), and Cardon and Valentin (2017) have demonstrated a statistically significant positive relationship between firm size and skilled workforce. Thus, these past studies suggest that larger firms have the capital, skillset, and capacity to supplying products to foreign markets. Increased demand, both locally and abroad, potentially drives these firms into achieving economies of scale. Further, participation and experience in foreign trade allows these firms to have an advantage in forming backward linkages with locally based MNCs. Indeed, numerous studies have established a positive relationship between the participation of local firms in foreign trade and the formation of backward linkages with locally based MNCs (see, for example, Battat et al. 1996; Dimitratos et al. 2010; Yeung and Coe 2015). Therefore, by exporting, firms not only achieve economies of scale (and therefore favourable prices and supply certainty) but also gain international experience, thus becoming potential suppliers to locally based MNCs. For a summary of this discussion, see **Figure 4.**

Figure 4: Summary — Forming Backward Linkages



Source: Author's compilation, 2019. Note at this stage the arrow (→) reflects an association between variables

2.2 Firm's Production Capabilities (PC): The Capability Theory of the Firm

When examining the capability theory of the firm, the current research reflects on two theories, namely the Coasian theory of the firm (Coase 1937) and the Penrosian theory of the firm (Penrose 1959).

The Coasian theory posits that while the production costs determine technical substitution choices, the transaction costs determine which stages of the productive process are assigned to the institution of the price system and which are assigned to the institution of the firm. As such, "the firm emerges as the more convenient way of realising the production process, which is the lowest cost option for obtaining control over the relevant cluster of capabilities needed" (Andreoni 2011:9). On the other hand, Penrose (1959) theorises that creating a firm may not just be a way of reducing transaction costs, but rather could denote the highest value option for the creation and development of capabilities.[14]

[14] Penrose defines the firm as 'a pool of resources the utilisation of which is organised in an administrative framework' Penrose (1959:149) and constitutes the basis of the capability theory of the firm.

A firm refers to a collection of physical and human resources that can be deployed in numerous ways in order to provide a variety of productive services. In fact, the services generated by resources are a function of the ways in which they are used—exactly the same resource when utilised for different purposes or in different ways and in combination with different types or amounts of other resources provide a different service or set of services (Penrose 1959). Indeed, the growth process in the Penrosian framework is achieved when firms recognise and exploit productive opportunities, especially all production capabilities that entrepreneurs see and take advantage of (Penrose 1959). As demonstrated by Best (1999), productive opportunities connect the firm to the customer in an interactive relationship in which new product concepts are developed. As such, the advances in productive services can extend the productive opportunity of a firm by enlarging the employees' capacity to recognise and respond to new product concept possibilities in the surrounding context.

2.2.1 Definition of Production Capability

The term capability was first introduced in economics by Richardson (1972) by further developing and building on the Penrosian theory of the firm. By maintaining the analytical distinction between productive resources and productive services, Richardson describes industries and their firms as entities whereby many activities are undertaken through the adoption of an appropriate cluster of productive capabilities.

> 'It is convenient to think of industry as carrying out an indefinitely large number of activities, activities related to the discovery and estimation of future wants, to research, development, and design, to the execution and coordination of processes of physical transformation, the marketing of goods, and so on. And we have to recognize that these activities have to be carried out by organizations with appropriate *capabilities*, or, in other words, with appropriate knowledge, experience, and skills.' (1972:888)

Therefore, Richardson's definition emphasises how the concept of capability refers to a form of *know-how*, namely "appropriate knowledge, experience and skills" that cannot be reduced to *know-that* (Andreoni 2011). This is because productive capability imply the *capacity to apply the know-that* required to achieve a given goal (Loasby 2002; Andreoni 2011). Moreover, by synthesising a vast body of literature and empirical research (Dahlman et al. 1987; Lall 1992; Bell and Pavitt 1997; Romijn 1998; Iammarino et al. 2008; Andreoni 2011), the definition of production capability incorporates personal and collective skills, productive knowledge, and experiences ingrained in the physical agents and organisations required for firms to execute different production activities as well as to undertake internal improvements across different

technological and organisational functions.[15] While the "*static efficiency*" viewpoint of this definition encompass all the skills and knowledge required to perform and execute a set of interdependent production tasks given the time and scale constraints, the "*dynamic efficiency*" perspective involves the absorptive capabilities and innovativeness associated with a firm.[16] Here, absorptive capabilities refers to the ability of a firm to, through their skilled employees, identify, value, assimilate and apply knowledge that is developed in other more technologically advanced firms. Considering both perspectives together, the current study defines production capability as the process by which firms shift from the production of low-value-added goods to high-value-added ones.[17]

2.2.2 Operationalising Production Capabilities

Due to its multidimensional nature, the concept of production capability cannot readily be observed. However, there are methods of measuring product complexity and diversification using survey questions. For example, Falk (2015) used a comprehensive measure of firm-level technological innovations, which aligns very well with our definition of production capability accumulation. The key variables in Falk's study include (1) the introduction of new goods or services or significantly improved versions of those already available from competitors in the market ("new products"); (2) the introduction of new or significantly improved goods or services into the market before competitors ("new market products"); and (3) the implementation of a new or significantly improved production process, distribution method or support activity for goods or services ("process innovations"). Process innovation, meanwhile, comprises three subgroups: (3a) new or significantly improved methods of manufacturing or producing goods or services; (3b) new or significantly improved logistics, delivery or distribution methods; and (3c) new or significantly improved support activities for processes, such as maintenance systems or operations for purchasing, accounting or computing (2015:429).[18]

Overall, the section above has established two main theories of the firm; namely, the Coasian and the Penrosian theories. The Penrosian theory forms the original foundation for the capability theory of the firm. **Table 3** below summarises the adopted definition of production capabilities as well as how the concept is operationalised.

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[15] In this definition, a firm refers to a pool of resources, the utilisation of which is organised in an administrative framework.
[16] While "static efficiency" is concerned with the most efficient combination of existing resources at a given point in time, "dynamic efficiency" is concerned with the productive efficiency of a firm over a period of time.
[17] This definition is also inspired by work of Hausmann et al. (2016).
[18] A similar operationalisation of firm-level production capability can be found in Andreoni (2011) and Le Bas et al. (2011).

Table 3: Summary — Definition and Operationalisation of Production Capabilities

Production Capabilities – Firm Level	
Definition	Operationalisation
Process by which firms shift from the production of low-value-added goods to high-value-added ones	Introduction of new products/services
	Introduction of new market products
	Introduction of process innovations

Source: Author's compilation, 2019.

2.2.3 Accumulation of Production Capabilities

Production capability clearly emerges and accumulates via a continuous process of trial and error, interpretations and falsifications based on an experimental and pragmatic approach to the solutions of technological and organisational problems in production, , that is, *learning processes* (see, for example, Arrow 1962; Rosenberg 1976; Rosenberg 1982, 1994; Andreoni 2010).

The learning processes in which capabilities emerge are cumulative, in that "the acquisition of certain kinds of know-how facilitates the acquisition of further knowledge of the same kind, and impedes the acquisition of knowledge of incompatible kinds" (Loasby 2002:58).[19]

The ways through which production capabilities are accumulated have two major implications. First, firms specialise in the execution of a certain set of interrelated production activities that require the availability of a limited set of capabilities (Andreoni 2011; Hausmann et al. 2014; Hausmann et al. 2016; Hausmann 2016). Secondly, firms need to know not only how to perform certain production activities, but also how to get others to perform these activities for them (Andreoni 2011). As such, firms can indirectly acquire capabilities in two primary ways: either by gaining *control* of other capabilities, for example through the institution of the firm or through inter-firm cooperation, or by obtaining *access* to them, for example through the institution of the market.[20] Therefore, capabilities dynamics are active at the very basis of the organisation of industry (Richardson 1972).

[19] See also Hausmann (2016) for a similar argument.

[20] Market-supporting institutions ensure that property rights are respected, people can be trusted to live up to their promises, externalities are held in check, competition is fostered, and information flows smoothly (McMillan 2007).

2.2.4 Empirical Evidence of Production Capability Accumulation

Let us begin with the "*dynamic efficiency*" perspective of our definition of production capability. This perspective relates to the absorptive capabilities and innovativeness associated with a firm.[21] What is emerging here is that, at the level of the firm, there appears to be a fundamental connection between the skilled workforce and absorptive capabilities of a firm and the learning process by which production capabilities are accumulated. Indeed, there exist empirical studies supporting a strong *causal-inter-relation* between a skilled workforce and production capability accumulation. For example, Toner (2011) and Maré et al. (2014) have identified a causal interconnection between a skilled workforce and production capability accumulation. Meanwhile, a different stream of literature argues that the absorptive capability of a firm has a causal relation to a firm's accumulation of production capability (Kostopoulos et al. 2011). There exists an apparent consensus that a skilled workforce within an organisation is required to create and diffuse the knowledge needed for a successful shift from the production of low-value-added goods to high-value-added ones (see, for example, Jones and Grimshaw 2012).

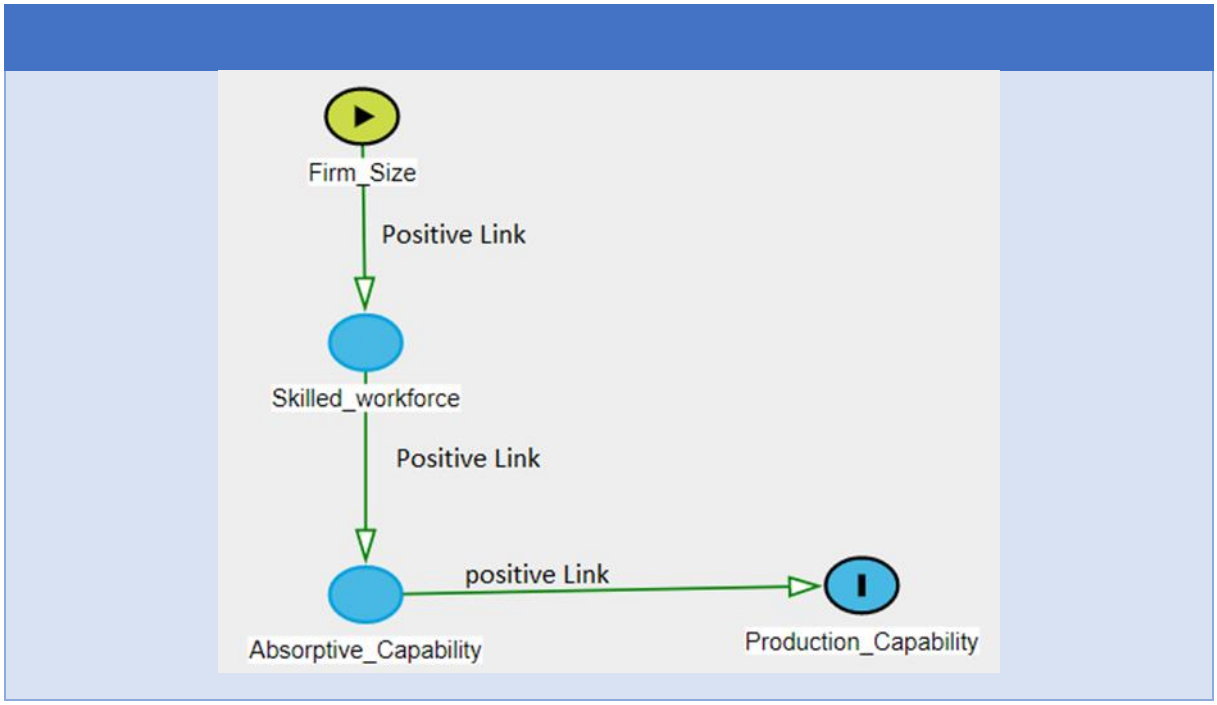
A skilled workforce can play a crucial role in the transfer of knowledge between firms, for example, through collaboration in R&D and technical problem-solving by firms involved in supply chains (Lundvall 2016) or in facilitating the acquisition of client-specific knowledge in complex models of outsourcing (Miozzo and Grimshaw 2011).

Studies also reveal that there exists a variation in the level of the skilled workforce and the absorptive capability in firms. Although this variation can be explained by various factors, there is a consensus in the literature that firm size matters. Indeed, as established by Gorodnichenko et al. (2009) and Falk (2015), there is a positive link between *firm size* and *production capability accumulation*. Thus, if a skilled workforce leads to an increase in firms' absorptive capability, and subsequently to *production capability accumulation*, then one can argue that firm size matters. Studies have shown that larger firms have more revenue and can invest in R&D and training for the skills development of their employees. In fact, Loan-Clarke et al. (1999), Kotey and Slade (2005), Kotey and Folker (2007) and Cardon and Valentin (2017) established a statistically significant positive relationship between firm size and a skilled workforce. A synthesis of this information demonstrates that the link between firm size and production capability accumulation is mediated by a skilled workforce and absorptive capability, and in that order. Although larger firms are more likely to have more knowledge-based resources than

[21] Note that absorptive capability is defined here as the ability of a firm to, through their skilled employees, identify, value, assimilate and apply knowledge that is developed in other more technologically advanced firms.

smaller firms, they may be limited in the flexibility often required for acquisition and assimilation (Daspit and D'Souza 2013). For a visual representation, see **Figure 5** below.

Figure 5: Firm Size, Skilled Workforce, Absorptive Capability, and Production Capability Accumulation



Source: Author's compilation, 2019. Note at this stage the arrow (→) reflects an association between variables.

Moreover, there is plenty of research based on case studies that demonstrate how firms can accumulate production capabilities. For example, a group of countries across East and Southeast Asia attained great success in their processes of industrial and technological progress based on the development of local suppliers of the manufacture industry. Based on the processes of learning and the accumulation of capabilities, these local suppliers advanced rapidly from simple assembly activities in the 1960s and 1970s, toward product design in the late 1980s, and finally to introducing their own brands to international markets and carrying out R&D activities for new products in the 1990s (for examples, see Hobday 1995; Kim 1997; Brahmbhatt and Hu 2007).

On one side, the Mexican model was different from that of East and Southeast Asia, in the sense that transnational firms established their own assembly plants along the northern border, which where denominated as *maquilas*.[22] A study by Dutrénit and Vera-Cruz (2005), which applied the taxonomy of technological capabilities proposed by Bell et al. (1995), established that there was a change in the nature of several *maquilas* operating in Mexico during the 1990s. Resulting

[22] *Maquila* refers to a company that allows factories to be mainly duty-free and tariff-free. These factories take raw materials and assemble, manufacture or process them, and then export the finished product.

from internal learning, their productive and technological activities improved toward more complex products and more innovative technological activities. In contrast, other dimensions evolved slowly, such as the engagement of Mexican suppliers in global supply chains.

In sum, empirical studies on the accumulation of production capabilities converge on the idea that as firms learn, they spread in technical activities with a high degree of innovativeness and develop innovative technological capabilities. Moreover, it is these learning processes, augmented by a skilled workforce and the absorptive capabilities within the firms, that lead that to the accumulation of production capability. Regarding production capability accumulation in developing and emerging economies, knowledge flows from advanced countries remain the primary source of new ideas (see, for example, Brahmbhatt and Hu 2007).

2.3 Linking Backward Linkages from MNCs and Production Capability Accumulation

One of the main issues central to the argument of classical development economist Hirschman was the concept of linkages. In fact, he argued that linkages lead to economic development (Hirschman 1958). Contemporary researchers have attempted to combine the concept of linkages with the capability's theory of the firm. The integration among these traditions in economic analysis appears promising, given their respective focus on intra- and inter-firm learning as processes that drive a firm's accumulation of production capabilities (UNCTAD 2001; Hu and Jefferson 2002; Görg and Greenaway 2004; Javorcik et al. 2017; Amendolagine et al. 2019a). As such, by sharing product information and production-related technological know-how, MNCs may lower the costs of innovation and product upgrading on the part of the suppliers in the host country. Thus, the presence of MNCs could encourage local firms to introduce more sophisticated goods in the host country (Javorcik et al. 2015). Moreover, learning may take place when domestic firms improve their efficiency by copying the technologies of MNCs through observation, for example. Learning can also occur when domestic firms are forced to use their resources more efficiently or search for new technologies to meet the quality and quantity demands of their MNC customers.

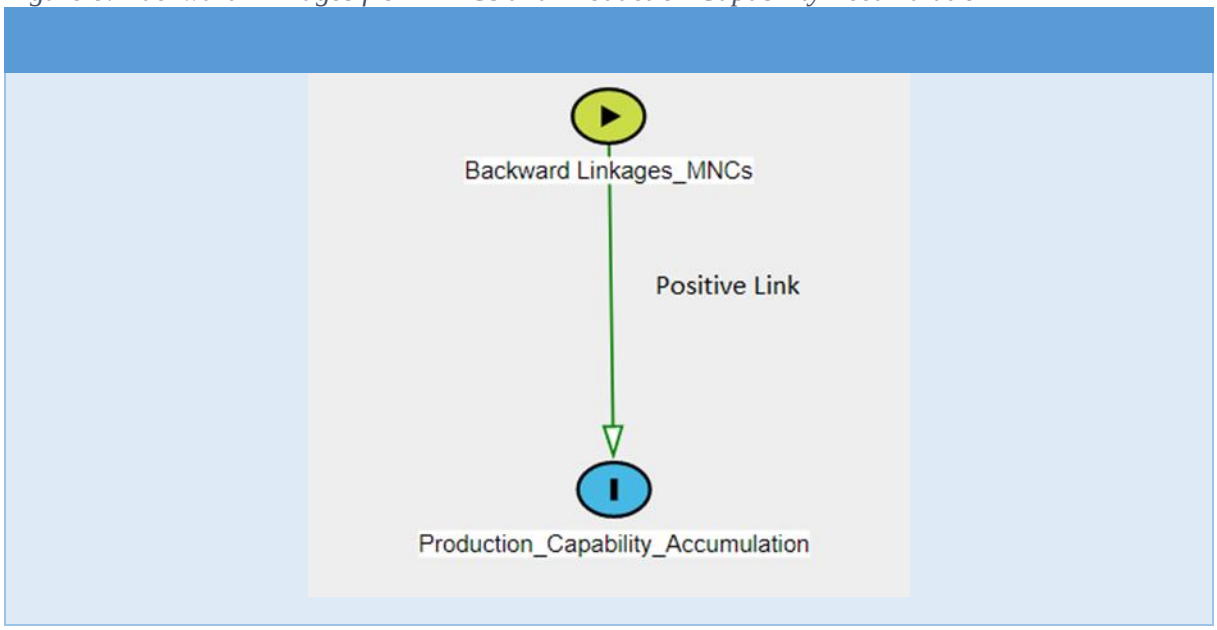
Beginning with the premise that linkages from MNCs provide countries with additional sources of capabilities that would otherwise not be available to them, researchers have analysed and found evidence of domestic firms "learning through-backward linkages from MNCs" (Harding and Javorcik 2011; Swenson and Chen 2014; Javorcik et al. 2015). Indeed, in an empirical model allowing for positive feedback between the complexity of newly introduced products by domestic firms and the presence of foreign firms, Javorcik et al. (2015) established that the presence of MNCs in downstream sectors, i.e. backward linkages, leads to a significant increase

in the complexity of new products at the firm level. Furthermore, when indigenous firms supply inputs/goods to locally based MNCs (backward linkages from MNCs), their likelihood of accumulating production capability increases (Girma et al. 2008, 2009; Brambilla et al. 2009; Gorodnichenko et al. 2009; Vahter 2011; Falk 2015).

But what are the firm characteristics that determine the learning processes of host firms? Literature on backward linkages from MNCs and production capability accumulation reveals that learning from MNCs is conditioned on the host firm's initial stock of knowledge, both in absolute terms and in reference to the production knowledge stock of the partner firm. This means that the innovative capabilities of a firm is largely a function of its level of prior related knowledge (Cohen and Levinthal 1990), and therefore hosting a firm's greater "absorptive capability" implies the ability to acquire new knowledge from MNCs more readily. Furthermore, to the extent that technological absorptive capacity is partner-specific, learning is also fostered when there is a substantial specialisation of the firms involved in the exchange (Hausmann and Hidalgo 2011). Additionally, through such specialisation, economies of scale and scope may arise as suppliers will serve multiple MNCs and become highly effective at their particular task; for an example, see Domberger (1998). Other studies show that in order to create effective backward linkages with MNCs, the learning processes of host firms should concentrate on research, design and innovation skills (Giroud and Scott-Kennel 2009; Giroud et al. 2012; Amendolagine et al. 2017).

Overall, the reviewed literature demonstrates that the integration of the concepts of "linkages" and the "capability theory of the firm" connects backward linkages from MNCs with production capability accumulation. The capability accumulation is necessitated by a learning process, which is in turn determined by the absorption capability of the host firm. Furthermore, host firms that are exposed by their MNC customers to joint design and research are more likely to accumulate higher production capabilities than firms that are not exposed to such activities. A visual representation of the link between backward linkages from MNCs and production capability is shown in **Figure 6**.

Figure 6: Backward Linkages from MNCs and Production Capability Accumulation



Source: Author's compilation, 2019. Note at this stage the arrow (→) reflects an association between variables.

2.3.1 Correlation of Variables and Causal Logic

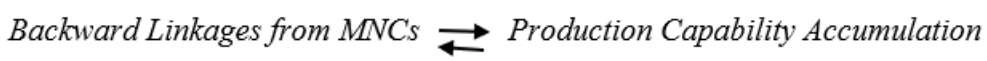
Correlation occurs when two variables vary together for a very long time, or when a researcher has a collection of variables which vary cohesively. Usually when people think about correlations, they really think causally. Why so? Things cannot be correlated unless there is a reason for them to vary together. As such, in most cases, hidden into human intuitions there is a notion of causation, because people cannot grasp any other logic except causation.

With observational studies, researchers must infer causal relationships from the correlations detected. The task of discovering causes was in the mind of ancient people (Pearl et al. 2018), but the mathematics of causal analysis was only developed in the 1920s (see Wright, 1920). Before 1920s, science had not provided humanity with the mathematics of X causes Y, and Y does not cause X. This is because all the equations of physics are symmetrical and algebraic, in that the equality sign goes both ways.

The value of, for example, production capability accumulation is dictated by what currently the researcher sees as the value of backward linkages from MNCs and is not the other way around. That is the rationale/ reasons for graphical models. It is an algebra for asymmetry contained in the idea of value (variable) assignment. This is different from the assignment as one would find in the potential outcome school of thought, where the assignment means controlled randomised experiment (see Angrist et al. 1996).

How researchers know, for example, backward linkages from MNCs causes production capability accumulation is a different question, how it is specified is what the current study is

dealing with. If it is not clear to a researcher as to whether backward linkages from MNCs causes production capability accumulation, or production capability accumulation causes backward linkages from MNCs, then both these positions can be expressed in terms of two hypotheses. That means there is an arrow going from backward linkages from MNCs to production capability accumulation and from production capability accumulation to backward linkages from MNCs. As such, one ends up with a double arrow hence cyclic graph, and that is how a researcher can express lack of knowledge/ignorance, that is, by stating that everything is connected to everything else. However, if a researcher has some knowledge, which allows he or she omit some arrows, then analysis is possible through observational data. It is worth noting that, the only way a researcher can separate the issue of reverse causality (two hypotheses) is by experiment, and the graph where he or she specifies the ignorance, like:



the graph will guide a researcher on which experiment he or she should undertake to disentangle it and to decide on the direction of causality. For example, a researcher may decide to select firms that have similar characteristics such as, but not limited to, internal organization and level of skill sets. Once selected, the researcher then could assign these firms into two groups: one group as a control group, and the other group linked to MNCs. The researcher would then observe the way production capability in both groups develops over time.

Therefore, researchers of causality must separate the specification from the inference. This separation is exactly what the current study has done. For more details on causal identification, see **Chapter 5**.

In summary, the covered literature has revealed two major, interrelated findings:

1. There exists a positive link between:
    a. Firm size and a firm's foreign trade interaction
    b. Firm size and production capability accumulation
    c. Backward linkages from MNCs and production capability accumulation

Here, the implied causal relationship amongst the variables takes the following form:[23]

[23] At this point, we would like to make a strong but testable assumption that the statistically significant relationships identified in the literature were causal. Note: a path in a graph represents a sequence of links in the way that each link starts with a node (variable) ending the preceding link.

Causal Path* 1**: ***Firm Size → Foreign Trade Interaction → Backward Linkages from MNCs → Production Capability

2. A positive link exists between:
    a. Firm size and skilled workforce
    b. A skilled workforce and absorptive capability
    c. A skilled workforce and production capability accumulation

Jointly, the implied relationship between these variables is argued in this research to take the following causal form:

Causal Path* 2**: ***Firm Size → Skilled Work Force → Absorptive Capability → Production Capability.

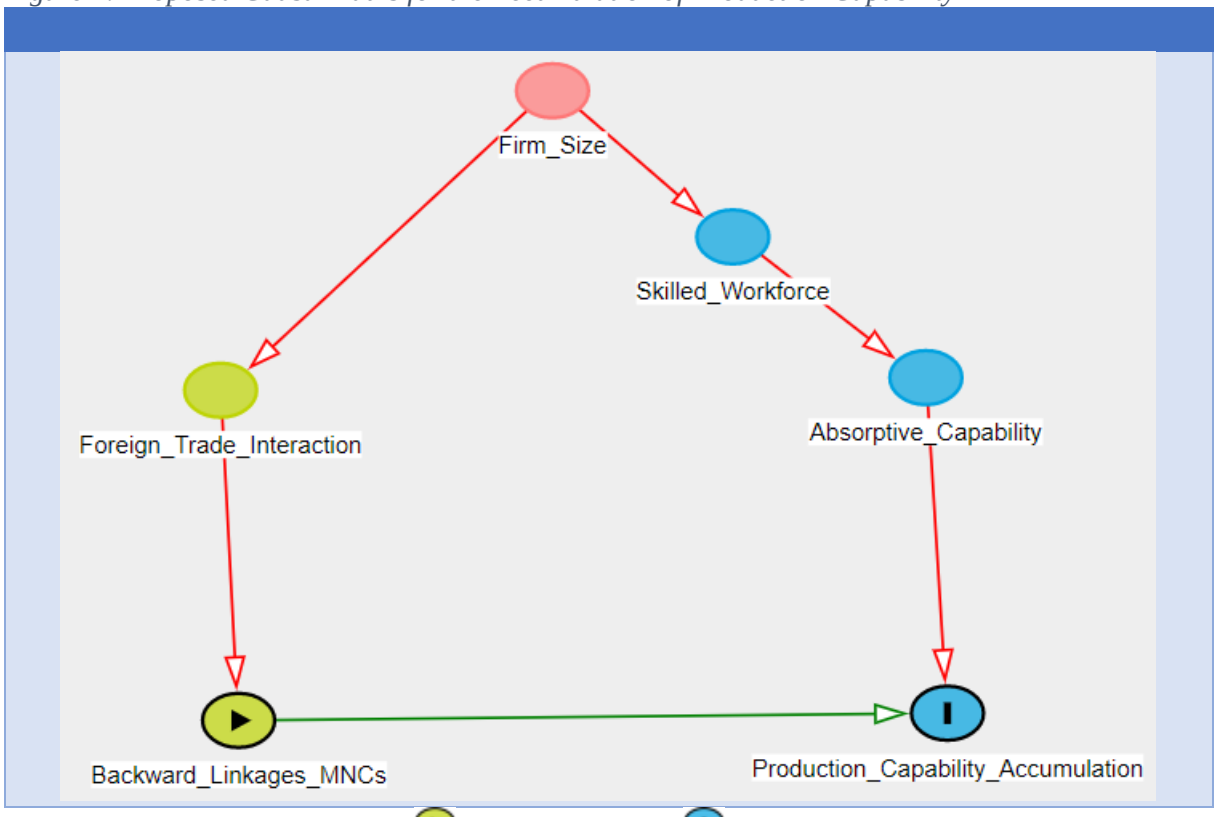
Moreover, there is no consensus in the literature covered above on whether a skilled workforce has a predictive or causal link to absorptive capability. This lack of clarity raises a *structure learning problem.* In order to address this problem, we propose a second causal path by excluding a skilled workforce from *Causal Path 2* and achieve:

Causal Path* 3**: ***Firm Size → Absorptive Capability → Production Capability.

Causal Path 3 means that absorptive capability transmits the effects of firm size to production capability accumulation. In other words, absorptive capability is a mediating variable.

Upon analysis of the two paths using data, we expect that if a skilled workforce is not causally related to absorptive capability, then the probability of production capability accumulation remains unchanged. In the affirmative, *Causal Path 3* would be closest to the true causal path between firm size and production capability accumulation. See **Figure 7** below for the illustration of the proposed causal paths.

Figure 7: Proposed Causal Paths for the Accumulation of Production Capability



Source: Author's compilation, 2019. *Exposure Variable,* *Outcome Variable. The green and red lines denote causal path and biasing paths, respectively.*

2.3.2 Hypotheses in Context

The existing literature has informed the current study to propose the hypotheses outlined below:

1. **Backward Linkages from MNCs and Production Capability Accumulation**

H1: There exists a significantly positive dependence between backward linkages from MNCs and the accumulation of production capability within host firms.

Absorptive Capability and Production Capability Accumulation

H2: There is a significantly positive dependence between absorptive capability and the accumulation of production capability within firms.

2. **Firm Size, Foreign Trade Interactions and a Skilled Workforce**

H3: There is a significantly positive dependence between firm size and foreign trade interactions.

H4: A skilled workforce is significantly and positively dependent on firm size.

3. Foreign Trade Interaction and Backward Linkages from MNCs

H5: There exists a significantly positive dependence between a firm's foreign trade interactions and the formation of backward linkages from MNCs.

Skilled Workforce and Absorptive Capability

H6: Absorptive capability is significantly and positively dependent on the skilled workforce within firms.

Concluding Remarks

In this chapter, we have connected backward linkages from MNCs to production capabilities accumulation. This connection occurs through the interaction of the new trade economics theory and the capability theory of the firm. Indeed, we have established that MNCs that set up in host countries have a strong incentive to outsource intermediate products to local suppliers. Subsequently, through backward linkages with MNCs, local suppliers, through a learning process, can potentially shift up the value chain from low value-added goods to higher value-added ones. Based on the review of the existing literature and empirical studies on FDI and spillovers, the causal relationship between backward linkages from MNCs and production capabilities accumulation is less well understood. To address this knowledge gap, the relationships between all the variables mentioned in the empirical studies are identified and a testable causal model on the effect of backward linkages from MNCs on the production capabilities accumulation of supplier firms in the host country is proposed.

The following section explores the role that backward linkages from MNCs have on Kenya and Malaysia's E&E and P&C subsectors.

Chapter 3: Kenya and Malaysia Compared

3.1 Case Selection

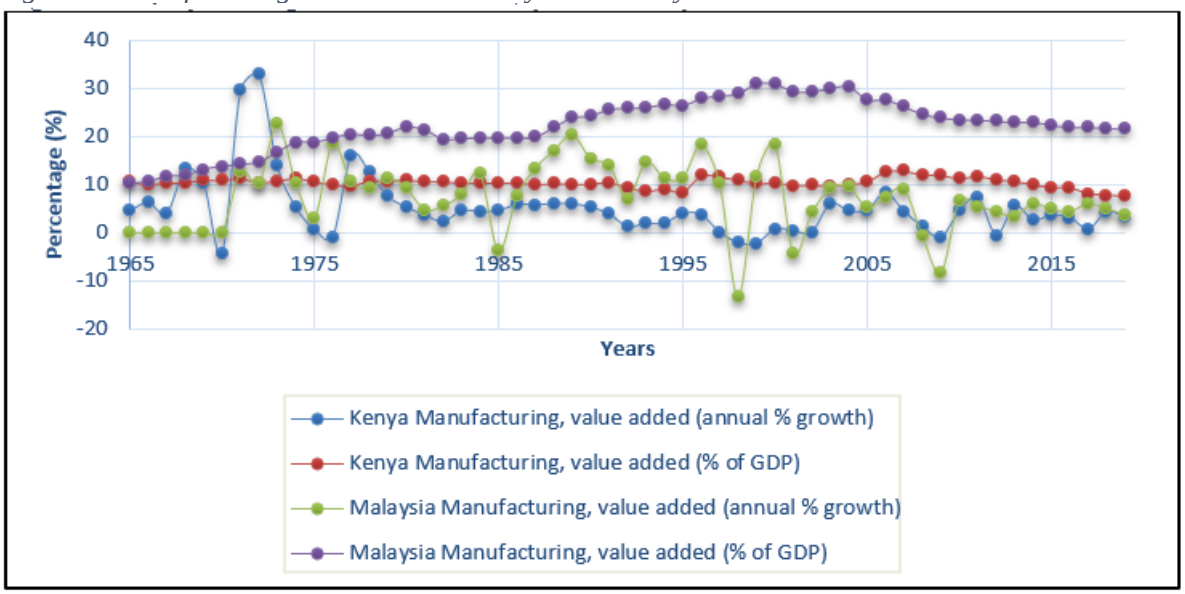
Case studies are analysis of persons, groups, countries, policies, institutions or other systems that are studied holistically by one or more methods. In this research, cases refer to countries.

The selection of appropriate cases is a crucial element in comparative case study research. The validity of the causality made by the current research, or how compelling the claim is that backward linkages from MNCs, rather than another variable, caused the accumulation of production capability, is largely based on the properties of the cases selected.

What are the appropriate case selection criteria for comparative case study? First, as in all types of research involving few cases, cases should not be selected randomly ((Blatter and Haverland 2012). Selecting a few cases in a random manner may result in the cases not varying in the independent variable of interest. To that extend, the current researcher, a Kenyan citizen, deliberately selected Kenya as one of the countries of study. This decision was informed by several factors, among them to fill the gap concerning backward linkages research in Kenya. The case selection for the second country of study was formulated as follows: first, a country, that in comparison with Kenya, varies as much as possible regarding backward linkages from MNCs, the key causal variable in the current study. Second, the selected cases must be similar as possible regarding two main factors: 1) the economic structures and, 2) reliance on FDI for the development. The case comparison procedure has limited the scope of this research project to two countries. This includes Malaysia, in which Foreign Direct Investment (FDI) has been strong and positive, and Kenya, where arguably, the impact of FDI on economic complexity have underperformed. These two countries have been compared in previous FDI studies in Kenya.

Both Kenya and Malaysia have relied on FDI in their industrial development. **Figure 8** shows that in 1965 the manufacturing sector in both countries accounted for less than 10 per cent of GDP. **Table 4** indicates that manufacturing was at that time heavily dominated by firms operating in the light industries.

Figure 8: Manufacturing value added in Kenya and Malaysia



Source: World Bank, World Development Indicators Database (2019)

In both Kenya and Malaysia, the production of manufactured goods within the early period of the 1960s was concentrated in sectors engaged in food products, beverage, tobacco, textile and apparel, which accounted for about 60 per cent of manufactured output in Kenya and more than 30 per cent in Malaysia. Additionally, the basic chemical and petroleum sectors contributed over 14 per cent of manufactured output in Kenya, while rubber and fabricated metal products accounted for 44 per cent of manufactured output in Malaysia. These industries existed under the import substitution industrialization strategy (ISI), which promoted the domestic production of previously imported goods. Given the limited nature of domestic firms in driving industrial development in both Kenya and Malaysia, the governments relied much on FDI in addition to government-established entities as the initial drivers of the industrial process (Kinuthia 2013; 2016).

The growth of the manufacturing sector in both countries started in the 1960s (see **Figure 8**). However, there was a significant change in the composition of manufacturing in GDP in Malaysia after 1967, when the government began the implementation of the export-oriented industrialization strategy (EOI), after it became apparent that ISI was ineffective as a growth strategy. By the early 1970s, Malaysia's efforts to encourage export-oriented industries were a top priority and free trade zones and licensed manufacturing warehouses were established, with a focus on labour-intensive foreign-owned firms (Kinuthia 2016).

Table 4: The structure of the manufacturing sector in Kenya and Malaysia (% of output)

	Kenya				Malaysia				
Sectors	**1963**	**1977**	**1994**	**2008**	**1968**	**1973**	**1985**	**1990**	**2011**
Food, beverage and Tobacco	45	44	46	33	27	22	30	19	7
Textiles and apparel	5	8	3	3	3	9	4	6	1
Leather and footwear	2	1	1	2	0	0	0	0	0
Wood & Wood products	2	4	2	1	7	11	5	6	3
Paper and printing	8	8	3	8	0	0	0	0	3
Chemicals, petroleum & plastic products	14	4	26	20	6	5	10	7	35
Rubber products	1	5	3	2	18	15	6	6	4
Non-metallic and glass products	4	6	4	8	3	3	4	3	2
Basic and fabricated metals &products	7	10	4	3	26	23	9	7	8
General Machinery	2	4	4	1	2	3	2	5	4
Electric/Electronics/precision equipment	0	0	0	0	2	5	13	25	28
Transport Equipment	7	5	4	3	2	3	3	5	5
Other manufactured goods	2	1	0	16	5	3	15	13	0

Source: Kinuthia (2016, table 1); Malaysia: Rasiah and Shari (2001, Table 5), Kinuthia (2016, table 1).

During the 1970s, Kenya continued pursing the ISI, relying much on foreign capital as well as government-established entities. Nonetheless, most of the firms were inefficient and could not compete internationally, particularly after the collapse of the East African Community in 1977. Moreover, at the end of the 1970s, the composition of the manufacturing sector remained unchanged in Kenya, while in Malaysia, the entry of FDI in the electrical and electronic sector was making significant contributions towards changing the manufacturing structure as shown in **Table 4**. Furthermore, the discovery of oil in the early 1970s in Malaysia also resulted in the manufacture of petroleum and coal products. There was also an increase in the production of basic metals. As such, there was evidence of industrial transformation taking place as Malaysia began to produce intermediate products in addition to consumer goods.

In the mid-1980s, Malaysia embarked on a further liberalization program, which saw the removal of restrictions on FDI and the privatization of state-owned enterprises. This move resulted in massive FDI inflows, mainly into the manufacturing sector. Consequently, there was a significant increase in the production of manufacturing goods, as shown in both **Figure 8** and **Table 4**. Moreover, there was a significant technology shift in the sector towards the production of high technology manufactured goods. By 2011, light industries accounted for less than 10 per cent of manufactured output, and the sector was now dominated by chemical and plastic products and electrical and electronic goods, both accounting for more than 63 per cent of the output as shown in **Table 4**.

In the late 1990s, Kenya established export processing zones, aimed at attracting foreign firms to produce manufactured goods for exports. At the same time, there was a legislation aimed at supporting small and medium enterprises, in anticipation of linkages resulting from their interaction with the foreign-owned firms. By 2008, although the share of consumer goods had reduced, Kenya registered an increased involvement in the production of cement and chemicals and other minerals, and the manufacturing sector had yet to undergo significant transformation.

Overall, Kenya's and Malaysia's economic structures relied mainly on traditional sectors, and the two countries followed similar development strategies focusing on the diversification of economic activities and industrialisation. Moreover, these countries have had a considerable reliance on FDI for the development of their industrial capabilities over the years. Whereas the manufacturing diversification and development in Malaysia in recent years has been partly associated with FDI's activities, Kenya's slow growth has been attributed not only to its inability to attract significant FDI but also to its failure to create favourable conditions for the formation of local linkages with the domestic industries. Where did Kenya go wrong? Light will be shed on the reasons shortly.

3.2 Why the E&E and P&C Subsectors?

As discussed, and summarised in **Table 1** in the current study, manufacturing sectors have the potential for growth as well as a world-market advantages. Moreover, plastics, rubber and electrical components are among the manufacturing sectors that form strong backward linkages. While Kenya is not as dominant in E&E as Malaysia, the relevant question for Kenya involves how it can emerge as dominant in this subsector. As portrayed in the Product Space, however, Kenya's P&C industry is gradually growing; this can be explained, in part, by the diversification from agriculture to chemicals. Meanwhile, Malaysia has diversified from rubber to electronics (see, for example, Amir 2018).[24] P&C is not a dominant success in Malaysia, but it is an interesting sector for Kenya due to its connection to agriculture. Taking these two sectors into consideration is linked to the causal question. For instance, regarding the E&E sector, the question is whether backward linkages from MNCs have played any significant role in growing Malaysian firms to such a competitive level, and why this sector has not been as successful in Kenya. Focusing on E&E and P&C, thus broadens the scope of the research.

[24] The Product Space is a network that formalises the idea of relatedness between products traded in the global economy Hausmann et al. (2014).

3.3 Kenya: Country Profile

Kenya is a multi-party and independent state that operates under a presidential system of government. Originally a British colony that attained independence in 1963, Kenya became a sovereign republic in 1964. The country has a diverse population that includes most major ethno-racial and linguistic groups found across Africa. Kenya is predominantly Christian (83 %) and has an estimated 47 different communities, with Bantus 67 % and Nilotes 30 % constituting most native residents (Asongu and Marr 2007; Okoth and Ndaloh 2006). Cushitic groups also form a small ethnic minority, as do Arabs, Indians and Europeans.[25] The country has a bicameral parliament, that is, the Senate (Upper House) and the National Assembly (Lower House) and is headed by the president. The structure of the government allows for power to be held on two levels, namely the national level and the county level. In turn, this allows the counties of Kenya a form an autonomous entity.[26] Kenya is a lower middle-income country that has exhibited robust economic growth over recent years. Economic activity in Kenya slowed in 2017 as a result of multiple factors, but a recovery is currently underway. Economic growth decelerated to a 5-year low of an estimated 4.9 per cent in 2017, from 5.9 per cent in 2016.

3.3.1 Kenya's Foreign Direct Investment (FDI) Inflows

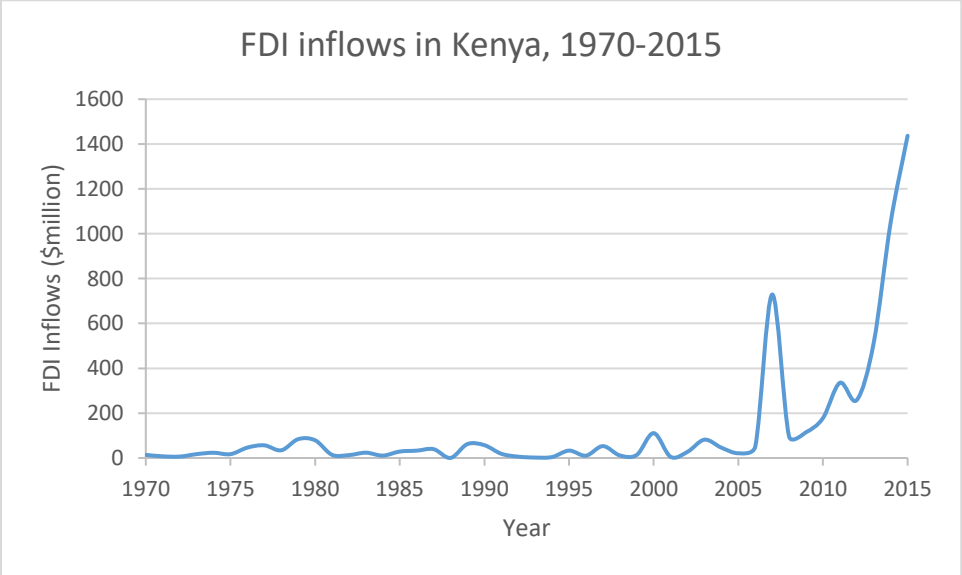
FDI forms an essential link between developing and industrial countries, and increasingly among developing countries. It provides an important channel for global integration and technology transfers. Kenya faces a significant challenge in attracting and sustaining FDI at levels that allow for domestic investment to take advantage of the benefits associated with capital inflows. This is despite government efforts to create a seemingly favourable environment to attract FDI, for example, by establishing the Investment Promotion Council (IPC) and the Export Processing Zone (EPZ), accompanied by tax and other trade incentives. It is true that MNCs will most certainly establish themselves in a country where they can potentially reap economies of scale. Indeed, studies (see, for example, Ngowi 2001) demonstrate that tax exemptions, tax holidays or tax reductions for foreign investors and similar incentives can play a positive role in attracting FDIs to a given destination. But, has Kenya done enough to attract substantial FDI?

[25] The 2009 Kenya Population and Housing Census Volume II - Population and Household Distribution by Social Economic Characteristics p. 397-398. Kenya National Bureau of Statistics (KNBS).
[26] The national government of the Republic of Kenya is composed of 47 counties, each county having its own semi-autonomous government.

Kenya registered an increase in 2015 with an inward FDI of approximately 11 per cent of Kenya's gross domestic investment, while FDI inflows in 1979/80 were nearly half of this figure. Yet, the susceptibility of the economy to internal and external shocks has created spikes, mainly in the years of political crises in Kenya as well as major global crises.

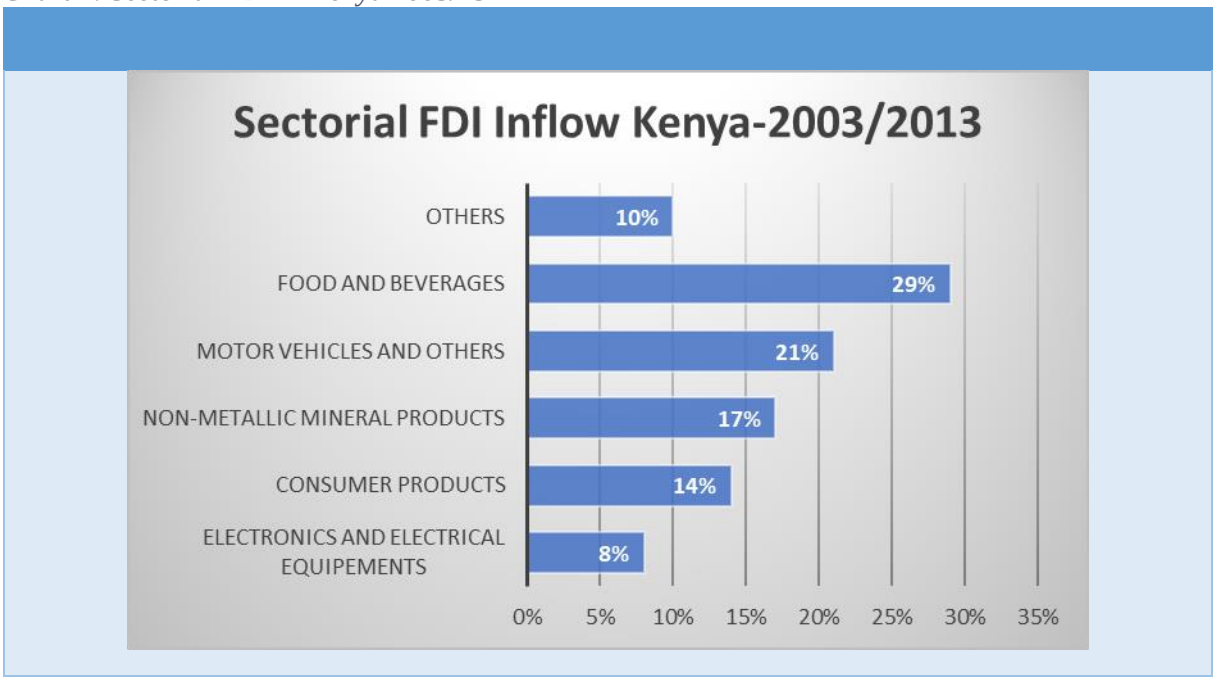
Foreign firms in Kenya since the 1970s have invested in a wide range of sectors. Most notably, they have played a major role in floriculture and horticulture, with close to 90 per cent of the flower industry being controlled by foreign affiliates. For an overview of sectorial FDI investment in Kenya between 1970 and 2015, see **Chart 1 below**.

Chart 1:FDI Inflows in Kenya, 1970-2015



Source: Author's compilation, data retrieved from (UNCTAD), FDI/TNC Database

Chart 2: Sectorial FDI in Kenya 2003/13



Source: Author's compilation. Data source: Chen et al. (2019) and FDI Markets Database (www.fdimarkets.com).

From **Chart 2**, the majority of FDI inflows in Kenya are reported in the food and beverages subsector, followed by the category of motor vehicles and others. The food and beverages subsector is largely involved with value addition to agricultural produce and, therefore, its success depends on an efficient agricultural sector in Kenya. Regarding the motor vehicle subsector, its success is due to government policies promoting subcontracting arrangements between small and medium enterprises and MNCs in Kenya (see Jiru and Ngii 1995; Okatch et al. 2011). The lowest inflows are reported in the E&E equipment subsector. We address the latter in more details later within this chapter under the subheading "*The E&E Manufacturing Industry in Kenya."*

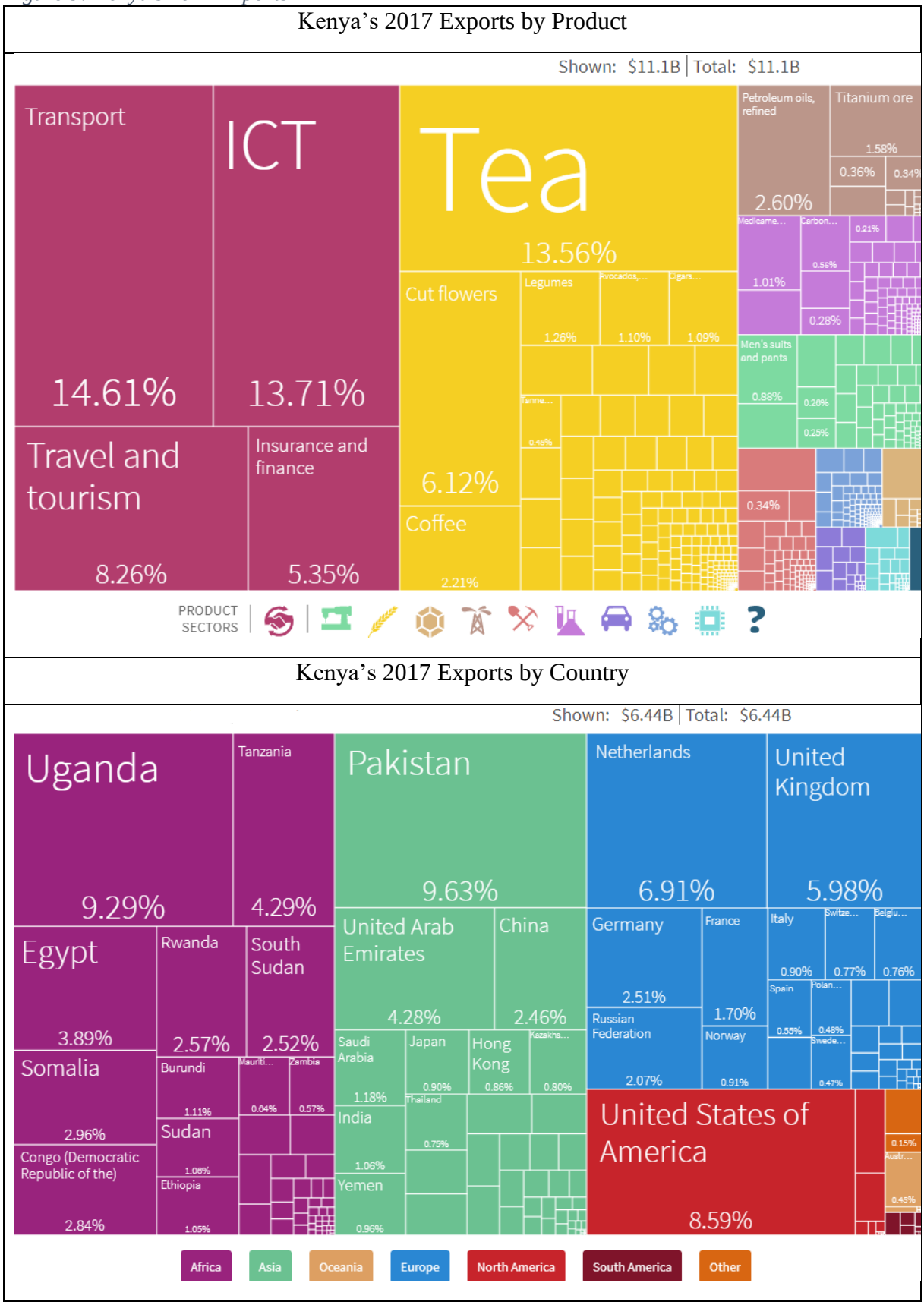
3.3.2 Kenya's Exports: An Overview

Traditionally, Kenya's main exports include coffee, tea, and petroleum and related products. In recent years, Kenya's export basket has registered some significant transformations, as shown in **Figure 9**. The table also demonstrates that Kenya exports more into neighbouring countries than to countries that are geographically further away. Indeed, there is evidence that neighbouring countries are a primary force determining national exports (see, for example, Sanidas 2018). While the easiest market access for most finished goods is in countries with geographical proximity, history, political enmity, colonial rules and other factors might prevent countries from seizing this natural advantage. For Kenya, the success in trading with the country's immediate neighbours can be largely explained by regional integration. Kenya is part

of an immediate economic market, known as the East African Community (EAC)[27], and this presents an important export market for Kenya.

[27] The EAC is an intergovernmental organisation composed of six countries in the African Great Lakes region in eastern Africa: Burundi, Kenya, Rwanda, South Sudan, Tanzania and Uganda.

Figure 9: Kenya's 2017 Exports



Source: Retrieved from the Atlas of Economic Complexity- http://atlas.cid.harvard.edu/ *(The Growth Lab 2019)* PRODUCT SECTORS *represents: services, textiles, agriculture, stone, minerals, metals, chemicals, vehicles, machinery, electronics, and others respectively.*

3.3.3 Classification of Firms in Kenya

In Kenya, the classification of enterprises is mainly organised by the number of employees engaged by firms as well as their rates of turnover. The Micro and Small Enterprises (MSEs) Act of 2012 only distinguishes between micro and small enterprises and remains silent on medium enterprises. However, an employee number of between 50-99 has been used to define medium-sized enterprises (see **Table 6)**. In fact, the message embedded in **Table 6** is that a firm with an annual turnover of over 5 million Kenyan shillings and below 10 million shillings can be classified as a medium enterprise.

As demonstrated by Waweru (2007), Wairimu (2015) and Ndemo (2015), the main characteristics of the Micro, Small and Medium Enterprises (MSMEs) in Kenya include:

- Cash-based businesses;
- Ease of entry and exit;
- Small-scale nature of activities;
- Little capital and equipment required to start and run;
- Labour-intensive;
- Mainly based on a low-skilled workforce;
- Having a low level of organisation with little access to organised and international markets;
- Limited access to formal credit;
- Limited in accessing services and amenities;
- Less focused on value addition; and
- A very high turnover rate.

Table 5: Classification of MSEs by the MSE Act, 2012

Sector	Micro	Small	Medium*
Manufacturing	Annual turnover: ≤ KES500,000 Employees: <10 Total assets & financial investment: ≤ KES10 mil	Annual turnover: KES500,000≤ KES5 Mil Employees: 10≤15 Investment in plants & machinery: KES10 mil ≤ KES50 mil	Employees: 50≤99
Services and Farming Sector	Annual turnover: ≤ KES500,000 Employees: <10 Total assets & financial investment: ≤ KES10 mil	Annual turnover: KES500,000≤ KES5 Mil Employees: 10≤15 Registered capital: KES10 mil ≤ KES20 Mil	Employees: 50≤99

Source: Author's compilation. Data from the Micro and Small Enterprises (MSEs) Act, 2012-Kenya.[28]

By comparing innovation activities at the firm level in Kenya, Cirera (2015) shows that medium-sized and large firms are often more innovative than small firms. This difference may be explained by the fact that large firms are more capable of overcoming the large fixed costs of innovating since they can potentially access more external sources of innovation finance than small firms do.

3.3.4 The Manufacturing Industry in Kenya

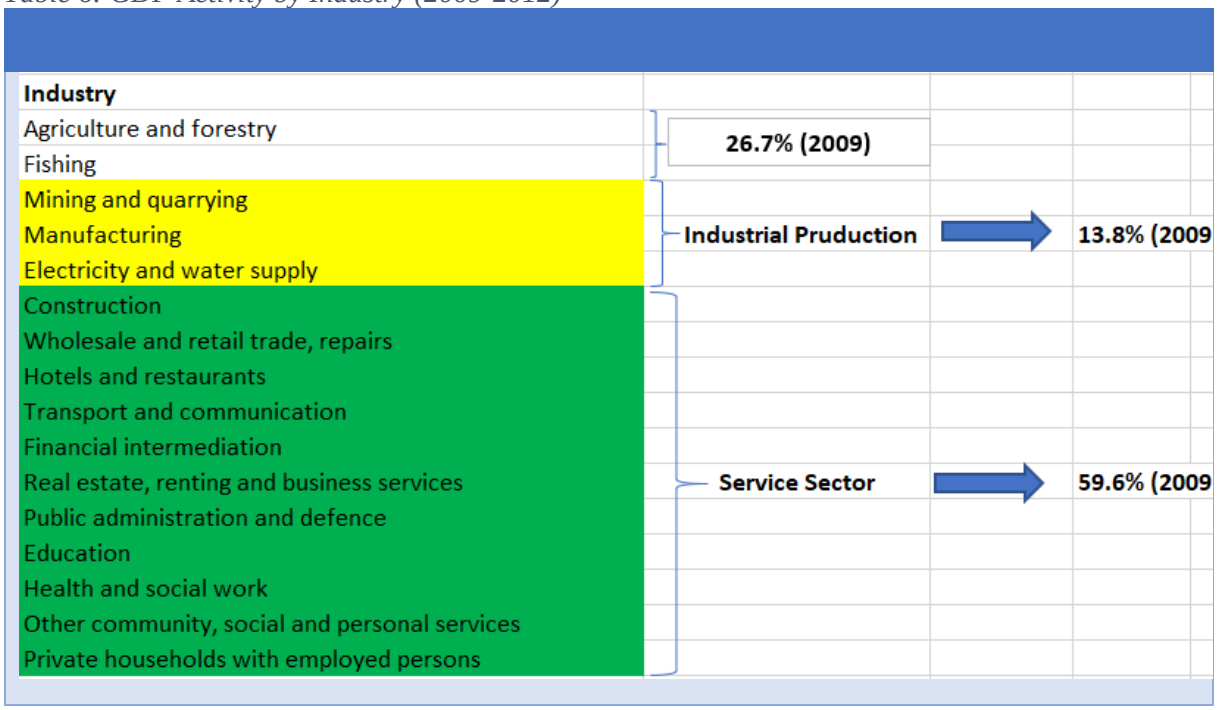
As of 2017, Kenya's manufacturing industry contributed about 8.4 per cent to the gross domestic product (GDP). The food products division has the highest number of firms, followed by the clothing manufacture. Few firms are classified in the manufacture of tobacco, computers, and electronic and optical products divisions (KNBS 2017).

Previous studies have demonstrated that firm-level productivity is lower in the manufacturing sector than in the services sector (see, for example, Cusolito and Cirera 2016). Indeed, there are indications that firms in the manufacturing sector are operating below their full capacity (Cirera

[28] See the Micro, Small and Medium Establishments, Basic Report 2016 by Kenya National Bureau of Statistics (2016).

2015). Hence, Kenya's manufacturing sector does not form extensive linkages with the rest of the economy. In fact, manufacturing firms may incur higher costs due to a lack of economies of scale, forcing them to charge customers higher prices for their finished goods. The result is a lack of customers who demand a variety of goods and, therefore, fewer investments in R&D and a subsequent lack of innovativeness. The overall implication is a shrinking (due to market exit) or stagnant manufacturing sector, as witnessed in Kenya today. Indeed, historical data show that the manufacturing sector's contribution to the economy in Kenya has stagnated at around 10 per cent of GDP and was about 8.4 per cent in 2017. For a breakdown of Kenya's GDP by activity, see **Table 7**.

Table 6: GDP Activity by Industry (2009-2012)



Source: Author's compilation, 2019. Data Source: (Kenya National Bureau of Statistics 2018)

3.3.4.1 Role of Backward Linkages from MNCs in Kenya's Manufacturing Industry

As discussed from **page 8** to **page 12** in the current study, backward linkages are potentially beneficial to a country when established in the manufacturing industries, in the sense that when a finished manufactured good requires several manufactured inputs and the internal production of such inputs is costly, then outsourcing becomes unavoidable. The impact of this outsourcing means greater linkages within an economy, job creation and certainly economic progress of a country.

Regarding Kenya, the empirical literature on backward linkages is scarce. Nevertheless, studies by Amendolagine et al. (2013), Amendolagine et al. (2017) and Amendolagine et al. (2019b)

show that Kenya, in comparison to Zambia, Tanzania, Ethiopia, Uganda and Nigeria, has a larger share of outsourcing from MNCs. Moreover, most backward linkages between Kenya's firms and MNCs are in the food and beverages manufacturing subsector (Amendolagine et al. 2019b). To a large extent, there is a strong interdependence between the food and beverages subsector and the plastics and glass sector, in the case of packaging, as well as the electronics and electrical sector in terms of storage (for example, the use of fridges in cold storage). This means that the food and beverage subsector is strongly linked to sectors that have a great potential to maximise the impact of backward linkages from MNCs. We, therefore, expect that MNCs have played a substantial part in fostering knowledge within the linked local firms.

Early studies found evidence that MNEs in Kenya train indigenous managers and spread know-how in the country (for example, see Gershenberg 1987). Recent research also supports this position. For example, Managi and Bwalya (2010) found evidence of both intra-industry and inter-industry productivity spillovers from FDI in Kenyan firms. Furthermore, a study by Ndemo (2015) shows that the backward linkages between Kenya's firms and MNCs are beneficial to the former in terms of capacity building. Within the manufacturing sector, MNCs sought backward linkages with local firms in order to produce part of their product content. Major benefits to the local firms included, but were not limited to, increased competition, human capital, and technology partnership with MNCs.

Overall, the reviewed literature establishes the positive impact that backward linkages from MNCs have on local firms in Kenya. Training and technological partnership appear to be the main channels by which MNCs transmit capabilities to their local suppliers in Kenya. As such, the variation in production capability accumulation in Kenyan firms may be largely determined by how skilled employees are at learning and absorbing the external knowledge from MNCs into their production processes.

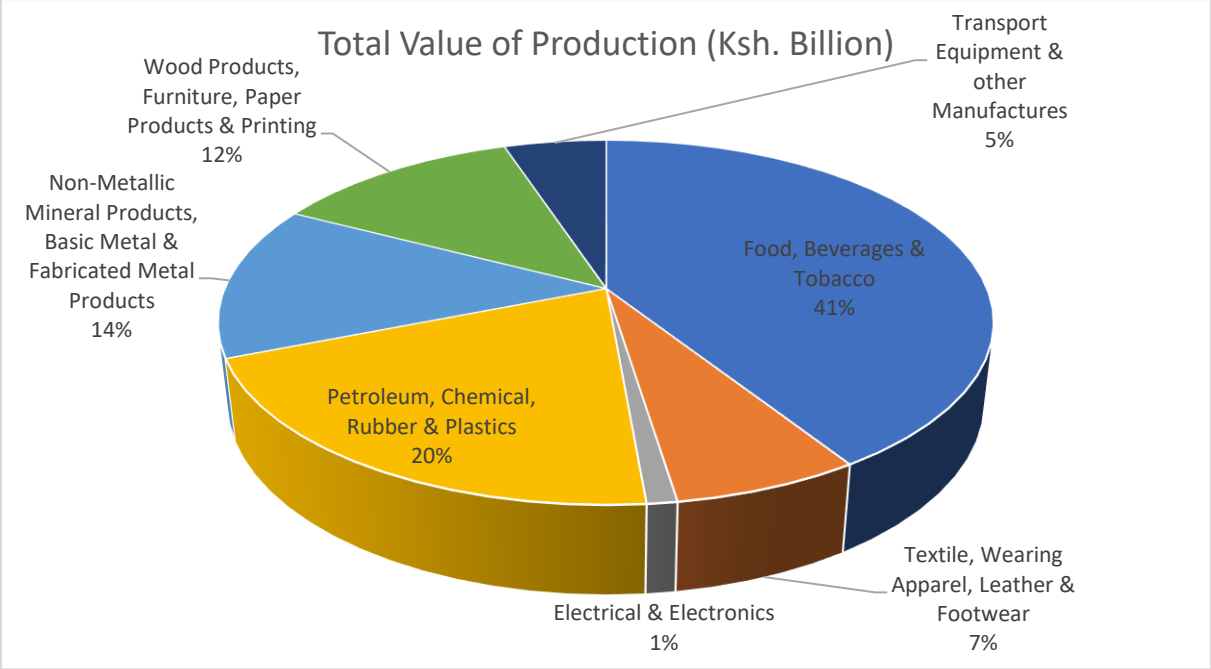
The following section investigates Kenya's E&E sector, one of the manufacturing subsectors focused on within the current study.

3.3.4.2 The E&E Manufacturing Industry in Kenya

Kenya has never experienced any significant wave of investment in its E&E industry. In fact, there were only a few foreign investors in consumer electronics manufacturing in the early 1970s (Agola 2016). Today, most firms engage in the production of traditional electrical products, such as electric cables, lamps, electrodes and fans. Only a few firms have been involved in the manufacture of more modern and high growth potential products, such as

computation, automation and communications equipment (Magu 2011). Yet, research in developed economies, such as the United States, shows the manufacture of modern and dynamic electric and electronic products to be the primary growth vessel in the subsector. **Chart 3** reflects Kenya's manufacturing subsectors and demonstrates that in 2013-2017, E&E accounted for only *1 per cent* of the total production value.

Chart 3:Kenya's Manufacturing Subsectors (2013-2017)



Source: Author's compilation, 2018. Data Source: Kenya National Bureau of Statistics (2018).

Specifically, the main products in Kenya's E&E sector include portable electric lamps; electronic integrated circuits; transmission apparatus for radio-broadcasting or television; television cameras, digital cameras and video camera recorders; insulated electrical wires; electrical motors and generators; electrical transformers; radar; electrical boards; electricity generating sets; rotary converter; nuclear reactors; and boilers (The Growth Lab 2019; KAM 2018). See **Table 8** for Kenya's main E&E products.

Table 7: Kenya's main E&E Products

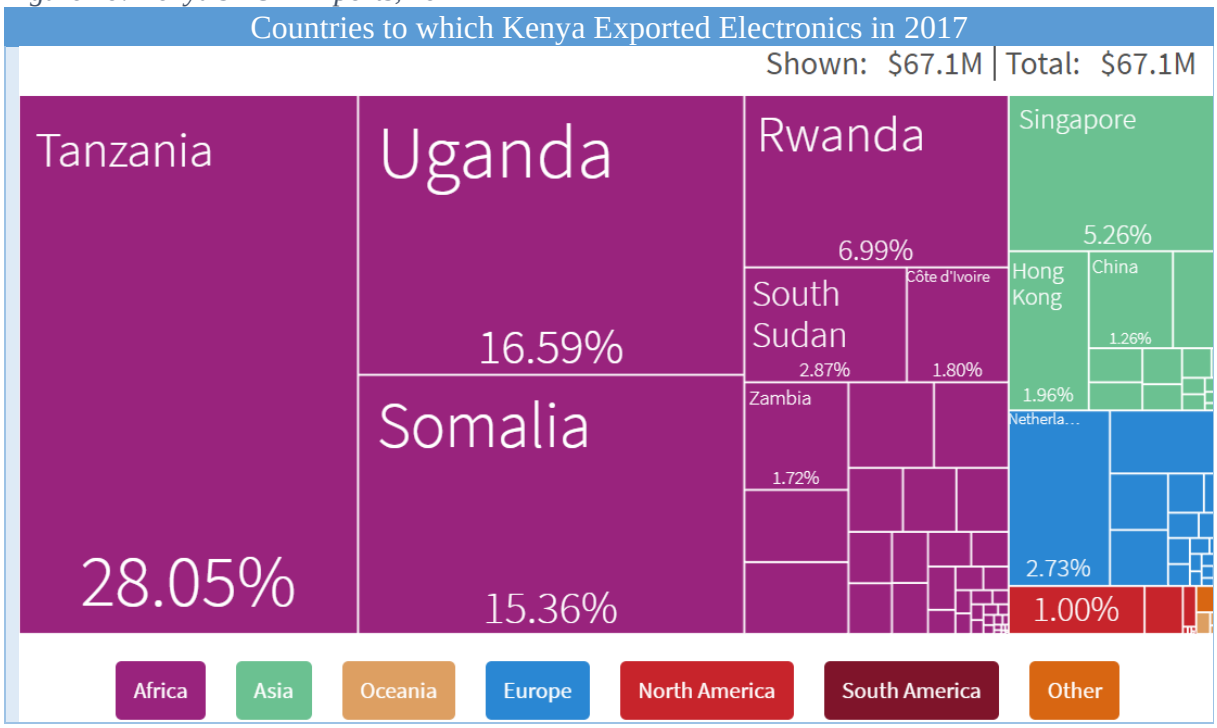
E&E Manufacturing Sector in Kenya: Major Goods
1. Portable electric lamps
2. Electronic integrated circuits
3. Transmission apparatus for radio-broadcasting or television
4. Television cameras
5. Electrical wires
6. Electrical motors and generators
7. Electrical transformers
8. Electricity generating sets
9. Rotary converters
10. Nuclear reactors
11. Boilers

Source: Author's compilation, 2018. Data Source: KAM (2018) and The Growth Lab (2019)

Studies show that the constraints facing Kenya's E&E subsector include, but are not limited to, competition from imports; lack of adequate financial resources; poor infrastructure; a lack of markets for high technology products; and a lack of trained manpower (see, for example, Magu 2011; Rosyln et al. 2013). These studies have also established that the methods of production capability accumulation that spur growth in the E&E subsector in newly developed countries, such as joint ventures, FDI and the hiring of technical licenses, were infrequently exploited by Kenya's firms. As such, most of the well-performing firms in the E&E sector emphasised internal R&D and the acquisition of hardware for their new technology requirements.

The nexus between the new trade theory and the capability theory of the firm in Kenya's E&E subsector is supported by many studies. For example, through Magu (2011) and Rosyln et al. (2013), we can establish that local firms in Kenya's E&E subsector continued operations from low technology and knowledge intensity segments mainly specialising in low-value-added goods. By producing low-value-added goods and components, local firms within the subsector may not meet the quality and quantity demands of locally based MNCs within the same subsector, and therefore no supply relationships are established. The result is that local firms do not get the opportunity to learn and gradually acquire production capabilities from MNCs, which are mainly carriers of advanced technology. Therefore, what emerges is a pool of Kenya's E&E firms that do not realise economies of scale and their associated benefits. In consequence, the subsector lacks the expected competitiveness and growth. Regarding international markets, the low competitiveness of Kenya's E&E firms, just like in the overall manufacturing sector, mean that they mainly export inputs/goods to those countries that are also characterised by a similar or lower level of competitiveness. This implies that exports would typicaly be higher in the neighbouring countries. In fact, this position is supported by the Atlas of Economic Complexity, as shown in **Figure 9** below.

Figure 10: Kenya's E&E Exports, 2017



Source: Generated from The Growth Lab (2019)

Overall, Kenya's E&E subsector contributes little to the country's GDP. The sector is characterised by low-value-added goods, suggesting low production capabilities at the firm level, and has limited links to locally based MNCs in the same subsector, implying low backward linkages from MNCs.[29]

3.3.4.3 P&C Manufacturing Industry in Kenya

The Kenya National Bureau of Statistics categorises the P&C subsector together with petroleum and rubber. This subsector is larger compared to the E&E subsector and contributed 20 per cent of Kenya's GDP in 2013-2017, see **Chart 3**.

On the one side, plastics products include PVC pipes and fittings, packaging bags, plastic shoes, crates, bottles, floor tiles, household wares and containers. On the other side, chemical products include basic industrial chemicals such as fertilizers and pesticides; soaps and cleaning preparations; perfumes, cosmetics; paints; varnishes and lacquers (KAM 2018). **Table 10** provides summary of products under Kenya's P&C subsector.

[29] Indeed, Rosyln et al. (2013) established that E&E firms in Kenya are characterised by low linkages with MNCs.

Table 8: Major Products in P&C Manufacturing Subsector

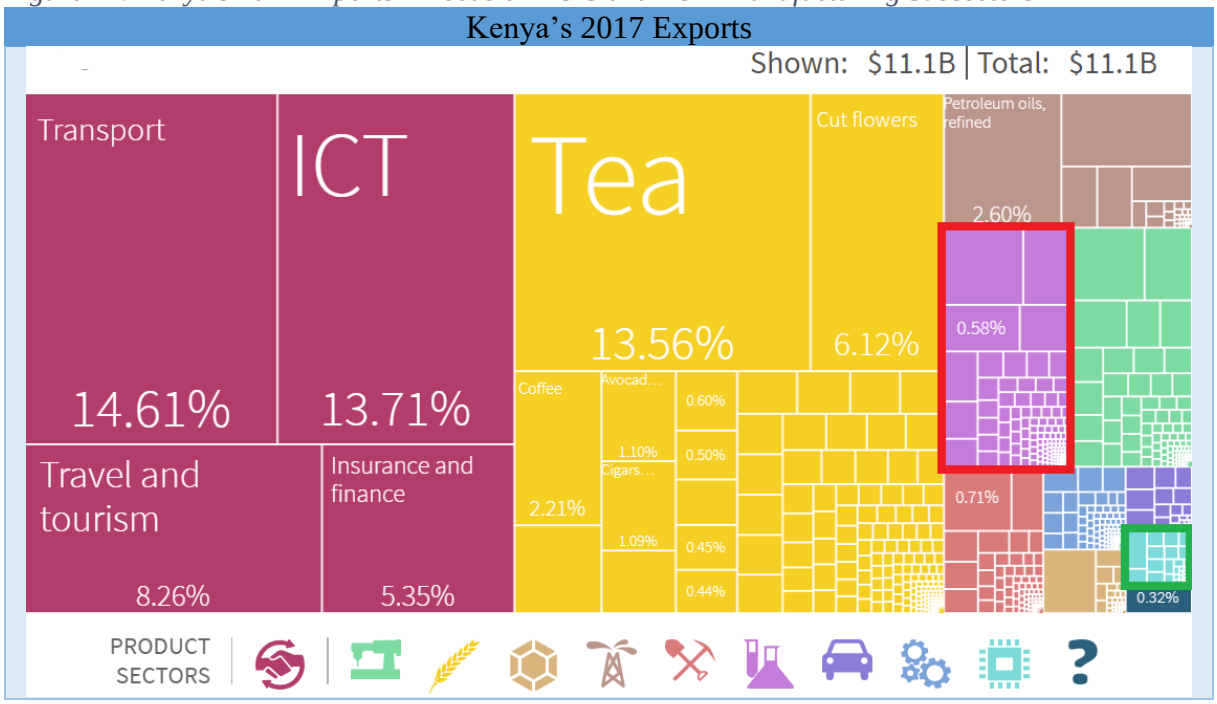
Plastics Products	Chemicals Products
• PVC pipes and fittings	• Fertilizers and pesticides
• Packaging bags	• Soaps and cleaning preparations
• Plastic shoes	• Perfumes
• Crates	• Cosmetics
• Floor tiles	• Paints
• Household wares and containers	• Varnishes
• Adhesives	• Lacquers

Source: Author's compilation, 2018. Data Source: KAM (2018).

Kenya's plastic production can be traced back to the late 1930s. Its development should be understood in the context of the wider manufacturing sector and the evolution of Kenya's macroeconomic and industrial policies. Plastic production has been one of the key drivers for Kenya's economic growth and employment creation (KAM 2006, 2007; Ombis 2012). Moreover, recent studies also show that the P&C subsector, in general, demonstrates significant competitiveness on the scale of world trade (see, for example, Mudavanhu 2014; Chege et al. 2014).

The growth of the P&C subsector has been supported by rapid technological changes, product diversification, and new entrants. In fact, many FDI and joint ventures with local firms have boosted knowledge diffusion across the subsector (Njeru 2006; Ombis 2012). As the subsector has grown, it has created many jobs — both directly and indirectly. Indeed, it is logical to conclude that the presence of local MNC linkages within the P&C subsector has been one of the important channels by which local firms have learned through their interactions with the latter. The impact of inter-firm learning is projected in the product diversification within the subsector. Of course, the competitiveness of an industry is mainly reflected in how much it can export. By examining Kenya's export data, we can confirm that exports in the P&C manufacturing sector are at a significant level in comparison to the E&E sector. For more detail, see **Figure 11**.

Figure 11: Kenya's 2017 Exports – Focus on P&C and E&E Manufacturing Subsectors



Source: Generated from The Growth Lab (2019). Note: The red and the green border highlights represent P&C and E&E, respectively. For the meanings attached to the product sectors, see Table 4.

Although **Figure 11** shows some level of diversification in the P&C sector, a less conducive investment environment can increase the cost of doing business and further offset the benefits from factor endowments. For example, as a result of the high costs of electricity, serious losses have been incurred in Kenya's chemical, plastic, & rubber subsector (Chen et al. 2019). Due to these costs, the sector has not grown to its full potential.[30]

Summing up: Kenya has a poorly developed manufacturing industry. Moreover, Kenyan firms have a revealed an overall comparative disadvantage in manufacturing, although there are particular subsectors in which they do have some degree of comparative advantage, for example, in food and beverages and plastics and chemicals. Regarding product diversification, Kenya's P&C subsector, in comparison to its E&E subsector, is more diversified. Local firms that are linked to MNC customers substantially benefit from acquiring know-how from the MNC customers. The main mechanism for the acquisition of know-how by Kenyan firms is through training and joint technological activities with MNCs. Essentially, then, the acquisition of production knowledge is largely determined by the level of skilled employees within the host firm and the ability of the firm to learn, absorb and adopt the acquired knowledge.

[30] Note that there is very little literature and empirical research on backward linkages from MNCs in Kenya's P&C subsector.

3.4 Malaysia: Country Profile

Economic objectives and policies in Malaysia have been shaped by the country's political and social context. This country is governed by a constitutional monarchy with a federalist system, whereby power is divided between a central government and thirteen state governments. Nonetheless, the distribution of power overwhelmingly favours the federal government, therefore providing scope for centralised economic planning.

Of Malaysia's almost 28.3 million multi-ethnic inhabitants, according to the 2010 census, Bumiputeras or Malays accounted for 67.4 per cent, while Chinese constituted about 24.6 per cent and Indians 7.3 per cent, with additional minor ethnic groups constituting 0.7 per cent. This multi-ethnic context is important in order to better understand the history of economic development policy in Malaysia.[31]

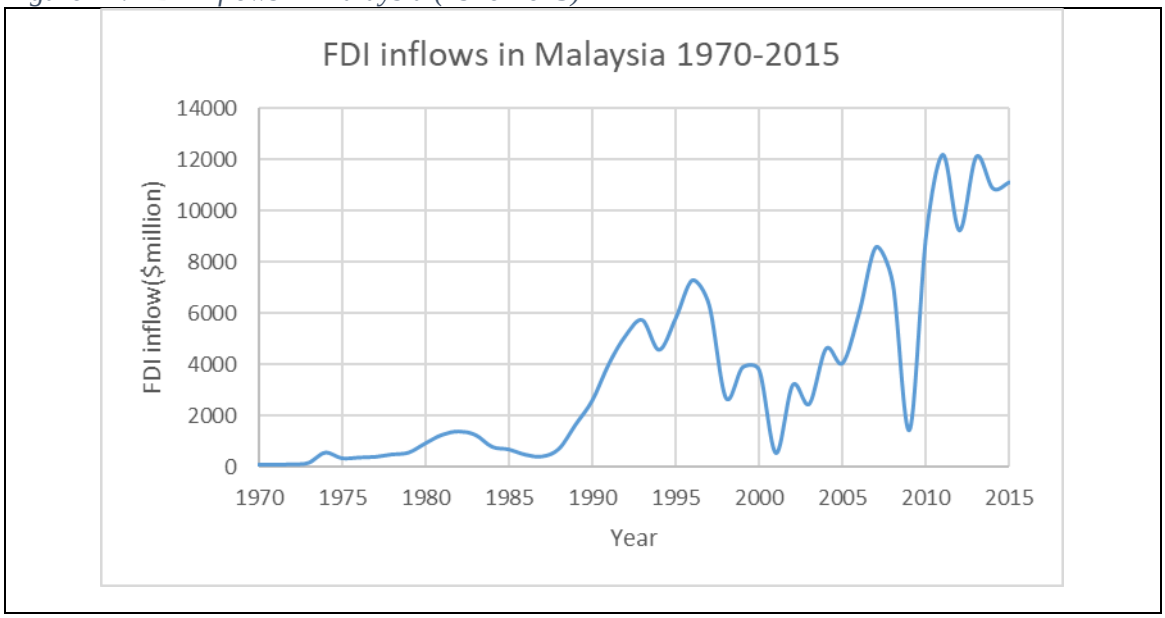
3.4.1 FDI in Malaysia

Malaysia is a growing and relatively open economy. The country had a consistent record of economic growth in GDP over the period 1970–2005, averaging an annual rate of approximately 7 per cent. Due to its open economy, externalities have occasionally had a major impact, including the oil crises of the 1970s, the downturn in the electronics industry in the mid-1980s, and especially the Asian financial crisis of 1997 (Karimi and Yusop 2009).

Foreign direct investment (FDI) in Malaysia has been a pillar for the strong growth performance experienced by the Malaysian economy (Karimi and Yusop 2009; UNCTAD 2011). Investment policy reforms, such as the introduction of the Investment Incentives Act in 1968, the establishment of free trade zones in the early 1970s, and the provision of export incentives alongside the acceleration of open policy in the 1980s led to an increase of FDI in the late 1980s. **Figure 12** provides an overview of the FDI inflows in Malaysia from 1970 to 2015. Moreover, **Figure 13** indicates that most of Malaysia's FDI inflows in 2017 went to extractive industries, with manufacturing ranking third.

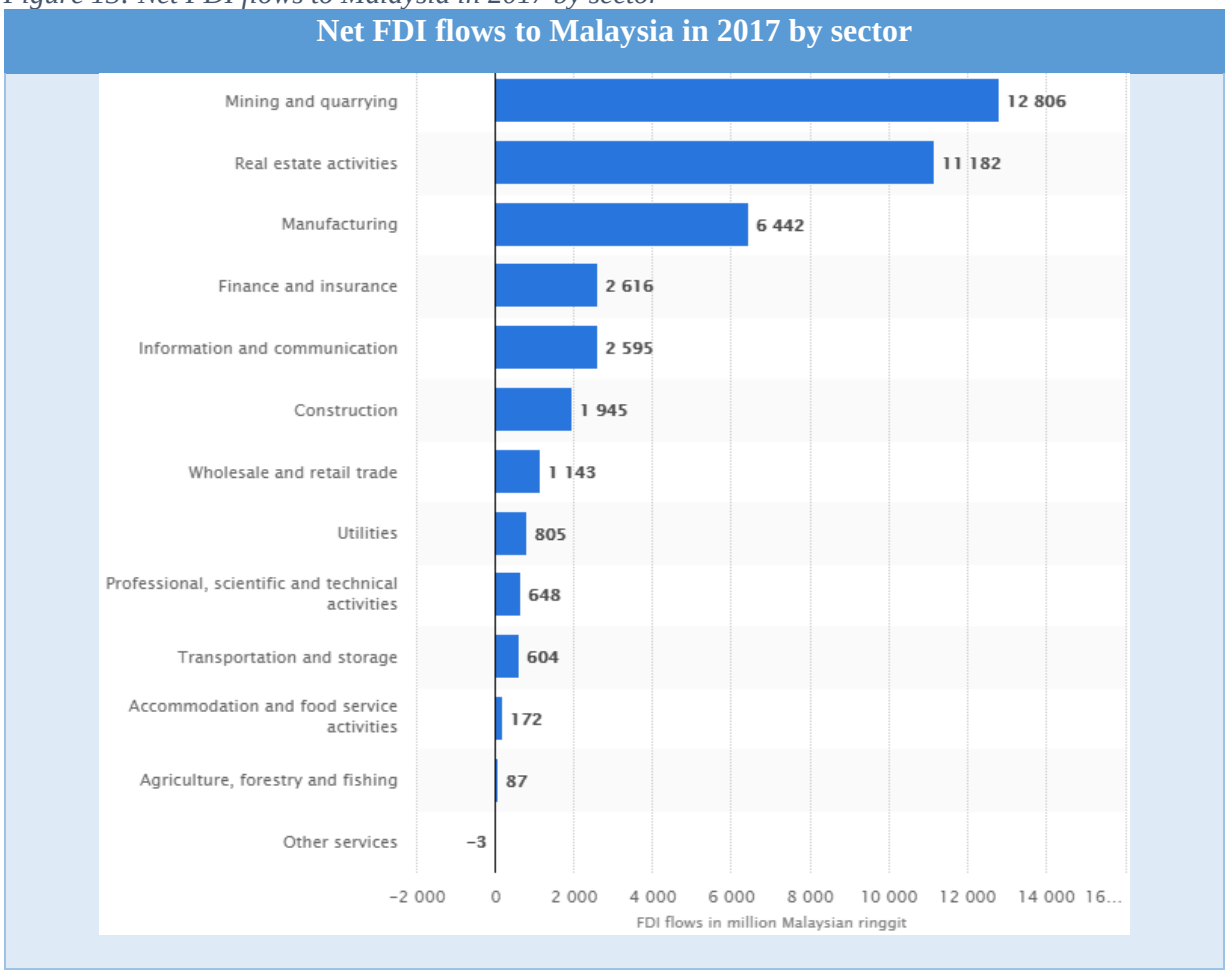
[31] Bumiputera means 'sons of the soil', and is the term used in reference to ethnic Malays and other indigenous peoples.

Figure 12: FDI Inflows in Malaysia (1970-2015)



Source: Author's compilation, 2018. Data retrieved from (UNCTAD) FDI/TNC Database.

Figure 13: Net FDI flows to Malaysia in 2017 by sector



Source: (Statista)

In their study, Giroud and Mirza (2010) show that MNCs that are established in Malaysia, and the ASEAN region as a whole, have two main motivations.[32] Most of the MNCs are resource-seeking and are predominantly established in Malaysia to gain access to low-cost labour with appropriate skills and language abilities. Moreover, a large share of MNCs are also efficiency-seeking in nature in that they establish themselves in Malaysia in order to take advantage of preferable incentives and policies, such as benefiting from preferential taxes and consolidating business contacts, including original equipment manufacturing. To that extent, such motivation highlights how MNCs tend to be more internationally oriented; rather than seeking access to local and regional markets, they integrate Malaysian operations with their overall global engagements.

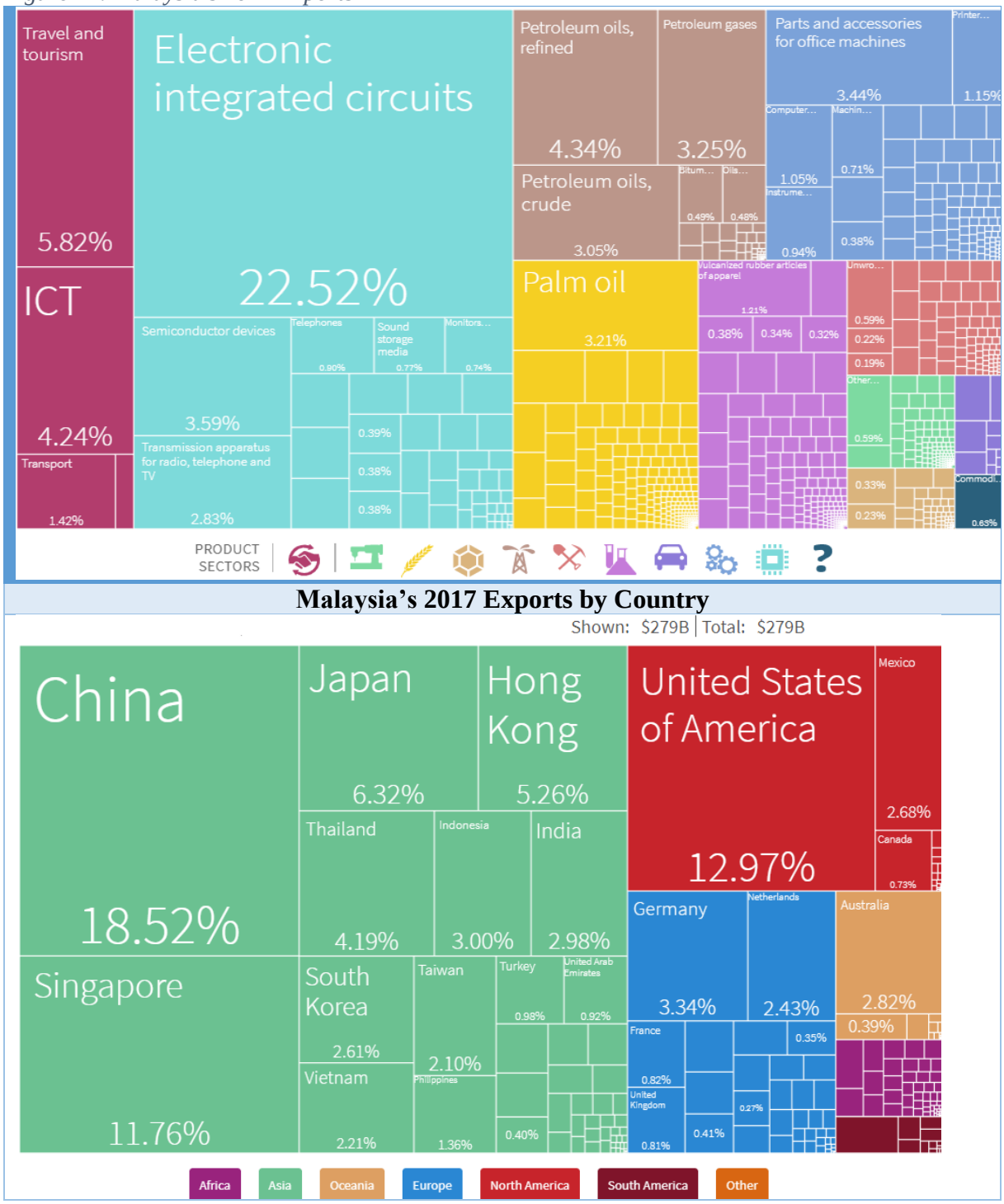
3.4.2 Malaysia's Exports: An Overview

Malaysia is the 19th largest export country in the world and the 25th most complex economy according to the Economic Complexity Index (ECI).[33] In 2017, Malaysia exported $263B and imported $197B; hence it has a positive trade balance of $66.4B. In 2017, the GDP of Malaysia was $314B and its GDP per capita was $29.4k (The Growth Lab 2019).

Malaysia's top exports are integrated circuits, refined petroleum, office machine parts, petroleum gas and palm oil. The country's top export destinations are China, Singapore, the United States, Japan and Hong Kong (The Growth Lab 2019). **Figure 14** below provides a summary of Malaysia's exports, alongside the export destinations.

[32] The Association of Southeast Asian Nations (ASEAN) is a regional intergovernmental organisation comprising ten countries in Southeast Asia, which promotes intergovernmental cooperation and facilitates economic, political, security, military, educational, and sociocultural integration among its members and other countries across Asia.
[33] ECI is a holistic measure of the productive capabilities of large economic systems, usually cities, regions or countries. The Growth Lab (2019).

Figure 14: Malaysia's 2017 Exports



Source: The Growth Lab (2019)

3.4.3 Classification of Firms in Malaysia

According to the Malaysian Economic Census 2011, SMEs accounted for 97.3 per cent or 645,136 of total business establishments in 2010. The Malaysian government has adopted a common definition of SMEs to ease the identification of such establishments in the various sectors and to facilitate the formulation of policies and programmes to nurture entrepreneurial SMEs. Due to economic developments since 2005, such as price inflation, structural changes and changing business trends, a review of SME definition was undertaken in 2013, and a new definition was endorsed at the 14th National SME Development Council (NSDC) meeting in July 2013. This new definition covers all sectors, namely services, manufacturing, agriculture, construction and mining and quarrying.[34] Regarding the manufacturing sector, SMEs are defined as firms with a sales turnover not exceeding RM50 million or a number of full-time employees not exceeding 200. For services and other sectors, SMEs are defined as firms with a sales turnover not exceeding RM20 million or a number of full-time employees not exceeding 75. Approximately 77 per cent of SMEs can be classified as micro-enterprises. A large majority of micro-firms are found in the service sector, compared to the manufacturing sector and agriculture. **Table 13** shows the various definitions of SMEs in Malaysia and **Chart 4** the percentage distribution of Malaysia's SMEs by size and sector.

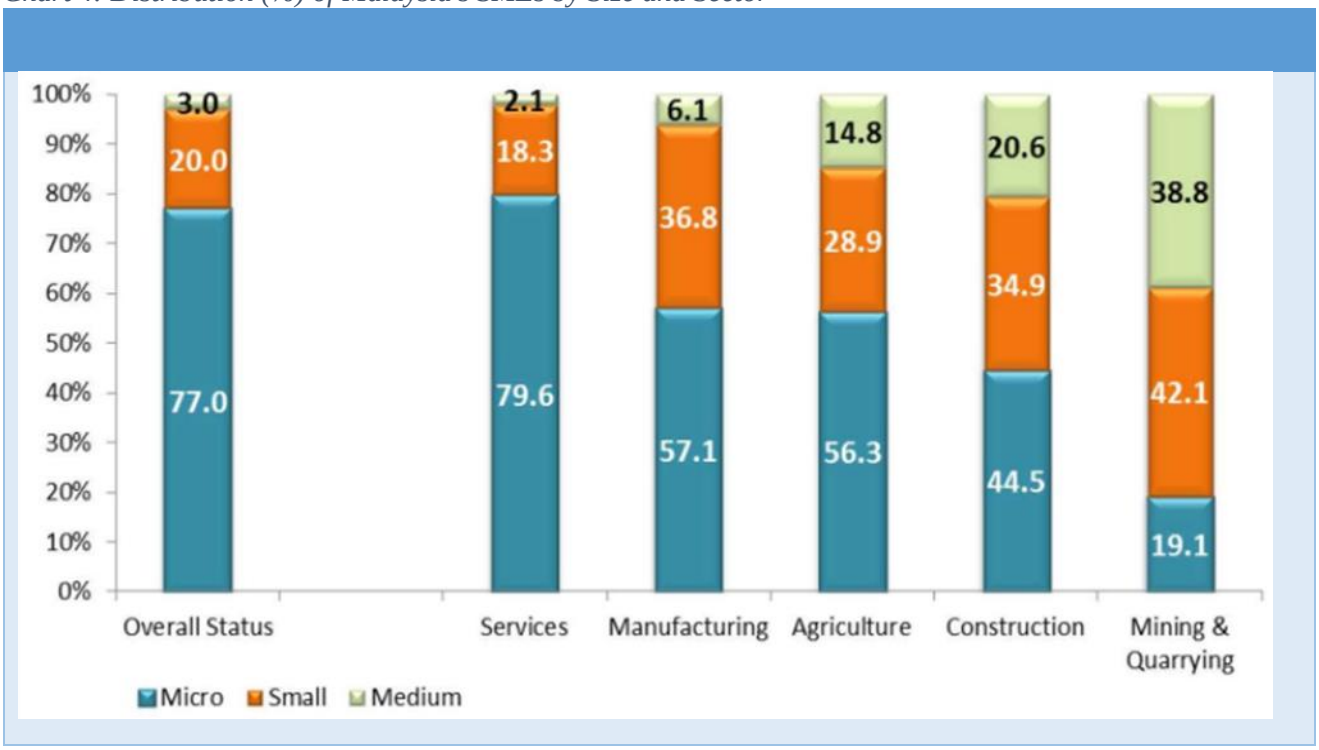
[34] See SME Corp, Malaysia (2017, June 1) SME definition. Retrieved from http://www.smecorp.gov.my/index.php/en/policies/2015-12-21-09-09-49/sme-definition.

Table 9: Malaysia's Definition of SMEs

Sector	Micro	Small	Medium
Manufacturing	Sales turnover: <RM300,000 OR Employees: <5	Sales turnover: RM300,000 < 15 mil OR Employees: From 5 to <75	Sales turnover: RM15mil ≤ RM50 mil OR Employees: From 75 to ≤ 200
Services or Other	Sales turnover: <RM300,000 OR Employees: <5	Sales turnover: RM300,000 <3 mil OR Employees: From 5 to < 30	Sales turnover: RM3mil ≤ RM20 mil OR Employees: From 30 to ≤ 75

Source: Author's compilation, 2017. Data from SME Corp, Malaysia (2017, June 1) SME definition. Retrieved from http://www.smecorp.gov.my/index.php/en/policies/2015-12-21-09-09-49/sme-definition.

Chart 4: Distribution (%) of Malaysia's SMEs by Size and Sector

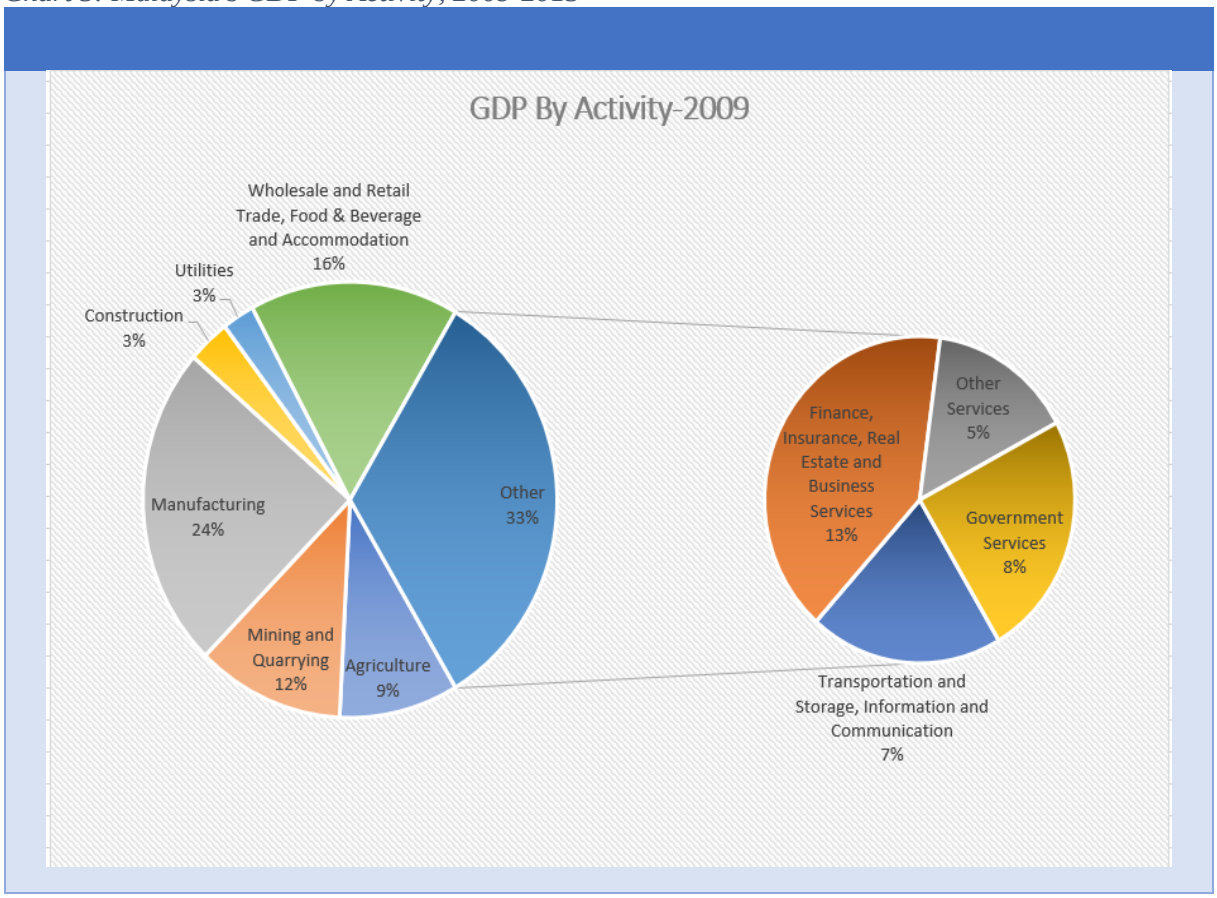


Source: Extracted from SME Corp, Malaysia (2017, June 1) SME Statistics. Retrieved from http://www.smecorp.gov.my/index.php/en/policies/2015-12-21-09-09-49/sme-statistics.

3.4.4 The Manufacturing Industry in Malaysia

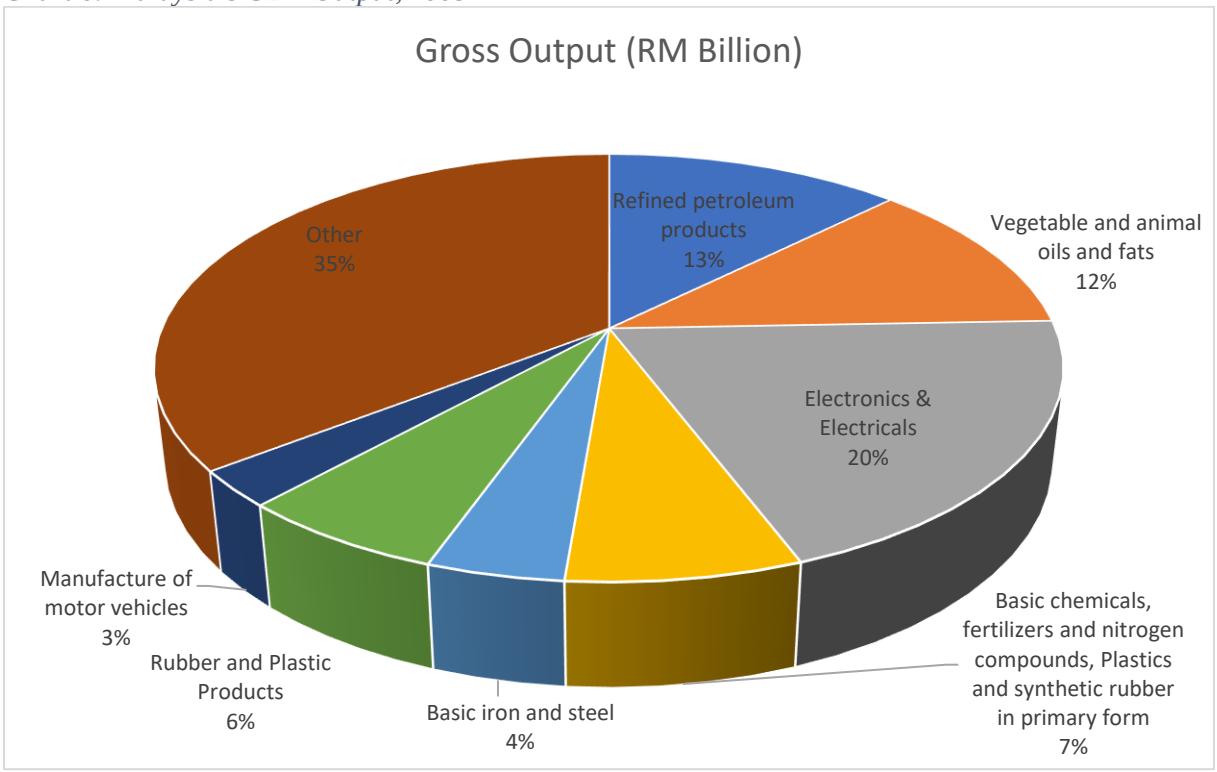
Manufacturing remains a core sector for sustainable growth under the 11th Malaysia Plan (Malaysia Ministry of Economic Affairs). The manufacturing sector has played an important role in the economic transformation of Malaysia. The country continues to attract significant investments in the manufacturing sector due to its highly diversified economy, strong manufacturing foundation, developed infrastructure and connectivity, proactive government policies, and hardworking workforce. As such, Malaysia is evolving from light industries to more capital- and knowledge-intensive industries. Today, the challenge Malaysia faces is for local firms to move from low-value-added to high-value-added activities within or across industries. Between 2009 and 2015, the manufacturing sector in Malaysia accounted for 24 per cent of the country's GDP (see **Chart 5)**. Within the manufacturing sector, the E&E subsector had the largest gross output, at 20 per cent, followed by the rubber, plastics and chemicals subsector at 13 per cent and refined petroleum products at 13 per cent. See **Chart 6** for further detail.

Chart 5: Malaysia's GDP by Activity, 2009-2015



Source: Author's compilation, 2017. Data Source-National Accounts Statistics Division, Department of Statistics, Malaysia

Chart 6: Malaysia's GDP Output, 2009



Source: Author's compilation, 2017. Data Source-National Accounts Statistics Division, Department of Statistics, Malaysia

3.4.4.1 The Role of Backward Linkages from MNCs in Malaysia's Manufacturing

The local sourcing of inputs by MNCs in Malaysia is higher than in other countries in the ASEAN region (Giroud and Mirza 2010). Numerous studies of manufacturing in Malaysia have established that FDI and the growth in the manufacturing sector are interdependent (see McKendrick et al. 2000; Lean 2008; Moran 2012). For instance, McKendrick et al. (2000) found that the principal thrust of FDI turned Malaysia into a large producer of semiconductors and computers and other electronic products.

Studies have established that backward linkages from MNCs stimulate economic activity and employment in local firms in Malaysia (Giroud and Mirza 2010; Moran 2012). This phenomenon is integrated into the economies of scale effects, whereby MNC demand for a wider variety of intermediate goods allows for a further deepening of backward linkages within the manufacturing sector, thus creating more jobs. In their study of MNCs in the ASEAN region, Giroud and Mirza (2010) established that the majority of inputs bought from domestic suppliers by MNCs are composed of low-tech inputs and secondary products such as packaging.

Knowledge transfer from MNCs to their local suppliers is more frequent in Malaysia (Giroud 2007). Malaysia has reached a higher level of economic development and has competitive local suppliers. This facilitates knowledge exchange with foreign subsidiaries (Giroud and Mirza

2010). However, the extent to which such knowledge is shared with local firms influences the overall capacity to absorb and learn from knowledge brought by MNCs.

There is a consensus in the literature that MNCs in Malaysia play an active role in providing training to local suppliers. Such training is most frequent when MNCs share technological knowledge with local suppliers. This includes both on-the-job and off-the-job training, often taking place either at the MNCs themselves or at local suppliers. Therefore, local suppliers can benefit immensely from their MNCs if they have sufficient absorptive capacity to absorb and learn from their interactions with MNC clients. Furthermore, MNCs in Malaysia often also have a direct and immediate policy of improving the quality and competitiveness of their local suppliers using supplier partnership schemes (Giroud and Mirza 2010). These schemes demand commitment, action and activities such as training and application of world-class standards, especially the ISO 9000 and 14000 series. The result is increased commitment to high-quality standards among local firms.

3.4.4.2 Electronics and Electrical Subsector

Malaysia, in comparison with Kenya, has a very diversified E&E sector. This sector is grouped into electrical, consumer, components and industrial subsectors. In 2009, the E&E subsector contributed a 20 per cent gross output in Malaysia's manufacturing sector. To Malaysia, this is a very important subsector in terms of spearheading country's economic development. **Table 14** presents some examples of products in each group.

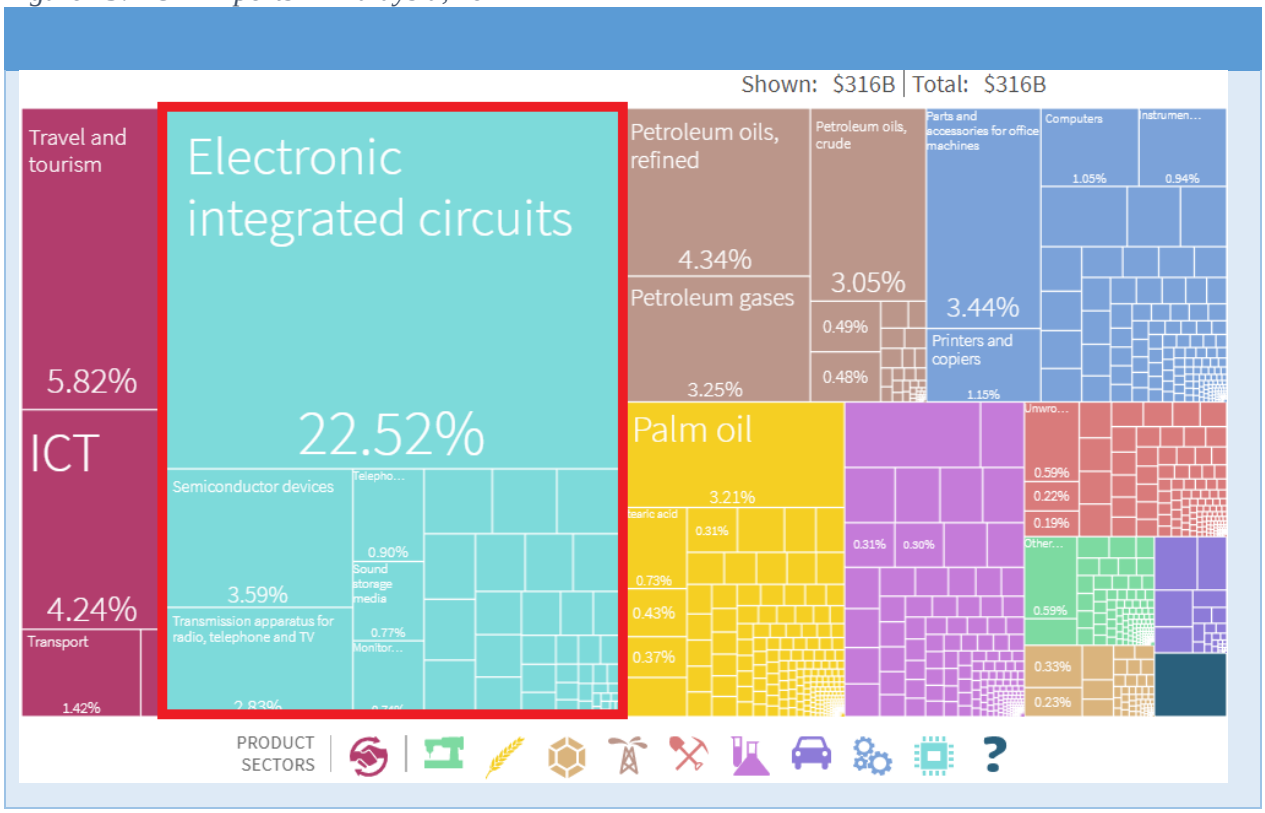
Table 10: Structure of the E&E Industry in Malaysia (2017)

Sectors	Subsectors	Example of Products
Electrical	Electrical	Lightings, solar-related products and household appliances such as air-conditioners, refrigerators, washing machines and vacuum cleaners
Electronics	Consumer	LED television receivers, audio visual products such as Blu-ray disc players/recorders, digital home theatre systems, mini disc, electronic games consoles and digital cameras.
	Components	Semiconductor devices, passive components, printed circuits, media, substrates and connectors
	Industrial	Multimedia and information technology products such as computers, computer peripherals, telecommunication products and office equipment.

Source: MIDA Reports (www.mida.gov.my/home/electrical-and-electronics/posts/) accessed on 03.11.2017.

In fact, Malaysia's E&E subsector represents the country's major exports, thus demonstrating its competitiveness in the global market. This position is confirmed by **Figure 15** Out of Malaysia's total export revenue of $316 billion, $120 billion was generated by the E&E subsector, representing a very substantial contribution to the country's revenue.

Figure 15: E&E Exports in Malaysia, 2017



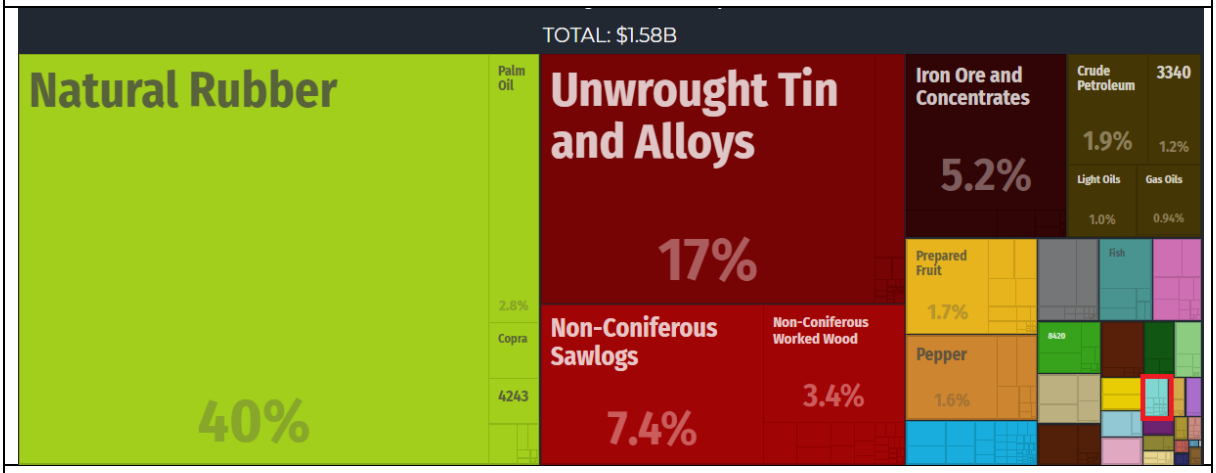
*Source: Extracted from The Growth Lab (2019). The **red border** highlight shows the total E&E exports in Malaysia in 2017.*

But importantly, how has the E&E subsector in Malaysia grown to reach this competitive level?

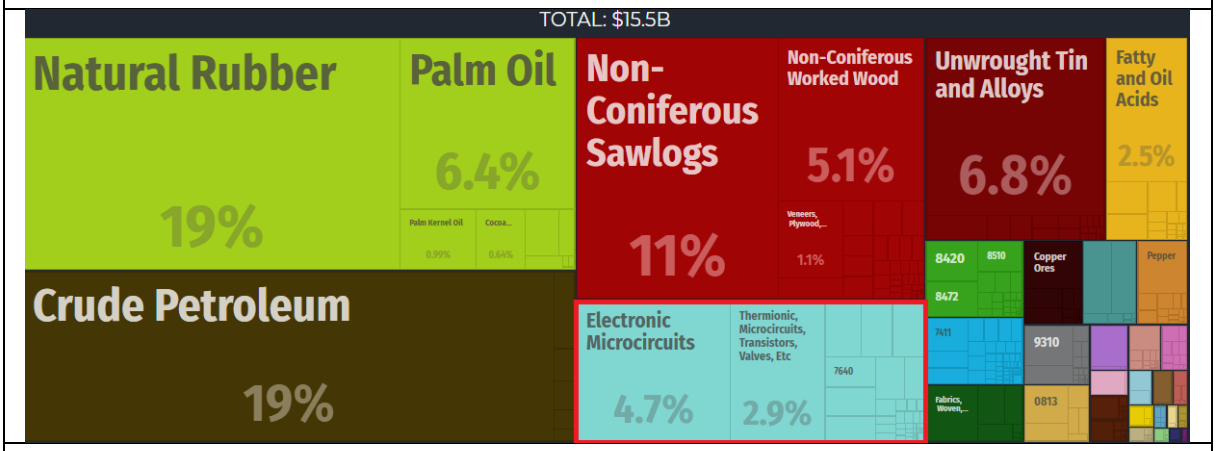
Early firm level studies on Malaysia's electronics subsector indicated few backward linkages in the late 1970s and early 1980s, but these started to evolve in the 1990s (see Tham 2004). Moreover, Tham and Loke (2011) established improvements in backward linkage development from 2000 to 2005, but the electronics subsector continued to have weaker-than-average industry backward linkage development in 2005. Based on this information, the current study traces the contribution of E&E subsector based on the Malaysian export data from 1965 (shortly after Malaysia's independence from Great Britain) to 1990, when the sector started forming significant linkages with MNCs. The data reveal that the E&E subsector contributed very little to Malaysia's exports during the 1965–1970 period. However, E&E exports in 1975 recorded an improved contribution to national exports, at about 6 per cent. The subsector grew substantially between 1980 to date. Many studies of the E&E subsector in Malaysia have attributed this growth to the presence of MNCs in the country (Tham 2004; Giroud 2007; Giroud and Mirza 2010; Tham and Loke 2011). For an overview of the growth of Malaysia's E&E subsector, see **Figure 16**.

Figure 16: Growth of Malaysia's E&E Subsector from 1965 to 1990

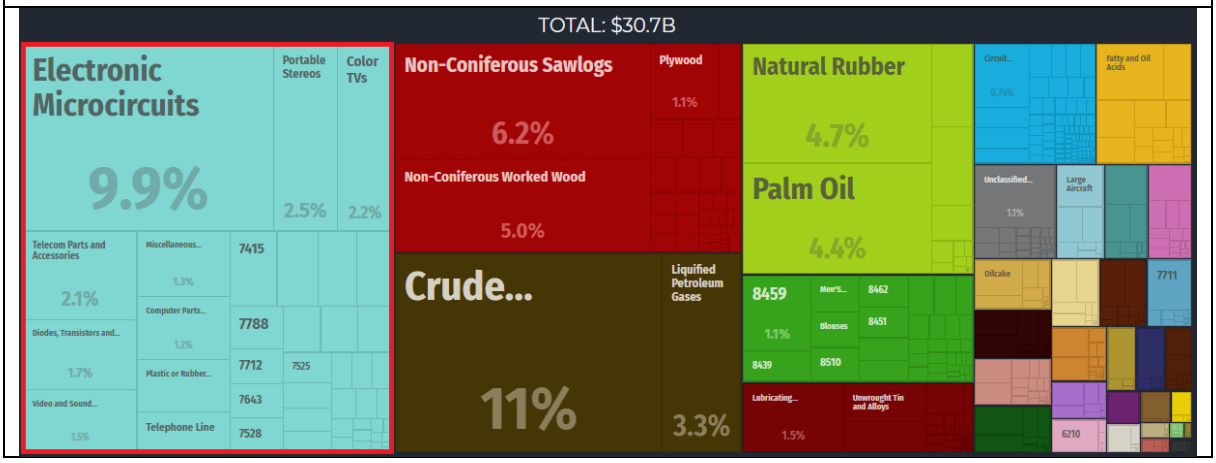
Malaysia's 1965 Exports



Malaysia's 1980 Exports



Malaysia's Exports 1990



*Source: Retrieved from https://oec.world/. Note: The **red border** highlight shows the total E&E exports in Malaysia in the given periods.*

The Malaysian E&E subsector has been shown to have attracted the highest level of knowledge transfer from its MNC customers, in comparison to the other subsectors, such as the garment and textiles subsector (Giroud and Mirza 2010).

In conclusion, Malaysia's E&E subsector is very diversified and demonstrates substantial global competitiveness, as demonstrated in Malaysia's export data. The growth of the subsector can largely be attributed to the presence of many MNCs within the same subsector. In this way, local Malaysian E&E firms have benefited from knowledge and technology transfer from their locally based MNC customers. Put differently, the backward linkages formed between MNCs and local firms in the E&E sector have fostered, through learning, the development of know-how in the local firms, subsequently contributing to the growth of the E&E subsector in Malaysia.

3.4.4.3 The Plastics and Chemical Subsector in Malaysia

The chemical and petrochemical sector is the second largest contributor to the total exports of manufactured goods in Malaysia (MITI, n.d). The sector is connected to almost every other sector of the economy, such as the automotive, E&E, pharmaceuticals and construction sectors.

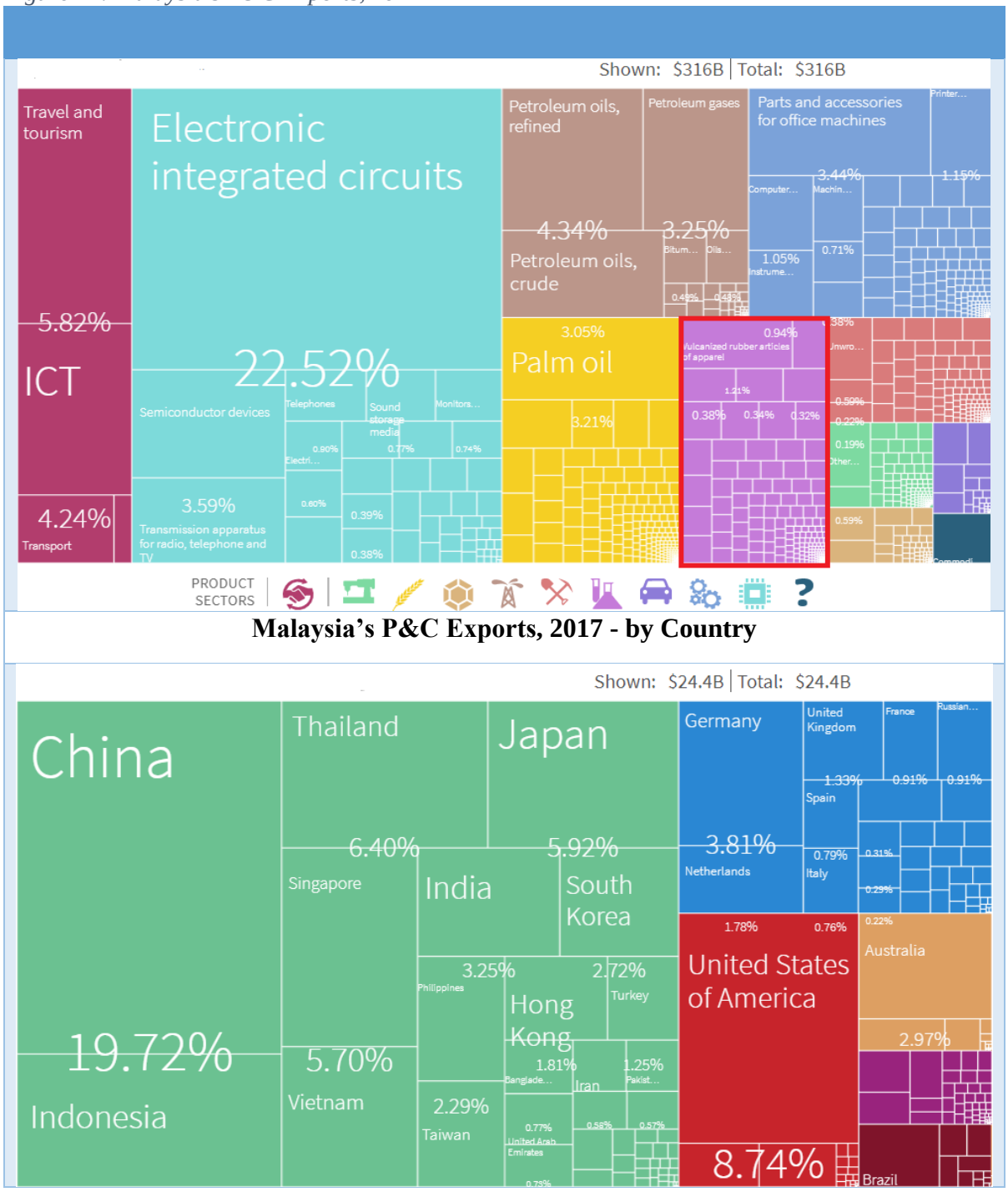
Moreover, the sector is high-technology driven and capital-intensive and requires highly trained and skilled workers for R&D, operating activities and a continuous development programme (MITI, n.d). The sector is divided into three subsectors, namely:

1. Chemicals and chemical products;
2. Petroleum products; and
3. Plastic products.

There is unanimity in the literature that the growth of the P&C subsector in Malaysia is largely attributed to the availability of oil and gas, acting as feedstock, as well as well-developed infrastructure, a strong base of supporting services, and the strategic location and network of major markets in Asia (such as ASEAN) and the Middle East. This position is confirmed by **Figure 17.**

Drawing from Malaysia's export data in 2017, we can see that out of the total exports of $316 billion, the P&C subsector contributed $24.4 billion, or approximately 8 per cent, of the total export (see Table 16). Indeed, this subsector also plays a key role in Malaysia's economic development.

Figure 17: Malaysia's P&C Exports, 2017



*Source: Retrieved from (The Growth Lab 2019). Note: The **red border** highlight shows the total P&C exports in Malaysia in 2017.*

To the best of our knowledge, we have found no studies in Malaysia addressing the role of backward linkages in the development of P&C subsector. However, we would like to conclude that this sector is closely linked to the E&E sector, and as such, the success of the E&E subsector in turn has a substantial trickle-down effect to the success, either directly or indirectly, of the P&C subsector. This position is supported by Rasiah (1995), who established that Malaysian firms benefit from the activities of MNCs, particularly in the semiconductor industry, by

specialising in auto-precision turning works, precision engineering, plastic fabrication, manufacture automation systems, precision plastic moulding products, plastic extrusion products, stamping and making moulds, tooling, die making, and packaging. Indeed, this position reflects the assertion by MITI that the P&C subsector is connected to almost every other sector of the economy, including E&E.

Overall, the success of Malaysia's P&C subsector is mainly attributed to the local availability of oil and gas, well-developed infrastructure, and market opportunities presented by ASEAN nations and the Middle East. In 2017, Malaysia's P&C subsector contributed nearly 8 per cent of total export revenue, making it one of the top export contributors in the manufacturing sector. While there is a lack of research on the role that backward linkages have played in the development of Malaysia's P&C subsector, we argue that the success of Malaysia's E&E subsector, attributed to the presence of MNCs, has played a critical role in the growth of the country's P&C subsector.

3.5 Summary: Malaysia and Kenya Compared

Malaysia, in comparison with Kenya, demonstrates a higher level of FDI inflows, that is, as of 2015, Malaysia registered FDI inflow of around $11 billion as compared to $ 1.4 billion registered by Kenya in the same period. Moreover, when examining export diversification, Kenya's exports are less diversified and largely agriculturally based; however, ICT is emerging to be an important export contributor. On the other hand, Malaysia's export basket is significantly diversified, with the largest share of manufacturing exports originating from the E&E sector. Regarding the manufacturing industry, Malaysia rates higher than Kenya, at 24 per cent and 8.4 per cent, respectively, with the E&E subsector as the largest contributor. In Kenya, food and beverages are the highest contributors to manufacturing.

Concerning the role of backward linkages from MNCs on the development of the manufacturing sector, we can establish that Kenya's manufacturing has a lower level of linkages from MNCs in comparison to Malaysia. However, the impact of these linkages to the manufacturing sector of both countries is positive. Both the Kenyan and Malaysian manufacturing sectors present evidence of technology and knowledge transfer from MNC affiliates. Both countries also reveal that knowledge and technology acquisition by local firms occurs through a learning process whereby the skillsets and absorptive capability within local firms largely determine the successful adoption of external know-how.

It is also established that the E&E subsector in Malaysia, in comparison with that of Kenya, is very established. In this regard, Malaysia's E&E subsector contributes about 20 per cent of manufacturing output while Kenya's E&E subsector accounts for only 1 per cent of total manufacturing. While Malaysia's E&E subsector is very diversified, its Kenyan counterpart is not, and it is largely dominated by low-value-added and cheaper products. As with manufacturing in general, there is evidence of knowledge and technology transfer from MNCs to local firms within the E&E subsector in both countries. The acquisition of this knowledge and technology also occurs through learning processes.

The contribution of the P&C subsector to manufacturing is higher in Kenya, at approximately 20 per cent, compared to Malaysia's 13 per cent. There is evidence of product diversification in this subsector in both countries. Although we did not find any studies in Malaysia supporting knowledge transfer from MNCs to local firms in the P&C subsector, such evidence was present in Kenya. **Table 18** presents the highlights of the chapter summary.

Table 11: Summary of Cases – Kenya and Malaysia

Item	Kenya	Malaysia
FDI inflows	Low	High
Export diversification	Low (predominantly agricultural, with ICT upcoming)	High (predominantly the E&E subsector)
Manufacturing industry	Low at 8.4% (2017)	High at 24% (2015)
Role of backward linkages from MNCs	Positive: Evidence of knowledge and technology transfer	Positive: Evidence of knowledge and technology transfer
Channel of knowledge transfer	Learning	Learning
E&E subsector	Small (1% of manufacturing output) Less diversified Evidence of knowledge transfer from backward linkages from MNCs Learning process	Large (20% of manufacturing output) Very diversified Evidence of knowledge transfer from backward linkages from MNCs Learning process
P&C Subsector	Accounts for approx. 20% of manufacturing output Diversified Evidence of knowledge transfer from backward linkages from MNCs Learning process	Accounts for approx. 13% of manufacturing output Diversified Evidence of knowledge transfer from backward linkages from MNCs Learning process

Source: Author's compilation, 2019.

We have established that manufacturing firms that are supplying MNCs, in both Kenya and Malaysia, benefit from knowledge and technology transfer. The message revealed here is that through interacting with MNCs, local firms in both countries can potentially shift from the production of low-value-added goods to high-value-added goods (accumulation of production capabilities). This phenomenon can be explained through a nexus of two theoretical perspectives: the new trade theory of backward linkages and the theory of the firm. We witness the presence of MNCs that often demand diversified inputs/goods at reasonable prices. The prohibitive cost of importing these inputs/goods forces them to source among the local firms in

Kenya or Malaysia. Realising this, local firms engage in internal strategies for effective and efficient production and more quality control to meeting the quality demands of their MNC customers. This increase in demand for inputs/goods from MNC customers allows local host firms to attain economies of scale, meaning that they will charge reasonable prices on their products and thus appeal to their price- and quality-sensitive MNC clients. Over the supply interactions, MNCs have the incentive to train or engage their local suppliers in joint designs, and this allows MNCs to minimise costs associated with quality controls. Through the learning process, and dependent on internal skillsets and absorptive capability, local host firms accumulate know-how that potentially allows them to move from the production of low-value-added goods to high-value-added goods.

Chapter 4: Proposed Methodology

In December 2018, the current researcher launched an online survey (via SurveyMonkey) for cross-sectional data collection. The production capability accumulation model was built upon the quantitative evidence base assembled via the cross-sectional data of firms within the E&E and P&C sectors in Kenya and Malaysia. To further explain the quantitative results, this study used qualitative research. As such, mixed methods data collection facilitated the understanding of the causes of production capability in firms across the selected sectors in Kenya and Malaysia, where learning from their MNC customers appeared to be an important component. Specifically, the method enabled the current study to address the following research question: *Do local firms that interact with MNC customers increase their changes of shifting from the production of low-quality products to high-quality ones?*

4.1 A Mixed Methods Approach to Production Capability Accumulation

A mixed methods approach is a procedure for collecting, analysing and integrating both quantitative and qualitative data at some stage of the research process within a single study (Creswell et al. 2011). Indeed, this method is very intuitive, whereby a researcher collects numeric data and a story and combines the two. The rationale for mixing both quantitative and qualitative of data is that neither of the methods is sufficient by themselves in capturing the trends and details of situations, such as the complex matter of a firm's accumulation of production capability. Indeed, such use of the results from a qualitative study to inform a quantitative survey is said to *enhance the sensitivity* and accuracy of the survey questions (Jones-Harris 2010).

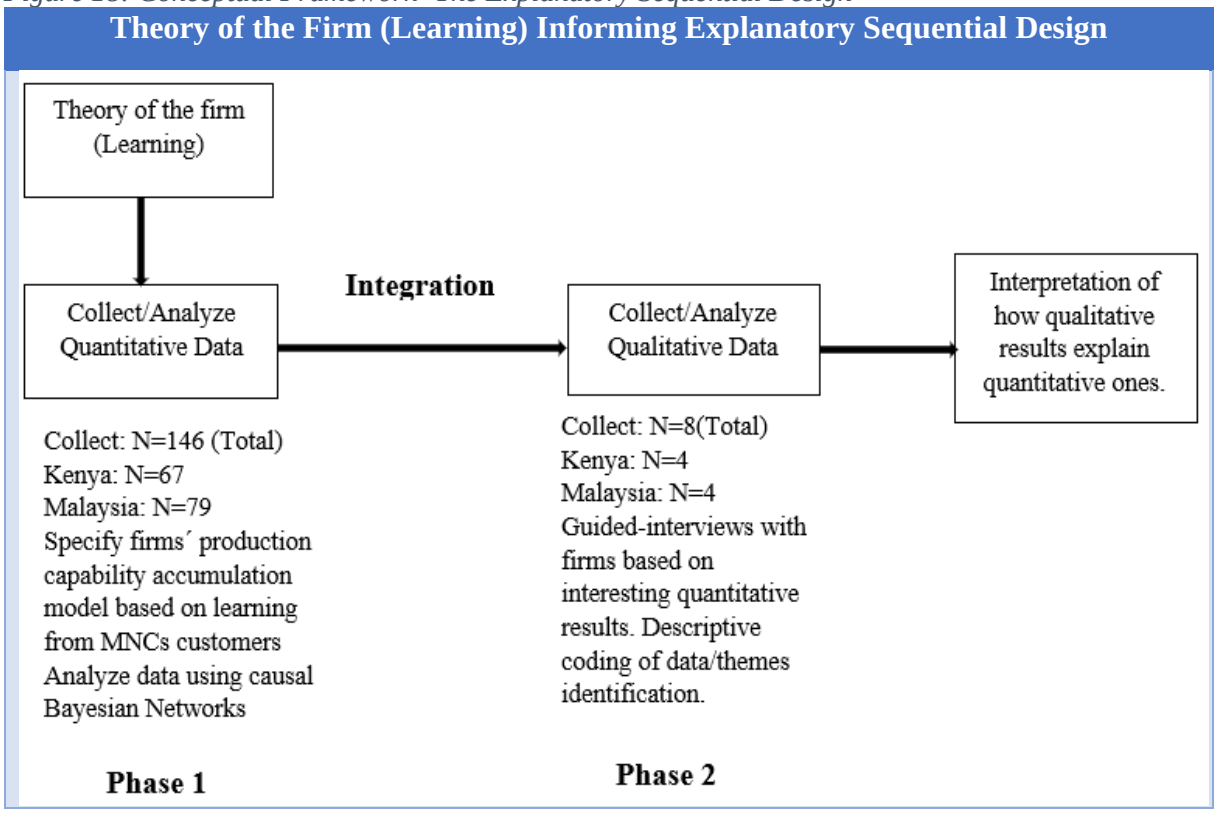
4.1.1 Mixed Methods Designs: Which One?

Mixed methods designs are procedures for conducting mixed methods research. This is a widely discussed topic in the mixed methods literature. Creswell and Plano Clark (2011) reviewed twelve different classification schemes of designs that researchers use in mixed methods. Their findings uncovered different names, different fields and different approaches used, and therefore mixed methods design has become a complex issue. To mitigate this complexity, Creswell and Plano Clark (2011) reduced all twelve designs down to three basic models. They found that each of the three basic models could be applied in many settings. Moreover, Creswell (2014a) has demonstrated design as a lynchpin, that is, as a way to connect many parts of a research process. The three designs include: 1) *convergent design*, where a researcher gathers qualitative and quantitative data and merges the two to make an interpretation; 2) *explanatory sequential*, where a researcher starts with the qualitative data collection, comes up with the results, and then follows with the qualitative data collection, for example, via interviews or

focus groups, in order to explain the quantitative results in more detail; and 3) *exploratory sequential design*, where a researcher starts qualitatively and then develops something that can be used for the quantitative phase, such as new variables. It involves a three-phase model with the intention to first explore before building into a quantitative phase.

This study used explanatory sequential design, because the study itself is built upon an already existing theory. This theory informs the quantitative data collection (see **Figure 18** for a diagram of the theory informing an explanatory sequential design in the study).

Figure 18: Conceptual Framework- The Explanatory Sequential Design



Source: Author's compilation, 2019

4.1.1.1 Explanatory Sequential Design

This design consists of two distinct phases: a quantitative phase and a qualitative one (Creswell and Plano Clark 2011; Creswell et al. 2011; Creswell 2014b). In this design, the quantitative (numeric) data is collected and analysed first, while the qualitative (text) data is collected and analysed second, in a sequence. The qualitative phase offers a more detailed explanation for the quantitative results obtained in the first phase.

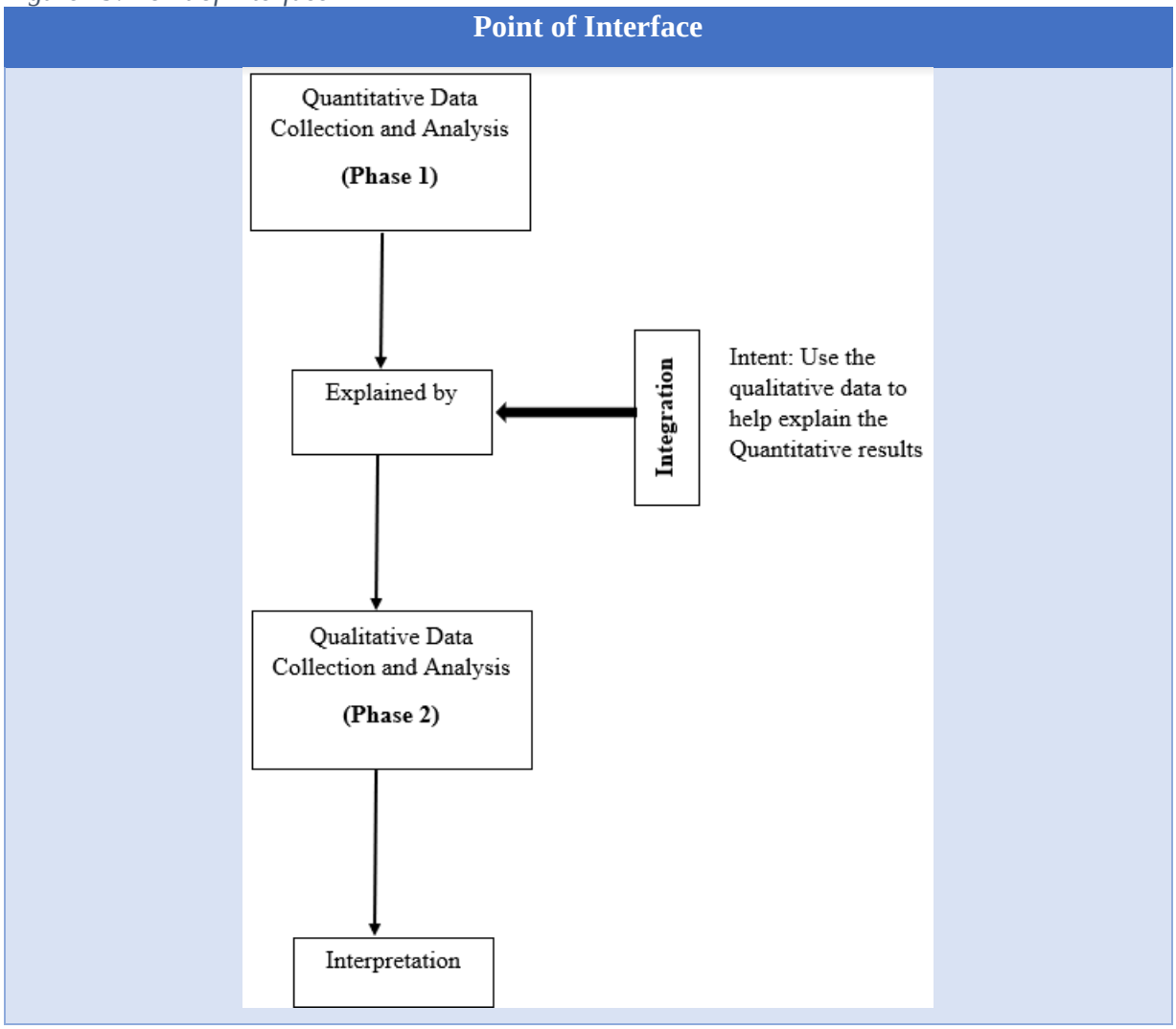
In the current study, the quantitative data helped to identify the potential causal effects of selected variables on a firm's production capability accumulation. Moreover, the data helped to establish the probabilities of firms to accumulate production capability as well as purposefully

select firms for the second phase. Next, qualitative cases were used to explain why certain firms, tested during phase one, had a higher level of production capability while others had a lower one. Thus, the quantitative data and results provided a general picture of the research problem, while the qualitative data and its analysis helped to explain the qualitative results by exploring, among other things, the firms' actions that led to the accumulation of production capability in more depth.

The quantitative and qualitative phases were connected. In that, the selection of the eight (8) firms for qualitative research and the development of the interview guide was based on the results from the quantitative phase.[35] The results of the qualitative and quantitative phases were also integrated, during the discussion of the outcomes of the entire research project (see **Figures 19** and **20** for a diagram of the point of integration and the mixed methods sequential explanatory design procedures, respectively, in the current study).

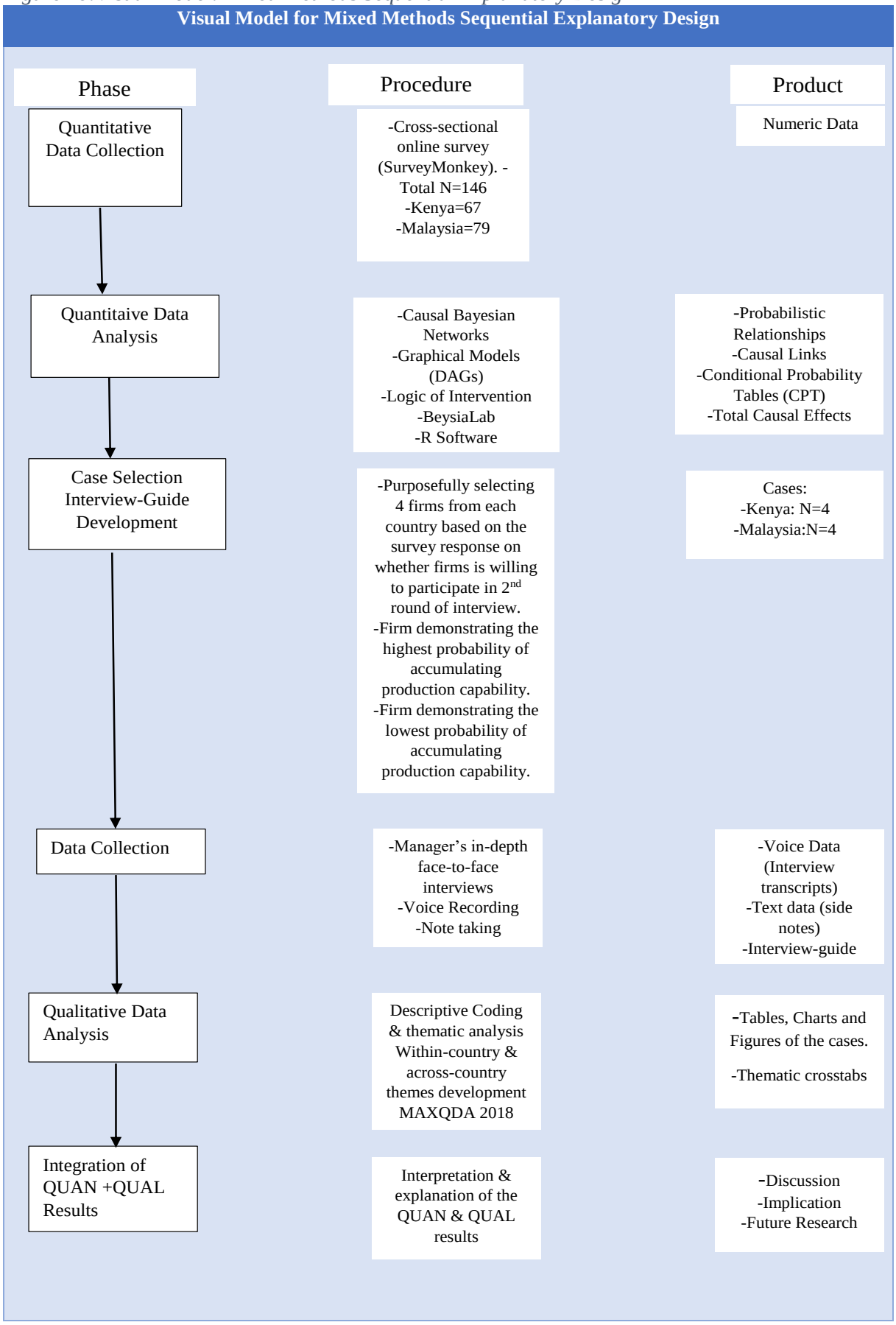
[35] For similar approach, see Fetters et al. (2013) and Plano-Clark and Ivankova (2016).

Figure 19: Point of Interface



Source: Author's compilation, 2019

Figure 20:Visual Model: Mixed Methods Sequential Explanatory Design



Source: Author's compilation, 2019

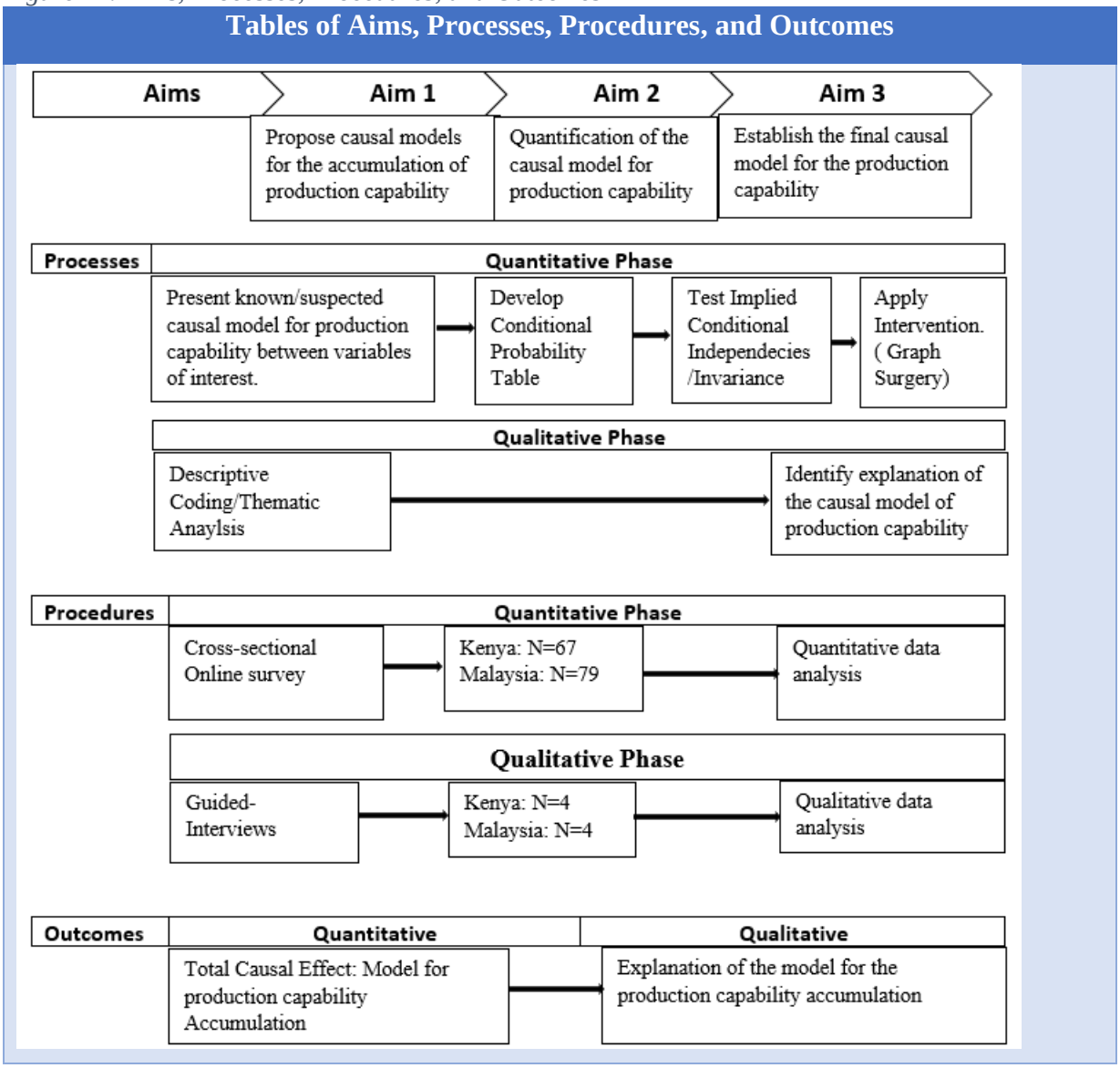
For a summary of the quantitative and qualitative implementation strategies as well as the study aims, see **Figures 21** and **22**.

Figure 21:Implementation Strategy: Quantitative and Qualitative Phases

Strategy	Sample	Goal	Analysis
Survey	Purposefully selected sample (based on E&E and P&C sectors in Kenya and Malaysia)*	Specify a causal model for production capability accumulation	Causal Bayesian Networks
Guided Interview	-Purposive: 4 firms from Kenya and 4 firms from Malaysia -Firms demonstrating, in the survey, a willingness to participate in a second round of interviews -Firms with a high probability of production capability accumulation - Firms with low probability of production capability accumulation**	Identify an explanation for the causes of production capability accumulation	Hypothetico-deductive method.

*Source: Author's compilation, 2019. Note: * E&E and P&C refer to the electronics & electricals and plastics & chemicals sectors, respectively. **This is in reference to the survey's quantitative results.*

Figure 22: Aims, Processes, Procedures, and Outcomes



Source: Author's compilation, 2019.

In sum, the above section has presented the mixed methods approach, applying an explanatory sequential design. We have also established our conceptual framework, referring to the explanatory sequential design. Additionally, we have highlighted our point of inference, which guides our interpretation of the quantitative and qualitative results. Finally, we have established the implementation strategy. The section that follows outlines the decided-upon implementation strategy.

4.2 The Quantitative Phase

Methodology and Data

Strategy

The current study models the shift by local companies from the production of low-value-added goods to high-value-added goods (hereafter referred to as production capability accumulation). The expected output is used to establish a causal model for production capability accumulation. First, the researcher specifies a suspected causal diagram based on the existing scientific knowledge. Particularly, we use Bayesian networks to specify the causal effect of backward linkages from MNCs on the accumulation of production capability by local firms in the host country.[36] Note that causal diagrams are simply node-and-arrow pictures that summarise existing scientific knowledge. The nodes represent variables of interest, and the arrows represent known or suspected causal relationships between those variables. In the words of Judea Pearl, it translates to a depiction of which variable "listens" to which others (Pearl and Mackenzie 2018:7). A causal diagram that contains both directed and acyclic arrows is called a directed acyclic graph (DAG).[37] Second, the researcher conducts the quantification of the causal effects using data collected from Kenya and Malaysia's E&E and P&C subsectors. The reviewed literature above has led to the identification of a structural learning problem in the sense that the causal model for a firm's production capability accumulation is built on suspected causal relations between variables. We establish a variable in the causal model that is expected to be predictive of, but not necessarily causal of, the associated variable.

Before proceeding with the data analysis, the following section offers a description of Bayesian networks analysis.

4.2.1 Bayesian Networks Analysis

Bayesian networks analysis is an advanced but nevertheless intuitive method that combines statistical analysis with a graphical presentation of the links between variables. In the words of Heckerman (1997), Bayesian networks offer a graphical model for probabilistic relationships among a set of variables. The current study chose Bayesian networks for several properties that can be useful in the context of production capability accumulation. First, Bayesian networks analysis is flexible, which is important when testing the theory behind intervention. Rather than simply measuring the statistical significance of correlations between dependent and

[36] A definition and discussion of Bayesian networks is provided in the following section.

[37] DAG will occupy much of our discussion of causality in the rest of this research. We make free use of the terminology of kinship (for example, parents, children) to denote various relationships in a graph. These kinship relationships are defined along the full arrows in the DAG.

independent variables, Bayesian network analysis can uncover the system of causal links within the network of variables, which in conventional statistical models could be either dependent or independent. Thus, Bayesian networks analysis is an innovative tool to explore the mechanisms underlying the change induced by a policy instrument, and in the context of the current study, a policy for a firm's production capability accumulation.

Formally, Bayesian networks (BNs), denoted as $B = (G, \Theta)$, are probabilistic graphical models that have two components (Russell and Modern 2003; Neapolitan and others 2004; Pearl 2009):

1. A network structure, a directed acyclic graph (DAG), denoted by $G = (V, A)$ in which each node $v_i \in V$ corresponds to a random variable X_i. In particular, the DAG consists of directed edges $a_{ij} \in A$ connecting the set of nodes (random variables) $X_1, X_{2,\dots} X_n$.[38] An edge from $X_i \; to \; X_j$ denotes that a value taken by the variable X_j depends on the value taken by variable X_i. Node X_i is referred to as a parent of node X_j. Similarly, node X_j is referred to as a child of node X_i. Thus, a DAG represents a network of links between variables (represented by nodes) and serves as a basis for inference in causality between variables.
2. A set of parameters, denoted by Θ, provides dependencies among the nodes in the form of probability distributions. The local probability distributions can be either *marginal*, for nodes without parents, or *conditional*, for nodes with parents. In the latter case, the dependencies are quantified by conditional probability tables (CPT) for each node, according to its parents in the DAG.[39] The table lists the probability of a child node X_j taking each of its values for each value of its parent X_i, that is, $P\left(X_j = x_j \middle| X_i = x_i\right) = \Theta_{x_j|x_i}$). Note that if X_j has more than two parents, it depends on their joint distribution since each pair of parents forms a convergent connection centred on X_j. In this case, the probability of X_j can be calculated using the chain rule given the topological ordering of X_i. In general, this rule states that if we have a set of n variables, $X_1, X_2, \dots X_n$, then the probability of joint variables $(X_1, X_2, \dots X_n)$ can be written as a product of n conditional probabilities:

[38] Where ***V*** is the *node* (or *vertex*) *set* and ***A*** is the *arc* (or *edge*) *set.*

[39] Even though Bayesian networks can handle continuous variables, the current study discusses Bayesian networks with discrete nodes exclusively. Such nodes can correspond to categorical variables, numerical variables with discrete values or discretised continuous variables.

$$P(X_1, X_2, \dots X_n) = P(X_n|X_{n-1}, \dots, X_2, X_1) \dots P(X_2|, X_1)P(\ X_1) \quad (1)$$

The chain rule probability calculus equation (1) permits us to decompose P as a product of n conditional distributions:

$$P(x_{1,} \dots, x_n) = \prod_j P(x_j|x_1, \dots, x_{j-1}) \quad (2)$$

Suppose that the conditional probability of X_j is not sensitive to all the predecessors of X_j but only to a small subset of those predecessors. Put differently, suppose that X_j is independent of all other predecessors once we know the value of a selected group of predecessors, called parents PA_j. One can then write

$$P(x_j|x_1, \dots, x_{j-1}) = P(x_j|pa_j) \quad (3)$$

in the product of equation (2), which considerably simplifies the input information required. Instead of specifying the probability of X_j conditional on all possible realisations of its predecessors $x_1, \dots, x_{j-1}$, one only needs to focus on the possible realisations of the set PA_j. The set PA_j is called the Markovian parents of X_j, or parents for short (Pearl 2009).[40] The reason for the name will be clarified when we build a DAG, based on the survey data and obtained using BayesiaLab software, around this concept.[41]

In the simplest scenario, the Bayesian networks analysis is defined by an expert who specifies the DAG and for every node X_i, the local distribution for X_i conditional upon the related nodes (variables). In more complex applications, the network structure and parameters must be learned from data, which is pursued within machine learning with the application of data-driven learning algorithm(s).

[40] Given a qualitative Bayesian network structure, the conditional probability tables $P(x_j|pa_j)$ are typically estimated with the *maximum likelihood approach* from the observed frequencies in the dataset associated with the network (Conrady and Jouffe 2015).

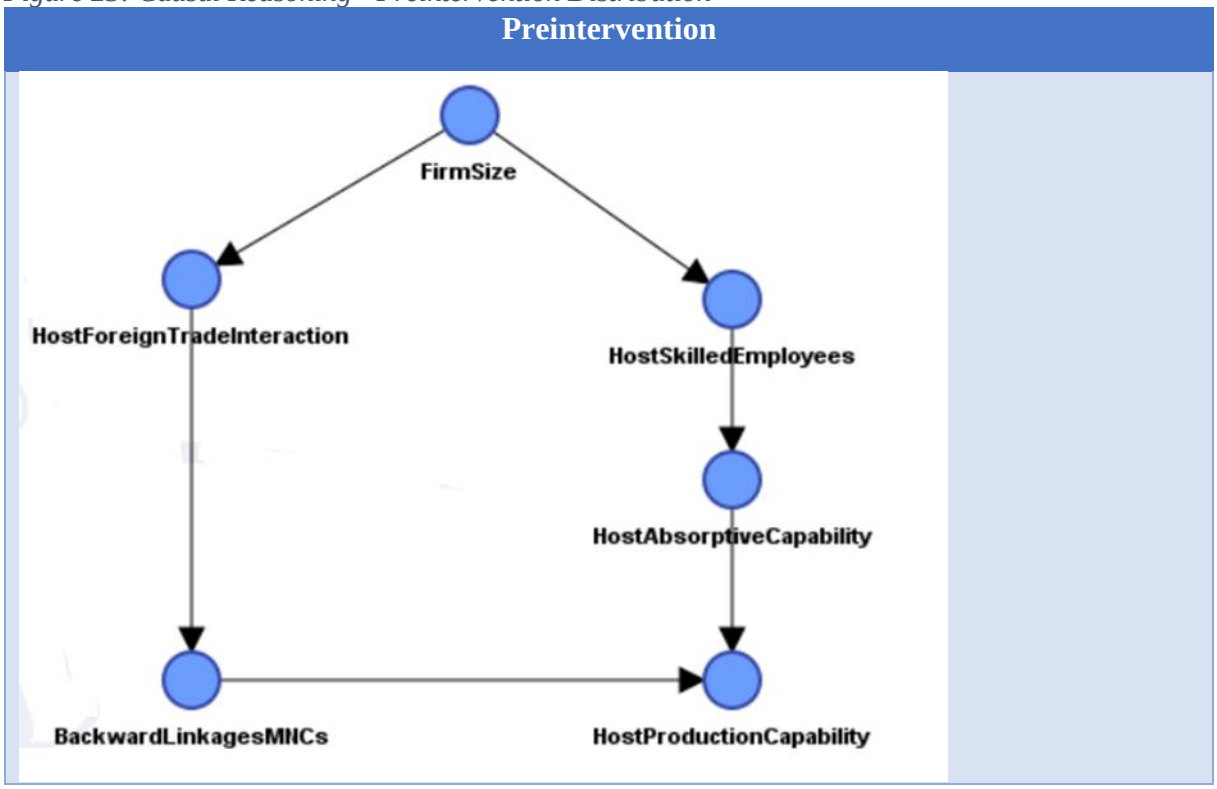
[41] BayesiaLab is a desktop application with a sophisticated graphical user interface, providing scientists with a comprehensive "laboratory" environment for machine learning, knowledge modelling, diagnosis, analysis, simulation and optimisation.

Note that in the former case, an expert can also specify a DAG and generate local distribution for X_i using one or more data-driven learning algorithms, in that Bayesian networks are designed from expert knowledge and include hyperparameter nodes. Data is then used as pieces of evidence for incrementally updating the distributions of the hyperparameters.[42] This study adopts BayesiaLab and combines expert knowledge with survey data.

4.2.2 Bayesian Networks and Causal Reasoning

Often, probabilistic models, including general Bayesian networks, describe a joint probability distribution (JPD) over possible observed variables (events) but ignore what will happen if a certain intervention occurs. For instance, what if we make local firms in Kenya and Malaysia form *backward linkages with locally based MNCs* (X_1) instead of just observing that these firms have the linkages? What effect does that have on the local firms' *production capability accumulation* (X_2)? Intuitively speaking, a causal network is a Bayesian network with the added property that the parents of each node are its direct causes, as in **Figure 23**.

Figure 23: Causal Reasoning - Preintervention Distribution



Note: Let BackwardLinkagesMNCs, HostproductionCapability, HostFirmAbsorptiveCapability, HostSkilledEmployees, Firmsize, and HostForeignTradeInteractions be represented by X_1, X_2, X_3, X_4, X_5, and X_6 respectively.

In such a network, the result of an intervention is obvious: the *BackwardLinkagesMNCs* node is set to $X_1 = Yes$ and the causal link between the HostForeignTradeInteractions X_6 and the

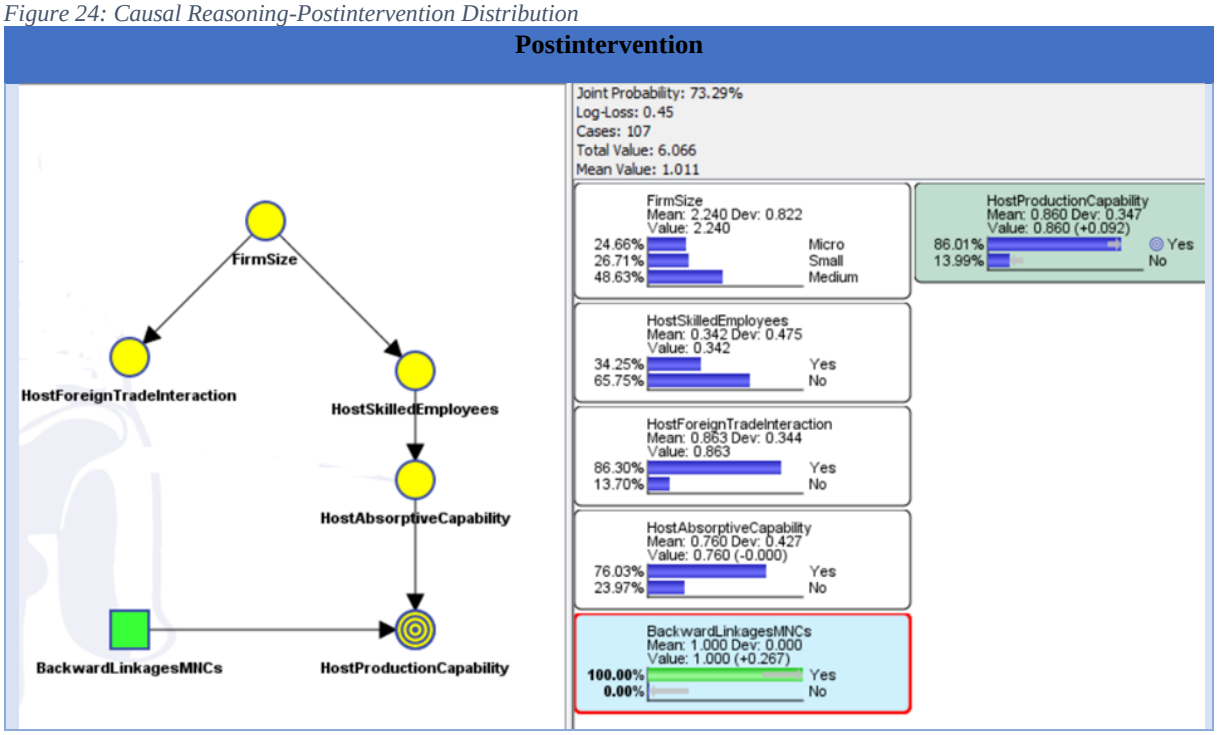
[42] A hyperparameter, as used in machine learning, is a parameter whose value is set before the learning process begins.

BackwardLinkagesMNCs X_1 is removed (**Figure 24**). All other causal links and conditional probabilities remain intact, so the new model is

$$P(X_1, X_2, X_3, X_4, X_5, X_6) = P(X_2|X_3, X_1 = Yes)P(X_3|X_4)\ P(X_4|X_5)P(X_5)P(X_6|X_5) \quad (4)$$

Note that this differs from observing that $X_1 = Yes$, which would result in a new model that includes the term $P(X_1 = Yes|X_6)$. This reflects the difference between seeing and doing: After observing that the local firms have formed backward linkages with MNCs, $X_1 = Yes$, we wish to infer, for example, that local firms accumulate production capability.

Figure 24: Causal Reasoning-Postintervention Distribution



Note: Let BackwardLinkagesMNCs, HostproductionCapability, HostFirmAbsorptiveCapability, HostSkilledEmployees, Firmsize, and HostForeignTradeInteractions be represented by X_1, X_2, X_3, X_4, X_5, *and* X_6, *respectively.*

In sum, causal networks are better defined as Bayesian networks in which the correct probability model, after intervening to fix the value of any node (or variable), is given simply by deleting links from the node's parents. In a causal networks model, the environment is a collection of stable component mechanisms. Such mechanisms may be reconfigured locally by interventions, with corresponding local changes in the model. Ultimately, this allows causal networks to be used naturally for prediction by an agent who is considering different courses of action (Conrady and Jouffe 2015). The action of intervening to fix a value on any variable is what Pearl (2009) describes as the do-operator, $do(.)$.

Once a DAG has been constructed, it becomes useful to a researcher only when it is attached to data. The following section describes the process of data collection and highlights the most important variables used for this analysis.

4.3 Survey Design

4.3.1 The Sample Frame

The sample frame was based on two distinct lists, namely the manufacturers and exporters directory owned by Kenya Association of Manufacturers (KAM) with a total of *1,072 firms*, and the Malaysian Products Directory compiled by the Malaysia External Trade Development Corporation (MATRADE) with *11,466 firms* listed.[43] Both directories have a considerable advantage. The former commands a readership of at least two million and has established itself over the years as the most respected, preferred and referenced business directory in Kenya, EAC and COMESA (KAM, 2018).[44] The latter is a very comprehensive directory and a useful tool in marketing Malaysian exporters abroad.

The Kenyan sample frame contained the name, postal address, phone numbers, fax, email addresses and website of each company, plus their basic activities, sector and region. Meanwhile, the Malaysian sample frame included the name, business address, factory address, telephone, facsimile, email, website, registration number and incorporation date of each firm. Additional information included the type of business, business enquiry contact, designation, certification/award and product(s) of each firm.

The KAM directory, in comparison to the MATRADE directory, has a lower number of listed companies. Moreover, both sample frames listed not only firms in the manufacturing sectors but also some firms in the service sector. This information is necessary in drawing the sample for three reasons: (1) the current research wanted to exclude firms in the service sector because the main aim is to investigate firms in the manufacturing sector; since (2) the manufacturing sector as a whole is too broad for a detailed investigation, the current study focused on two manufacturing sectors that exhibit a potential for growth, extensive linkage formations, and a world market advantages; and (3) if the proportion of manufacturing firms in the targeted sectors proved to be low, or there was a greater risk of getting sufficient responses due to the use of an online survey tool, then a purposive sampling of these firms might prove necessary.[45]

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[43] See KAM (2018) and MATRADE Directory (2018).
[44] EAC and COMESA stand for East African Community and Common Market for Eastern and Southern Africa, respectively.
[45] Manufacturing is important for the prosperity of an economy for four main reasons: the productivity contribution, the jobs contribution, the technology contribution and the trade contribution. For an elaborate discussion on manufacturing, see Greenhalgh and Gregory (1997).

The latter proved to be true for Kenyan firms in the *electronics and electrical (E&E) sector* and in the *plastics and chemicals (P&C) sector*, and therefore the *total population* of the firms in these sectors was considered for the sample. The need to adopt a homogenous sampling method in the two countries influenced the decision to apply a uniform sampling method to the two sampling frames.[46]

4.3.2 The Sample

4.3.3 Malaysia: E&E Industry

The Malaysia External Trade Development Corporation (MATRADE) has compiled a comprehensive directory, listing firms according to sectors. Regarding the E&E sector, MATRADE groups this sector into three categories, namely *E&E components, consumer and industrial E&E products*, and *computer hardware*. The three categories form the sampling frame for the current study. Selecting the sample from the sampling frame involved a key criterion: only local firms engaged in manufacturing subsectors were considered for the sample. **Table 19** below provides a breakdown of the three categories in terms of the subsectors.

Table 12: Structure of the Malaysian E&E Industry by Subsector

	Trading Firms	Manufacturers	Service Providers	Total
E&E Components	77	**192**	32	301
Consumer and Industrial E&E products	192	**241**	73	506
Computer Hardware	33	**26**	35	94
Total	302	**459**	140	**901**

Source: Author's compilation 2019. Data from MATRADE Products Directory, Malaysia.

As shown in the **Table 19**, a total of *459* E&E manufacturing firms were selected as a sample by the current study, from a sampling frame containing *901* E&E firms. The sample represented *50.9 per cent* of the total number of E&E firms listed in the sampling frame.

4.3.4 Malaysian: P&C Industry

As demonstrated in **Table 20** below, from a total of *607* P&C firms in the sampling frame, *405* firms were selected as a sample by this study. The selection criterion applied was similar to that used for the E&E sector.

[46] A purposive sample refers to a non-probability sample that is selected based on the characteristics of a population and the objective of the study. A total population sampling is a type of purposive sampling where a researcher chooses to examine the entire population that has one or more shared characteristics.

Table 13: Structure of the Malaysian P&C Industry by Subsector

	Trading Firms	Manufactures	Service Providers	Total
Plastics	29	**143**	5	177
Chemicals, Mineral and Allied	149	**262**	19	430
Total	178	**405**	24	**607**

Source: Author's compilation, 2019. Data from MATRADE Products Directory, Malaysia.

Overall, the current study included a total of *864* firms, or *57.3 per cent* of the P&C firms in the sampling frames in the Malaysian sample.

4.3.5 Kenya: E&E Industry

The KAM manufacturers and exporters directory merges the E&E and energy sectors into a single category comprising 55 firms. While in general these two sectors are complementary, their merger could have been due to the lower number of local manufacturing firms registered in both sectors.

Table 14: Structure of the Kenya E&E Industry by Subsector

Sector	Manufacturers	Service Providers*	Trading Firms	Energy Production
Energy	0	4	0	13
E&E	**33**		5	0

*Source: Author's compilation, 2019. Data from Manufacturers and Exporters Directory, KAM, Kenya. *Includes firms in both energy and E&E sectors.*

As demonstrated in **Table 21**, a total of *33* E&E manufacturing firms, or *60 per cent* of the firms listed under the energy and E&E sectors, was included in the sample in the current study.

4.3.6 Kenya: P&C Industry

In compiling the manufacturers and exporters directory, KAM divides the P&C sector into different categories, namely plastics and rubber, and chemicals and allied industry. Under the plastics and rubber category, 83 firms are listed, of which 11 firms belong to the rubber sector. The rubber sector is excluded in the sample. The remaining 72 local firms are all involved in plastics manufacturing. Regarding chemicals and allied industry, 84 firms are listed with only 1 (one) firm engaged in service providing and the rest in manufacturing. Therefore, a total of

155 P&C local firms are included in the sample. **Table 22** below gives a summary of the P&C sector in Kenya.

Table 15:Structure of the Kenya P&C Industry by Subsector

Sector	Manufacturers	Service Providers	Total
Plastics	**72**	0	72
Rubber	11	0	11
Chemicals and Allied	**83**	1	84

Source: Author's compilation, 2019. Data from Manufacturers and Exporters Directory, KAM, Kenya. Bold indicates the sector and subsector of interest.

In sum, the purposive sampling has limited the scope of the current research to the following delineations: first, 459 E&E and 405 P&C manufacturing firms in Malaysia, and second, 33 E&E and 155 P&C manufacturing firms in Kenya. The sample did not contain information on how the E&E and P&C firms of both countries form linkages with locally based MNCs.[47]

Firms may or may not form linkages with MNCs. Linkages with MNCs can take the form of local firms supplying intermediate products to MNCs (backward linkages) or the buying of inputs from MNCs (forward linkages).

The following section discusses the adopted variables and their measurements. This information is necessary as it allows for data collection and subsequent model quantification.

4.3.7 Variables and their Measurements

4.3.7.1 Backward Linkages from MNCs

Backward linkages from MNCs form an economic interaction by which firms in the host country supply inputs/goods to MNCs (Huang 2001; Mario 2016). At the firm-level analysis of backward linkages from MNCs, case studies (Giroud and Scott-Kennel 2009; Rugraff and Hansen 2011; Giroud et al. 2012; Monge-González et al. 2015; Amendolagine et al. 2017), have mainly relied on survey questions such as "*does this firm supply products to MNCs?*" in order to capture the intensity of backward linkages from MNCs. In this context, the current study asks

[47] A multinational corporation (MNC) is a firm that owns and controls production facilities or other income-generating assets in at least two countries. When a foreign investor begins a green-field operation (i.e., constructs new production facilities) or acquires control of an existing local firm, that investment is regarded as a direct investment in the balance of payments statistics. An investment tends to be classified as direct if a foreign investor holds at least 10 per cent of a local firm's equity. This arbitrary threshold is meant to reflect the notion that large stockholders, even if they do not hold a majority stake, will have a strong say in a company's decisions and participate in and influence its management. Hence, to create, acquire or expand a foreign subsidiary, MNCs undertake FDI.

firm managers whether they supply inputs/products to locally based MNCs. It is expected that this measure will capture the existence or non-existence of backward linkages with MNCs. As will be demonstrated elsewhere in this study, the latter question forms a variable that takes the value of one if the local E&E and P&C firms sell to foreign-owned firms in the specific period, or otherwise a value of zero. The expectation of the current study is that local E&E and P&C firms supplying inputs/intermediate products to MNCs have a higher level of accumulating productive capabilities, as compared to the level of productive capabilities accumulation of local E&E and P&C firms not supplying inputs/intermediate products to MNCs.

4.3.7.2 Production Capability Measurements

Due to its multidimensional nature, the concept of production capability cannot readily be observed. However, there are methods of measuring product complexity and diversification using survey questions. For example, Falk (2015) used the comprehensive measure of technological innovation, which aligns very well with our definition of production capability accumulation. The key variables in Falk's study include: "(1) the introduction of new goods or services or significantly improved versions of those already available from competitors in the market ('new products'); (2) the introduction of new or significantly improved goods or services into the market before competitors ('new market products'); and (3) the implementation of a new or significantly improved production process, distribution method or support activity for goods or services ('process innovations'). Process innovation, meanwhile, comprises three subgroups: (3a) new or significantly improved methods of manufacturing or producing goods or services; (3b) new or significantly improved logistics, delivery or distribution methods; and (3c) new or significantly improved support activities for processes, such as maintenance systems or operations for purchasing, accounting or computing" (2015:429).[48] The listed measures of production capabilities are governed by international criteria, as indicated in the OECD Oslo manual (OECD 2005). We adopt a composite measure of production capability, as used by Falk. This is because this measure captures the multidimensional nature of production capability in a comprehensive manner. For an economical representation of the joint probability function in our Bayesian analysis, we create a composite variable of production capability and then convert it to a binary variable, where "$1 = Yes$" and "$0 = No$".

[48] See also Le Bas et al. (2011) for a similar operationalisation of production capability.

4.3.7.3 Absorptive Capability Measurements

Drawing on Zahra and George (2002) and Camisón and Forés (2010), this study defines absorptive capability as the systematic and dynamic capacity that exists as two subsets of potential and realised absorptive capacities. The former captures a firm's efforts expanded in valuing, acquiring and assimilating new external knowledge. The latter reflects the firm's ability to integrate and reconfigure the existing internal knowledge and the newly assimilated knowledge and to incorporate this transformed knowledge into a firm's systems, processes, routines and operations, not only to refine existing knowledge and competences but also to create new operations and competences. These subsets demonstrate the multi-dimensional nature of absorptive capability with the challenges resting on establishing an optimal measure for this concept.

The combination of multi-dimensional measurement scales with the use of classification scales permits an expression of the judgment and experience of firm managers in subjective measurements.

The managerial self-evaluation of the firm's situation is growing as a way of measuring its resources and capabilities. Indeed, various studies demonstrate that they are convergent measurements with equivalent objective indicators (Camisón 2005). Although numerous studies use qualitative measures (that is, self-reports) that capture different dimensions and processes of absorptive capability, for example, Jansen et al. (2005) and Lichtenthaler (2009), there is no consensus in the literature regarding the operationalisation of absorptive capability (Kostopoulos et al. 2011).

Given this lack of consensus regarding the operationalisation of absorptive capability, this study builds an approach with inspiration from Escribano et al. (2009). In particular, the study builds a composite variable of absorptive capability composed of: (1) the intensity of firm's R&D expenditures, (2) the presence of employees that possess the proper qualifications to work on innovation projects, (3) qualified managers, (4) the integration of R&D, and (5) the development of patents. This composite variable has two main advantages.[49] First, it is based on R&D (expenditures and activities), which is considered to be a key feature for the conceptualisation and measurement of absorptive capability (Zahra and George 2002; Kostopoulos et al. 2011). Indeed, in their seminal work, Cohen and Levinthal (1990) posit that

[49] This study uses 4-point Likert-type self-evaluation scales, see Table (32) and Appendix (1), which reflect managers' perceptions of the strength of their firm's capacity to acquire, assimilate, transform and apply new external knowledge for each of the attributes of the construct. This procedure also has precedents in the literature surrounding idiosyncratic competencies (Camisón 2005; Hooley et al. 2005).

R&D is both a source of innovation and a reliable proxy for various capabilities that comprise absorptive capability, that is, knowledge acquisition, assimilation and exploitation. Second, the measure offers a combinative and more objective operationalisation of absorptive capability, which is frequently regarded as a necessity for an unbiased estimation of absorptive capability (Zahra and Hayton 2008; Kostopoulos et al. 2011). For a Bayesian analysis, the composite variable was later converted into binary, where "$1 = Yes$" and "$0 = No$". See **Table 23** for more detail on the absorptive capability measurements.

Table 16: Absorptive Capability Measurement

Please evaluate this firm in terms of the propositions below:				
	1.Very Low	2.Below Average	3.Average	4.Above Average
Employees possess proper qualification to work in innovation projects				
The firm heavily invests in research and development activities				
Managers have appropriate knowledge for the development of their functions				
The firm applies its accumulated knowledge to develop technology strategies				
The firm is capable of incorporating technological knowledge in patents				

4.3.7.4 Firm Size Measurements

The existing literature reveals the three most popular firm size measures, namely total assets, sales, and the market value of equity. Moreover, to the best of our knowledge, the literature has little to say about the rationale of using a certain measure of firm size in economic research. Therefore, the current study has operationalised firm size as being a firm's total annual turnover/value of sales for the 2017 financial year. A similar measure has been used to categorise firms as either small, medium or large across both Kenya and Malaysia. For more information, see **Table 24**.

Table 17: Firm Size – Malaysia and Kenya

Country	Micro	Small	Medium
Malaysia	Sales Turnover: <RM300,000 **($72,586) *** OR Employees: <5	Sales Turnover: RM300,000 **($72,586)*** <15 **($3.6M)** * mil OR Employees: From5 to <75	Sales Turnover: RM15mil **($3.6M)** * ≤ RM50 (**$12M**) * mil OR Employees from 75 to ≤ 200
Kenya	Annual Turnover: ≤KES500,000 **($4,953)*** Employees: <10 Total Assets & Financial Investment: ≤ KES10 mil **($99,060)***	Annual Turnover: KES500,000 (**($4,953) *** ≤ KES5 Mil **($49,560)*** Employees: 10≤15 Investment in Plants & Machinery: KES10 mil (**($99,060)** ≤ KES50 mil **($495,679)** *	Employees:50≤99

***Source**: Author's compilation, 2018.*

4.3.7.5 Foreign Trade Interactions Measurements

This is a variable that captures how exposed firms are to the international market.

The expectation is that the more firms are involved in foreign trade interactions, through the exports or imports of other corporations, the more likely they are to create sustained supply relationships with locally based MNCs. This is because indigenous firms with previous trade interactions with foreign firms may be more aware of and comfortable dealing with locally based MNCs, through either exports or imports.

The current study operationalises trade interactions as the ability of firms to engage in imports, exports or cooperative projects with foreign firms. Specifically, the employed survey question asks:

Does this firm engage in imports, exports or cooperative projects with other foreign investors?

This is followed by a *Yes or No* response.

4.3.7.6 Skilled Workforce Measurements

Numerous previous studies have operationalised a skilled workforce in terms of the education level of the employees, that is, primary, secondary and tertiary education (for example, see Söderbom et al. 2002; Maré et al. 2014). However, the industrial domain is progressively relying on rapid technological advances, and in order to utilise these, new competencies must be acquired by the employees to foster innovation and business success. In this context, and through the prism of globalisation, the rules of competition are redefined, and a competent workforce is the deciding factor (Karnouskos 2017). According to Barry et al. (2014), competency is a combination of attributes, such as knowledge, abilities and attitudes, which enable an individual to perform a set of tasks to an appropriate standard. In the context of this study, competent employees refer to those employees who can demonstrate acquired skills against an expected outcome of a firm. To measure this concept, the current study asks firm managers to rate their responses to the question of *how important a lack of competent employees is in their firms* using a 4-point Likert scale: *(1) not important, (2) low, (3) medium, and (4) high*. For a Bayesian analysis, the composite variable was later converted into binary, where "$1 = Yes$" and "$0 = No$".

Referring to the questionnaire, **Table 25** summarises the variables discussed above.

Table 18: Summary of Variables

Variable	Survey Question**	Measurement
Firm size	**Qtn.9 (Kenya)** **Qtn.10 (Malaysia)**	1. Micro 2. Small 3. Medium
Foreign Trade Interactions	**Qtn.12**	1. Yes 0. No
Skilled Workforce	**Qtn.34** (*sub-question 2*)	1. Yes 0. No
Backward Linkages from MNCs	**Qtn.13**	1. Yes 0. No
Absorptive Capability	**Qtn.33***	1. Yes 0. No
Production Capability	**Qtns.28 and 30***	1. Yes 0. No

** A composite variable that gives a summary of the considered variables was created. All composite variables have equal weightings (that is, each variable has an equal contribution to the new composite score). ** For survey questions**, see Appendix 1.***

4.3.8 The Survey

Due to the importance of information on the causal relationship between backward linkages from MNCs and the productive capabilities of local firms in the host country, the current study conducted a firm-level survey. Due to cost considerations, the study made use of the online platform SurveyMonkey. The survey had three main purposes that is, to determine (1) which

firms are supplying to MNCs and which are not; (2) the local characteristics of local firms and what caused them to be chosen as suppliers by the locally based MNCs; and (3) the presence or absence of production capabilities within the firms that supply/do not supply inputs and goods to locally based MNCs.

Two weeks of fieldwork in Kenya from 19th December 2018 to 9th January 2019 was conducted for piloting the questionnaire among some of the selected firms. The aim was to establish the content validity of the scores used in the instrument and to improve the questions, format and scales. For cost reasons, no fieldwork was conducted to Malaysia for piloting the questionnaire and instead online piloting through SurveyMonkey was conducted. For both Kenya and Malaysia, the comments from pilot testing were incorporated into the final instrument revisions.

4.3.8.1 Survey Response

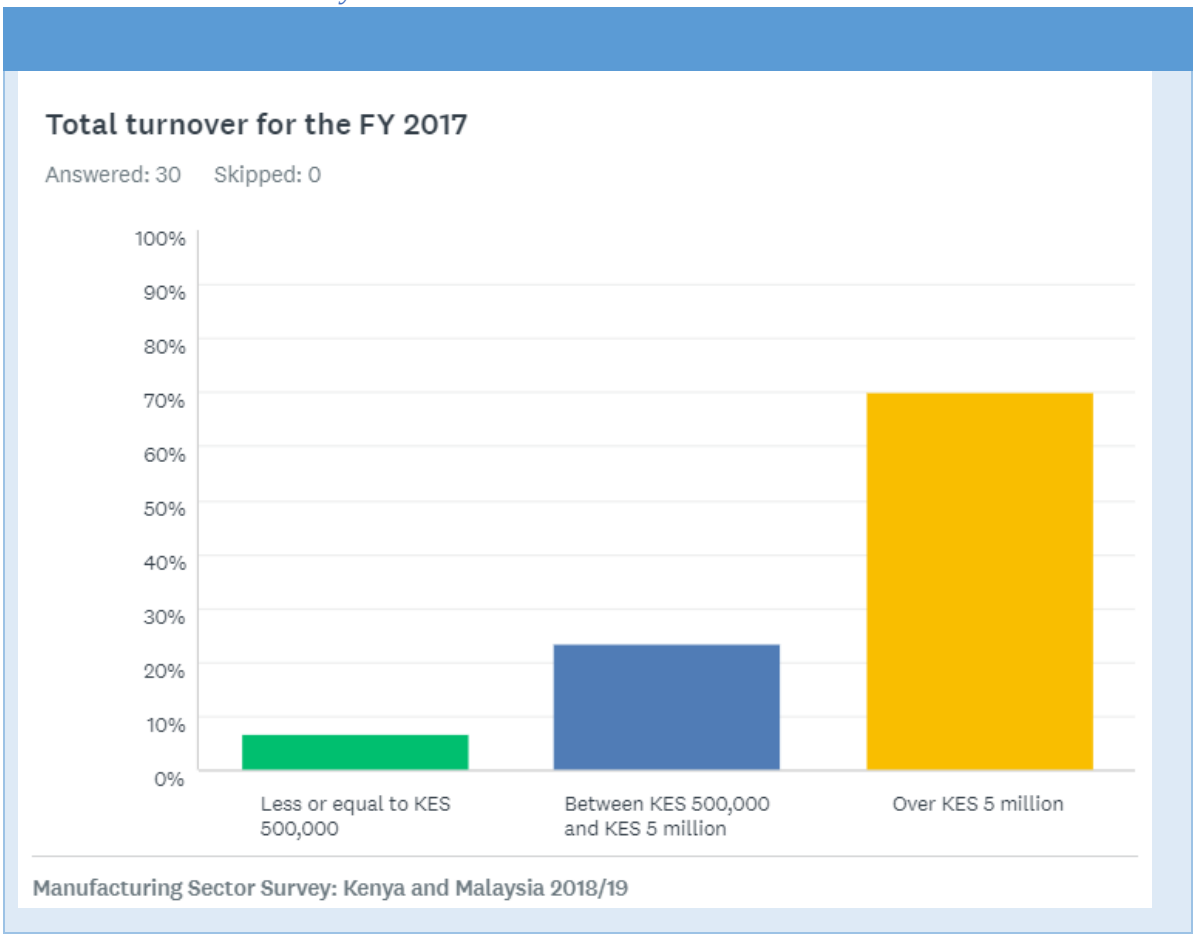
The total observations were *146*. This included *67* responses from Kenya (whereby 31 and 36 responses came from the E&E and P&C sectors, respectively). Malaysia had a total of *79* responses, whereby 40 observations were in the E&E sector, and 39 were in the P&C sector. The questionnaire can be viewed in **Appendix 1**.

4.4 Some Descriptive Statistics of the Key Variables

4.4.1 Kenya's E&E Subsector

In this subsector, most of the firms that reported were medium/large enterprises, as shown in **Table 26**.

Table 19: E&E Sector – Kenya

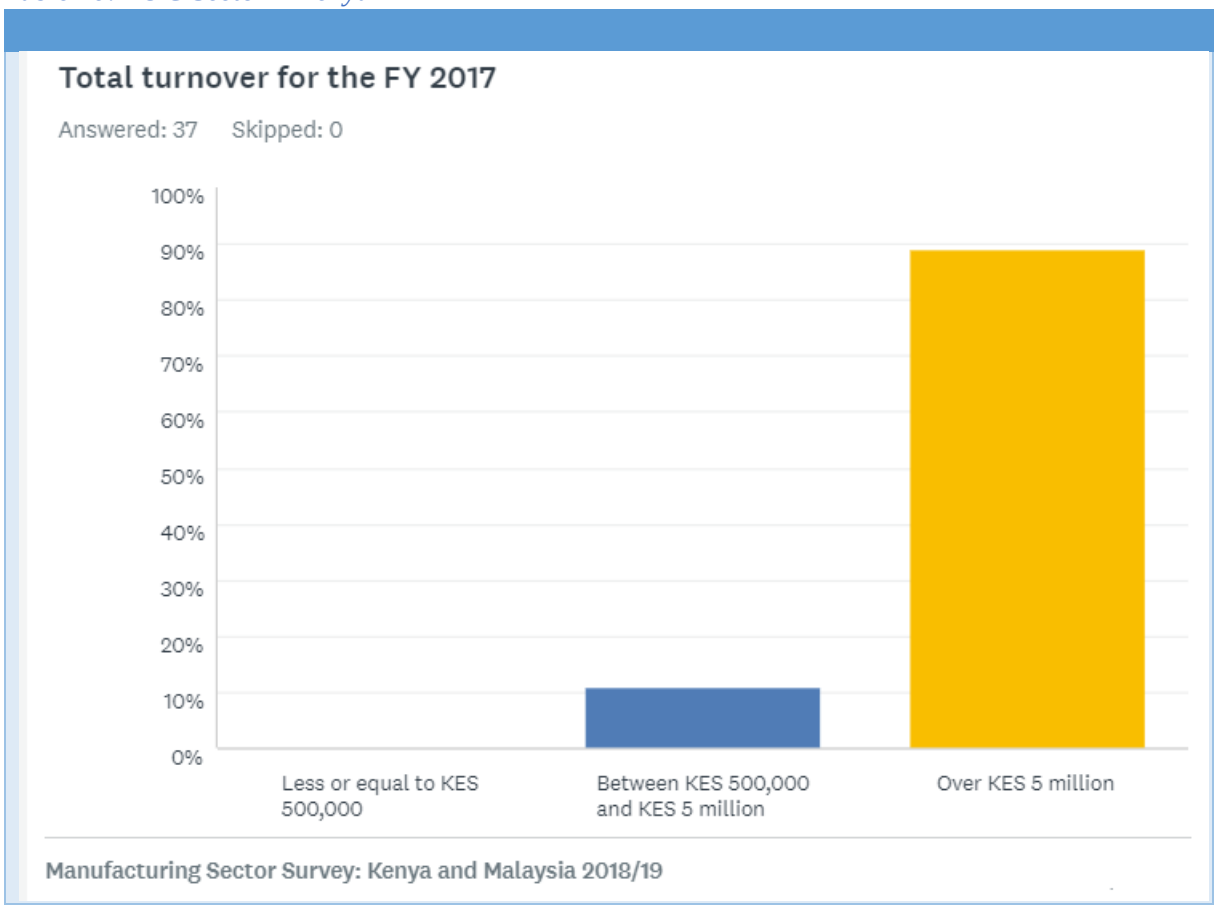


Source: Author's compilation, 2019. Dataset: Manufacturing Sector Survey – Kenya and Malaysia 2018/19.

4.4.2 Kenya's P&C Subsector

Similar to Kenya's E&E subsector, the P&C subsector recorded a higher number of respondents within medium/large firms; see **Table 27**.

Table 20: P&C Sector – Kenya



Source: Author's compilation, 2019. Dataset: Manufacturing Sector Survey – Kenya and Malaysia 2018/19. Note that according to Kenya's classification of SMEs, Less or Equal to KES 500,000, Between KES 500,000 and KES 5M, and Over KES 5M represents micro, small and medium/large firms, respectively.

Does the size of a firm determine backward linkages with MNCs?

Table 28 shows the relationship between firm size and the production capability accumulation status in Kenya's E&E and P&C sectors. The table demonstrates that there is indeed a relationship between firm size and the formation of backward linkages with MNCs. In this way, the larger the firm, the greater the changes of forming backward linkages with MNCs.

Table 21: Relationship between backward linkages from MNCs and firm size in Kenya's E&E and P&C sectors

Please select the sub-sector that best describes this firm's main manufacturing/business activity			Does this firm supply inputs/products to locally based multinational companies (MNCs)?		Total
			Yes	No	
Electronics and Electrical	Total turnover for the FY 2017	Less or equal to KES 500,000	0	2	2
		Between KES 500,000 and KES 5 million	5	2	7
		Over KES 5 million	18	3	21
	Total		23	7	30
Plastics and Chemicals	Total turnover for the FY 2017	Between KES 500,000 and KES 5 million	1	3	4
		Over KES 5 million	27	6	33
	Total		28	9	37
Total	Total turnover for the FY 2017	Less or equal to KES 500,000	0	2	2
		Between KES 500,000 and KES 5 million	6	5	11
		Over KES 5 million	45	9	54
	Total		51	16	67

Source: Author's compilation, 2019. Dataset: Manufacturing Sector Survey – Kenya and Malaysia 2018/19.

Does the size of a firm determine production capability accumulation?

Table 29 shows the relationship between firm size and the production capability accumulation status in Kenya's E&E and P&C sectors. The table demonstrates that there is indeed a relationship between firm size and the status of production capability accumulation in that the larger the firm, the higher the level of production capability accumulation.

Table 22: The relationship between firm size and accumulation of production capabilities in Kenya's E&E and P&C sectors

Total turnover for the FY 2017 * HostProductionCapability * Please select the sub-sector that best describes this firm's main manufacturing/business activity Crosstabulation

Count

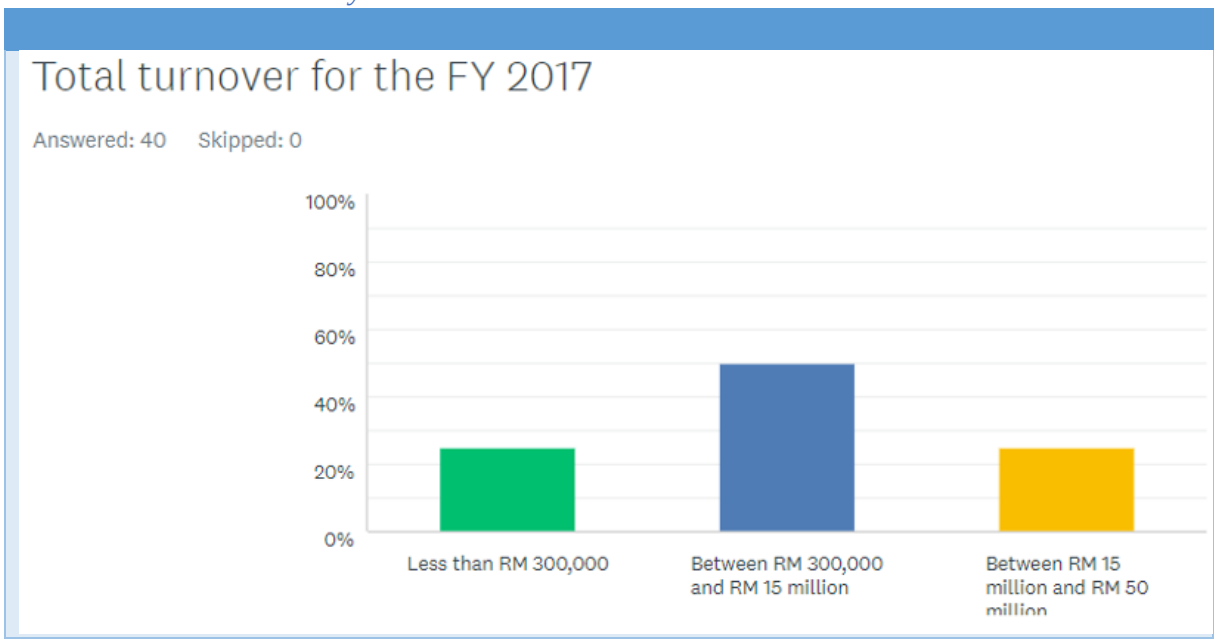
Please select the sub-sector that best describes this firm's main manufacturing/business activity			HostProductionCapability				Total
			None	Low	Average	High	
Electronics and Electrical	Total turnover for the FY 2017	Less or equal to KES 500,000	2	0	0	0	2
		Between KES 500,000 and KES 5 million	0	3	4	0	7
		Over KES 5 million	2	2	15	2	21
	Total		4	5	19	2	30
Plastics and Chemicals	Total turnover for the FY 2017	Between KES 500,000 and KES 5 million		3	1		4
		Over KES 5 million		5	28		33
	Total			8	29		37
Total	Total turnover for the FY 2017	Less or equal to KES 500,000	2	0	0	0	2
		Between KES 500,000 and KES 5 million	0	6	5	0	11
		Over KES 5 million	2	7	43	2	54
	Total		4	13	48	2	67

Source: Author's compilation, 2019. Dataset: Manufacturing Sector Survey – Kenya and Malaysia 2018/19.

4.4.3 Malaysia

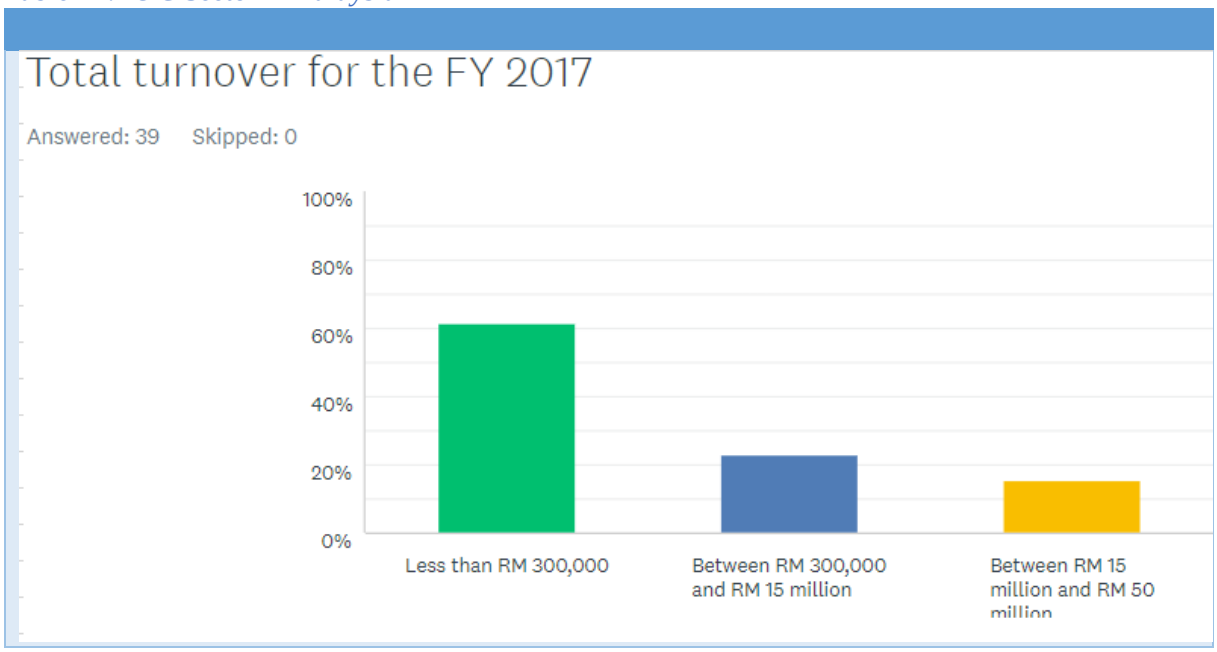
In Malaysia's E&E subsector, the majority of the respondents were small firms, as revealed in **Table 30**. Regarding the P&C subsector, the responses of the micro-firms outnumbered those of small and medium firms; see **Table 31**.

Table 23:E&E Sector – Malaysia



Source: Author's compilation, 2019. Dataset: Manufacturing Sector Survey-Kenya and Malaysia 2018/19: Note: Green, blue, and yellow represent micro, small, and medium/large firms, respectively.

Table 24:P&C Sector – Malaysia



Source: Author's compilation, 2019. Dataset: Manufacturing Sector Survey-Kenya and Malaysia 2018/19. Note: Green, blue and yellow represent micro, small and medium/large firms, respectively.

Does the size of a firm determine backward linkages with MNCs?

Table 32 below shows the relationship between firm size and the production capability accumulation status in Malaysia's E&E and P&C sectors. The table demonstrates that there is indeed a relationship between firm size and the formation of backward linkages with MNCs in that the larger the firm, the greater the chances of forming backward linkages with MNCs.

Table 25: Relationship between backward linkages from MNCs and firm size in Malaysia's E&E and P&C sectors

Please select the sub-sector that best describes this firm's main manufacturing/business activity			Does this firm supply inputs/products to locally based multinational companies (MNCs)?		Total
			Yes	No	
Electronics and Electrical	Total turnover for the FY 2017	Less than RM 300,000	90.0%	10.0%	100.0%
		Between RM 300,000 and RM 15 million	85.0%	15.0%	100.0%
		Between RM 15 million and RM 50 million	90.0%	10.0%	100.0%
	Total		87.5%	12.5%	100.0%
Plastics and Chemicals	Total turnover for the FY 2017	Less than RM 300,000	41.7%	58.3%	100.0%
		Between RM 300,000 and RM 15 million	55.6%	44.4%	100.0%
		Between RM 15 million and RM 50 million	100.0%		100.0%
	Total		53.8%	46.2%	100.0%
Total	Total turnover for the FY 2017	Less than RM 300,000	55.9%	44.1%	100.0%
		Between RM 300,000 and RM 15 million	75.9%	24.1%	100.0%
		Between RM 15 million and RM 50 million	93.8%	6.3%	100.0%
	Total		70.9%	29.1%	100.0%

Source: Author's compilation, 2019. Dataset: Manufacturing Sector Survey – Kenya and Malaysia 2018/19.

Does the size of a firm determine production capability accumulation?

Table 33 shows the relationship between firm size and the production capability accumulation status in Malaysia's E&E and P&C sectors. The table demonstrates that there is indeed a relationship between firm size and the status of production capability accumulation in that the larger the firm, the higher the level of production capability accumulation.

Table 26: Relationship between production capability accumulation and firm size in Malaysia's E&E and P&C sectors

Please select the sub-sector that best describes this firm's main manufacturing/business activity			HostProductionCapability			Total
			None	Low	Average	
Electronics and Electrical	Total turnover for the FY 2017	Less than RM 300,000	10.0%	20.0%	70.0%	100.0%
		Between RM 300,000 and RM 15 million	25.0%	10.0%	65.0%	100.0%
		Between RM 15 million and RM 50 million	10.0%		90.0%	100.0%
	Total		17.5%	10.0%	72.5%	100.0%
Plastics and Chemicals	Total turnover for the FY 2017	Less than RM 300,000	16.7%	29.2%	54.2%	100.0%
		Between RM 300,000 and RM 15 million	11.1%	22.2%	66.7%	100.0%
		Between RM 15 million and RM 50 million	16.7%		83.3%	100.0%
	Total		15.4%	23.1%	61.5%	100.0%
Total	Total turnover for the FY 2017	Less than RM 300,000	14.7%	26.5%	58.8%	100.0%
		Between RM 300,000 and RM 15 million	20.7%	13.8%	65.5%	100.0%
		Between RM 15 million and RM 50 million	12.5%		87.5%	100.0%
	Total		16.5%	16.5%	67.1%	100.0%

Source: Author's compilation, 2019. Dataset: Manufacturing Sector Survey – Kenya and Malaysia 2018/19.

4.5 Merging Descriptive Data: Kenya and Malaysia

A higher percentage of firms in Malaysia's E&E sector, or 60.3 per cent, report forming backward linkages with MNCs, compared to 39.7 per cent of Kenyan firms in the same sector. However, in the P&C sector, Kenyan firms report a higher level of backward linkages with MNCs, at 57.1 per cent, compared to Malaysia firms' 42.9 per cent. Overall, Malaysian firms record a higher number of backward linkages from MNCs, at 52.3 per cent, in comparison to Kenya's firms, who report 47.7 per cent. See **Table 34** below for details.

Table 27: Relation between backward linkages from MNCs and the location of the firm

Please select the sub-sector that best describes this firm's main manufacturing/business activity			Location of this firm		Total
			Kenya	Malaysia	
Electronics and Electrical	Does this firm supply inputs/products to locally based multinational companies (MNCs)?	Yes	39.7%	60.3%	100.0%
		No	58.3%	41.7%	100.0%
	Total		42.9%	57.1%	100.0%
Plastics and Chemicals	Does this firm supply inputs/products to locally based multinational companies (MNCs)?	Yes	57.1%	42.9%	100.0%
		No	33.3%	66.7%	100.0%
	Total		48.7%	51.3%	100.0%
Total	Does this firm supply inputs/products to locally based multinational companies (MNCs)?	Yes	47.7%	52.3%	100.0%
		No	41.0%	59.0%	100.0%
	Total		45.9%	54.1%	100.0%

Source: Author's compilation, 2019. Dataset: Manufacturing Sector Survey – Kenya and Malaysia 2018/19.

On the one hand, and as demonstrated in **Table 35**, Malaysian firms that accumulated *no* capabilities as well as those with average capabilities within the E&E sector were more, at 63.6 per cent and 60.4 per cent, respectively, compared to Kenyan firms' 36.4 per cent and 39.6 per cent, respectively, in a similar sector. Overall, only Kenyan firms reported the accumulation of high production capabilities. On the other hand, Kenyan firms in the P&C sector recorded a higher level of production capability accumulation, at 54.7 per cent, compared to their Malaysian counterparts, at 45.3 per cent. Overall, across both sectors, Malaysian firms recorded a higher percentage of *no* accumulation of production capabilities and average accumulation of production capabilities, at 76.5 and 52.5 per cent, respectively, compared to Kenyan firms under the same category. These results are interesting, and we conclude that they can be explained by other factors, such as firm size. Indeed, more firms in Kenya, across both sectors, reported to be medium/large in comparison to Malaysian firms reporting on the same. Therefore, the variations in the level of a firm's accumulation of production capabilities are also influenced by the size of the firm.

Table 28: Relation between production capability accumulation and the location of the firm

Please select the sub-sector that best describes this firm's main manufacturing/business activity			Location of this firm		Total
			Kenya	Malaysia	
Electronics and Electrical	HostProductionCapability	None	36.4%	63.6%	100.0%
		Low	55.6%	44.4%	100.0%
		Average	39.6%	60.4%	100.0%
		High	100.0%		100.0%
	Total		42.9%	57.1%	100.0%
Plastics and Chemicals	HostProductionCapability	None		100.0%	100.0%
		Low	47.1%	52.9%	100.0%
		Average	54.7%	45.3%	100.0%
	Total		48.7%	51.3%	100.0%
Total	HostProductionCapability	None	23.5%	76.5%	100.0%
		Low	50.0%	50.0%	100.0%
		Average	47.5%	52.5%	100.0%
		High	100.0%		100.0%
	Total		45.9%	54.1%	100.0%

Source: Author's compilation, 2019. Dataset: Manufacturing Sector Survey – Kenya and Malaysia 2018/19.

Summing up: The chapter addressed the causal question through a mixed methods approach and an explanatory sequential design. Here, the qualitative data were collected through an online survey instrument (SurveyMonkey) in Kenya and Malaysia's E&E and P&C subsectors. Lastly, descriptive statistics of some important variables in the study were presented. The following chapter sets forth to analyse the collected quantitative data.

Chapter 5: The Model: Quantitative Phase

5.1 Introduction

We present a causal model specifying how firms can shift from the production of low-value-added goods toward the production of high-value-added ones—hereafter referred to as production capability accumulation. A firm's accumulation of production capability faces a probability distribution ***P*** over several variables (including the characteristics of the firm). The production capability accumulation is characterised by a causal model, represented by a directed acyclic graph (DAG) over the set of variable labels. The production capability accumulation model attempts to fit to *P*, that is, the model's assumptions must be compatible with the data. The "degree of fitness" is tricky, given that there may be hidden variables that could result in a structural learning problem. This implies that there may exist different observable patterns or independencies, and thus more than one competing model. Despite this uncertainty, true or nearly true causes of production capability accumulation are estimated via a standard Bayesian network conditional independence test. As a result, if there is a causal effect that is non-zero, then the expectation is a conditional dependence of any two variables, given other variables.

5.2 Proposed Bayesian Networks Models

The rational-expectations postulate entails that agents in an economic model "know the model," and on average take the model's predictions as valid in the structure of correlations among variables. However, when dealing with causality, there are model uncertainties that can be attributed to either hidden variables or to a lack of consensus in the literature regarding the causal relationship among the given variables. This research proposes an approach to modelling the production capability accumulation by a firm, with uncertainty regarding whether some variables in the model have a predictive or a causal relationship.

Consider a firm whose production capability accumulation is defined over a collection of variables that can be presented in two causal models: first, $x = (x_1, x_2, x_3, x_4, x_5)$, where x, x_1, x_2, x_3, x_4, x_5 refers to production capability accumulation, backward linkages from MNCs, host firm absorptive capability, host firm skilled employees, host firm size and host firm foreign trade interactions, respectively; second, $x = (x_1, x_2, x_3, x_4)$, where x, x_1, x_2, x_3, x_4 refers to production capability accumulation, backward linkages from MNCs, host firm absorptive capability, host firm size, and host firm foreign trade interactions, respectively.

Imagine that before the accumulation of production capabilities, the firm gains access to a dataset consisting of many joint observations of the relevant variables. The empirical distribution $P\ over\ x$ in the dataset obeys the textbook chain rule/product rule:

$$P(x_i, \dots, x_n) = \prod_i P(x_i|pa_i) \tag{5}$$

Where x_i denotes some value of the variable X_i and Pa_i denotes some set of values for the parents of X_i.

In the context of the current study, for Model 1, we have,

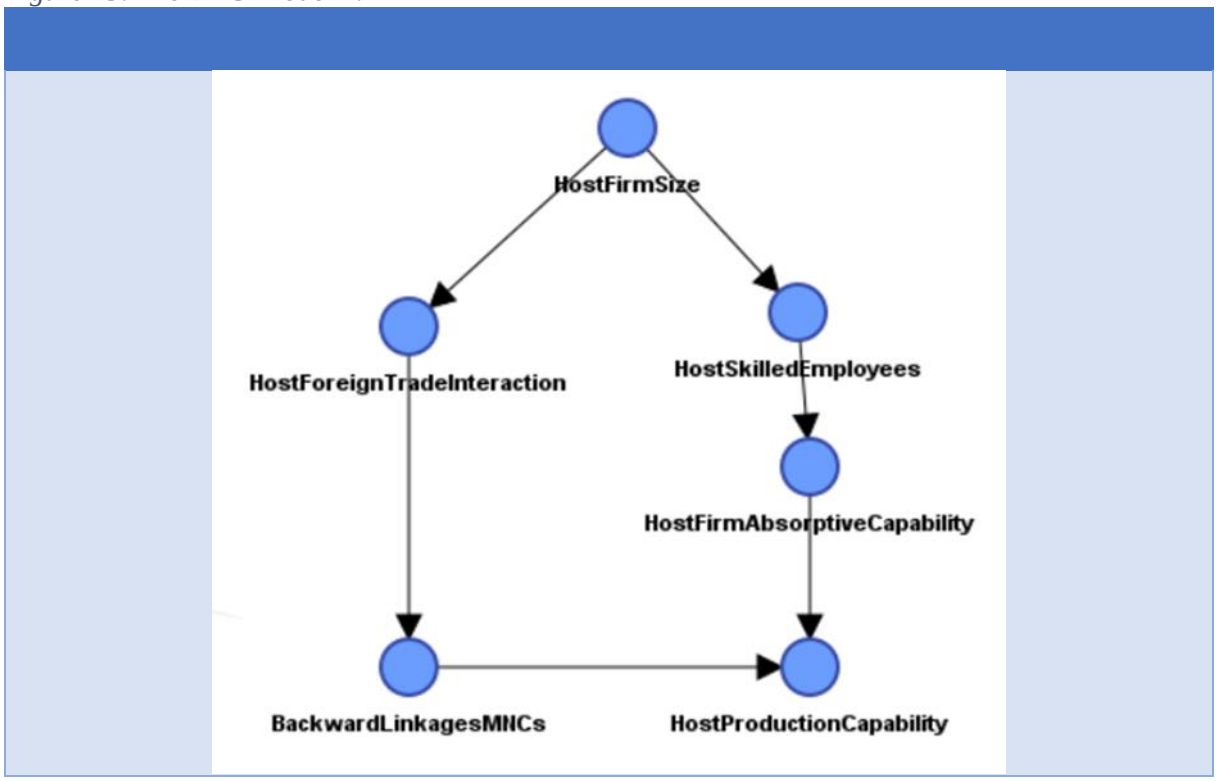
$$P(x, x_1, x_2, x_3, x_4, x_5) = P(x|x_1, x_2)P(x_1|x_5)P(x_2|x_3)P(x_3|x_4)P(x_4)P(x_5|x_4) \tag{6}$$

Regarding Model 2, we have,

$$P(x, x_1, x_2, x_3, x_4) = P(x|x_1, x_2)P(x_1|x_4)P(x_2|x_3)P(x_3)P(x_4|x_3) \tag{7}$$

The DAG associated with equation (6) is shown in **Figure 25**:

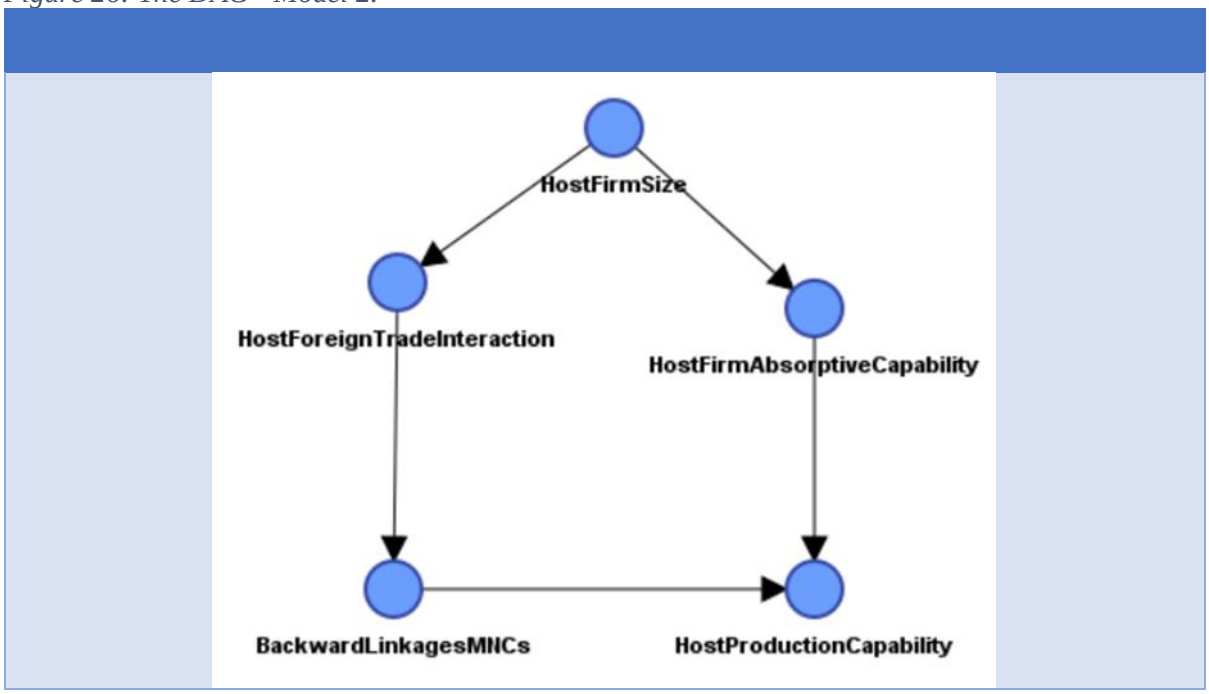
Figure 25: The DAG-Model 1.



Note: HostProductionCapability, backwardlinkagesMNCs, HostFirmAbsorptiveCapacity, HostskilledEmployees, HostFirmSize, and HostForeignTradeInteraction, represent x, x_1, x_2, x_3, x_4, x_5, respectively.

Regarding equation (7), see **Figure 26**.

Figure 26: The DAG - Model 2.



Note:HostProductionCapability, BackwardLinkagesMNCs, HostFirmAbsorptiveCapability, HostFirmSize and HostForeignTradeInteractions, refer to x, x_1, x_2, x_3, x_4, respectively.

The DAGs in **Figures 25** and **26**, and the set of distributions representable by equation (5), define what is known as a *Bayesian network*. This concept, as discussed above, is a representation of conditional independence assumptions and has become ubiquitous in artificial intelligence as a platform for efficient probabilistic inference algorithms (see Cowell et al. 2006; Koski and Noble 2011). In the present context, the DAGs in Models 1 and 2 are the production capability accumulation models, and equation (5) describes how the model's uncertainty affects the distribution of *P* into the subjective belief $P(x_i, \dots, x_{n)}$. When the DAG is fully connected, it reduces equation (5) to a standard chain rule, thus representing a firm with rational expectations. At the other extreme, when DAG is empty, it represents a firm which cannot perceive any correlations that might exist: $P(x_i, \dots, x_{n)} = P(x_i) \dots P(x_n)$.

Pearl (2009) advocated considering DAGs as causal structures that underlie observed statistical regularities: the link $BackwardLinkagesMNCs \rightarrow HostProductionCapability$ means that $BackwardLinkagesMNCs$ is an immediate cause of $HostProductionCapability$. Indeed, Sloman (2009) presented psychological evidence that people use intuitive causal models to perceive uncertain environments and used DAGs to represent such models. The causal interpretation is consistent with the directedness and acyclicity properties of a DAG: a causal chain from $BackwardLinkagesMNCs\ to\ HostProductionCapability$ should preclude a causal chain in the opposite direction. This interpretation also gives content to the factorisation formula (5): to predict $BackwardLinkagesMNCs$ conditional on its causes, one only needs to know the realisation of its immediate causes, in this case, $HostforeignTradeInteraction$.

Borrowing from Pearl (2009) and Sloman (2009), we essentially interpret DAG as a subjective causal model, such that the probability of DAG $P(x_i, \dots, x_n)$ is the outcome of causal Models 1 and 2 to fit to observational data. The model with the best fit is chosen as being reflective of a true causal model for production capability accumulation. The causal model is entirely nonparametric: it only posits the existence of certain causal links. From the model, correlations between $x_i\ and\ pa_i$ are extracted from the observational data represented by P. These correlations are important because they are required to quantify a causal model. The following section illustrates the implications of this idea.

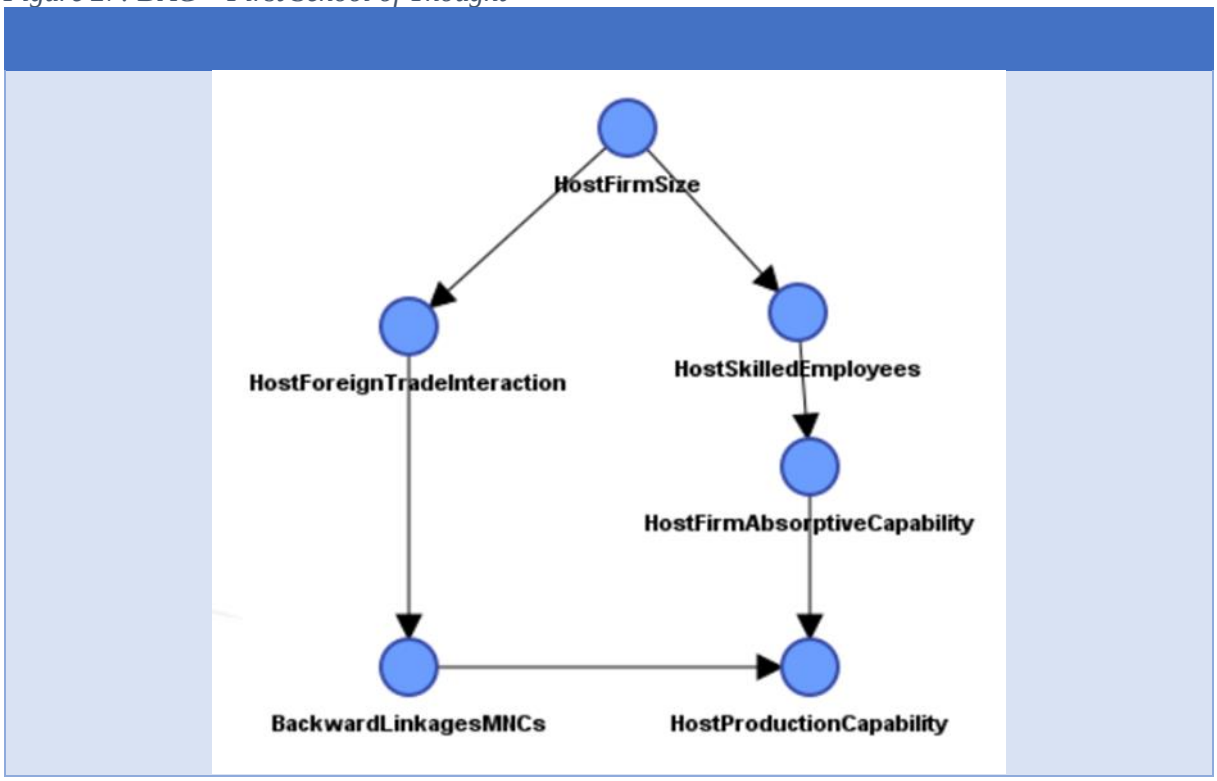
5.3 A firm's accumulation of production capability

Consider a firm that wants to shift production from low-value-added goods to high-value-added goods (production capability). This firm may contemplate a combination of various attributes to achieve the best outcome. In reality, the firm's decision-making will be guided by expert advice suggesting the best combination. The firm management realises that the experts are

divided into two schools of thought: The first school postulates that a firm's maximisation of the accumulation of production capabilities depends mainly on five major attributes (hereafter referred to as variables), namely backward linkages between the firm and the locally based MNCs, the level of absorptive capacity of the firm, the level of skilled employees in the firm, the size of the firm, and whether the firm is involved in foreign trade.

This school of thought presents a DAG. See **Figure 27** below for a summary of their recommendations.

Figure 27: DAG – First School of Thought



Note: HostProductionCapability, backwardlinkagesMNCs, HostFirmAbsorptiveCapacity, HostskilledEmployees, HostFirmSize, and HostForeignTradeInteraction, represent x, x_1, x_2, x_3, x_4, x_5, respectively.

Figure 27 demonstrates that $BackwardLinkagesMNCs$ and $HostFirmAbsorptiveCapability$ are independent, and therefore the objective distribution P can be written as

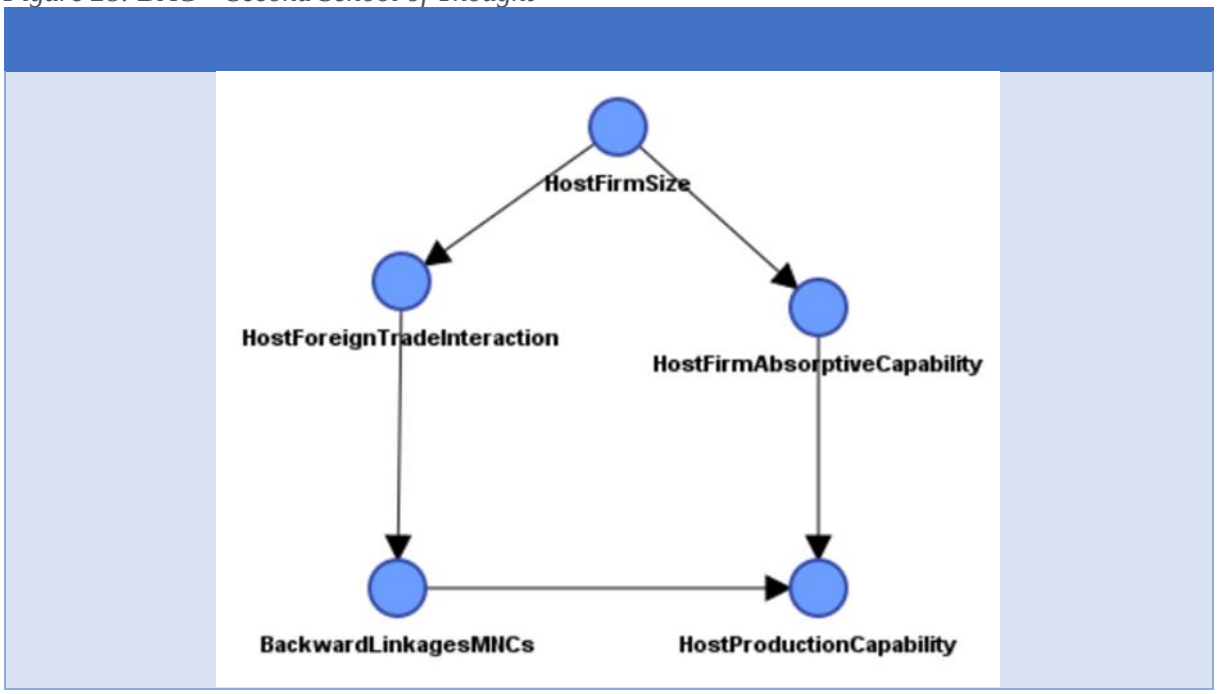
$$P(x, x_1, x_2, x_3, x_4, x_5) = P(x|x_1, x_2)P(x_1|x_5)P(x_2|x_3)P(x_3|x_4)P(x_4)P(x_5|x_4)$$

This represents a causal model that posits $BackwardLinkagesMNCs$ and $HostFirmAbsorptiveCapability$ as independent causes of $HostproductionCapability$.

The second school of thought posits that for any firm to maximise the accumulation of production capabilities, four main variables should be taken into consideration, namely

backward linkages between the firm and the locally based MNCs, the level of absorptive capacity of the firm, the size of the firm, and whether the firm is involved in foreign trade. This position is summarised in **Figure 28**.

Figure 28: DAG – Second School of Thought



Note: HostProductionCapability, BackwardLinkagesMNCs, HostFirmAbsorptiveCapability, HostFirmSize and HostForeignTradeInteractions, refer to x, x_1, x_2, x_3, x_4, respectively.

Both **Figures 27** and **28** represent a causal model that proposes $BackwardLinkagesMNCs$ and $HostFirmAbsorptiveCapability$ as independent causes of $HostproductionCapability$. From **Figure 28**, the objective distribution P can be written as

$$P(x, x_1, x_2, x_3, x_4) = P(x|x_1, x_2)P(x_1|x_4)P(x_2|x_3)P(x_3)P(x_4|x_3)$$

In sum, the objective distribution P with Bayesian networks translates into local semantics, which asserts that each variable is independent of non-descendants in the network given its parents. For example, the parents of x in **Figures 27** and **28** are x_1 and x_2 and they render x independent of the remaining non-descendants, $x_3, x_4, and\ x_5$ in **Figure 27** and x_3, x_4 in **Figure 28**. Mathematically, this independence is presented below.

In **Figure 27***:*

$$P(x|x_1, x_2, x_3, x_4, x_5) = P(x|x_1, x_2) \quad (8)$$

In **Figure 28***:*

$$P(x|x_1, x_2, x_3, x_4) = P(x|x_1, x_2) \quad (9)$$

Equations (8) and (9) suggest that $P(x)$ is the same regardless of which school of thought is adopted by a firm. This proposition will be tested later using observational data.

5.4 The Interpretation of DAG

The current study regards DAG as a subjective causal model: for every i, pa_i represents the collection of variables that are perceived as immediate causes of x, i.e., production capability. The subjective belief probability of DAG, $P(x_i, \dots, x_n)$, is the outcome of the proposed model's "degree of fitness" to observational data generated by P. The current researcher does not have any preconception regarding the sign or magnitude of the causal relations—those are inferred from the observational data. The proposed causal model merely postulates causal links and their direction.

To make the causal interpretation more concrete, the current researcher has access to, as described elsewhere, rich observational data consisting of all the variables in the model. From these data, a joint probability distribution of all the variables is generated in the form of a conditional probability table. Conditional probability tables are the engine of Bayesian networks (Pearl 2009). Correlations among variables in the model are generated from the conditional probability table. The current researcher forms his belief by taking the products of the measured conditional distributions $P(x_i|pa_i)$, thus quantifying the proposed causal model.

5.5 Potential Outcome Framework

Although there is no question about the common-sense meaning of ``cause and effect", a formal analysis requires a precise mathematical definition. In the fields of social science and biometrics, the potential outcomes framework is a widely accepted formalisation for studying causal effects. Rubin (1974) defines a potential outcome framework as follows:

> *"Intuitively, the causal effect of one treatment, T=1,*[50] *over another, T=0, for a particular unit and an interval of time from t_1 to t_2 is the difference between what would have happened at time t_2 if the unit had been exposed to T=1 initiated at t_1 and what would have happened at t_2 if the unit had been exposed to T=0 initiated at t_1: 'If an hour ago I had taken two aspirins*

[50] In this quote from Rubin (1974), the current study altered the original variable name *E* to *T=1* and *C* to *T= 0*. *T* is commonly used in the literature to denote the treatment condition.

instead of just a glass of water, my headache would now be gone,' or because an hour ago I took two aspirins instead of just a glass of water, my headache is now gone.' "

The current study's definition of the causal effect of *T=1* versus *T=0* treatment will reflect this intuitive meaning.

Put in the current context:

- $Y_{f.1}$ Potential outcome of firm f given treatment $T = 1$ (that is, establishing backward linkages from MNCs)
- $Y_{f.0}$ Potential outcome of firm f given treatment $T = 0$ (that is, no formation of backward linkages from MNCs)

The firm-level causal effect (FCE) is defined as the difference between the firm's two potential outcomes. That is:

$$FCE = Y_{f.1} - Y_{f.0} \tag{10}$$

Given that one cannot ignore the differences between firms (which effect heterogeneity), the current study defines the average causal effect (ACE) as the unweighted arithmetic mean of firm-level causal effects:

$$ACE = E[Y_{f.1}] - E[Y_{f.0}] \tag{11}$$

Where $E[.]$ is the expected value operator, which computes the arithmetic mean.

5.6 Causal Identification

The challenge with our definition of causal effect is that $Y_{f.1}$ $(treatment)$ and $Y_{f.0}(non - treatment)$ can never be both observed for the same firm at the same time. One can only observe treatment or non-treatment, but not both (Angrist et al. 1996). What the current study can produce is the "naïve" estimator of association, A, between the "treated" and the "untreated/control" sub-populations (for notational convenience, index f is omitted):

$$A = E[Y_1|T = 1] - E[Y_0|T = 0] \tag{12}$$

Since the sub-populations in the treated and non-treated groups possess different firms, A is obviously not a measure of causation, in contrast to ACE. This position confirms the adage "association does not imply causation."

Determining whether one can extract causation from association is referred to as identification analysis. The best approach to performing this analysis is conducting a randomised experiment. However, the position of the current study is that experiments are often not feasible for many research questions. Thus, the only option is to establish whether there were any conditions under which the measure of association A equals the measure of causation, ACE. In fact, this would be the case if the sub-populations were comparable with respect to the factors that can influence the outcome (Conrady and Jouffe 2015).

Ignorability

Surprisingly, the conditions under which one can identify causal effects from observational data are much like the ones that justify causal inference in randomised experiments. A pure random selection of treated and controlled firms does indeed remove potential bias, thus allowing an estimation of the effect of the treatment alone. This condition is referred to as "ignorability[51]" and can formally be written as:

$$(Y_1, Y_0) \perp\!\!\!\perp T \tag{13}$$

Equation (13) means that the potential outcomes $Y_1\ and\ Y_0$ must jointly be independent ("$\perp\!\!\!\perp$") of the treatment, T. This condition of ignorability holds in an ideal experiment. Regrettably, this condition is seldom met in observational studies. Nevertheless, *conditional* ignorability may hold, which refers to ignorability within subgroups of the domain defined by the values of X (where X can be a vector) (Rosenbaum and Rubin 1983; Conrady and Jouffe 2015).

$$(Y_1, Y_0) \perp\!\!\!\perp \mathrm{T}|\mathrm{X} \tag{14}$$

That is, conditional on variables $X, Y_1\ and\ Y_0$ are jointly independent of T, the assignment mechanism. If conditional ignorability holds, one can utilise the estimator, $A|X$, to recover the average causal effect, $ACE|X$.

[51] Ignorability reads: "Z is an admissible set of covariates if, given Z, the value that Y would obtain had X been x is independent of X." (Pearl 2009: 79).

$$
\begin{aligned}
ACE|X &= E[Y_1|X] - E[Y_0|X] \\
&= E[Y|T = 1|X] - E[Y_0|T = 0, X] \\
&= E[Y|T = 1, X] - [Y|T = 0, X] \\
&= \text{A|X}
\end{aligned}
\tag{15}
$$

Note that selecting the correct variable X among other variables in a system, and whether one knows that such variables X are observed depends on expert knowledge and assumptions.

According to MacMillan Dictionary, "assumption" is "something that you consider likely to be true even though no one has told you directly or even though you have no proof." It is logical to posit that this carries a somewhat negative connotation, suggesting that something is not known that perhaps should be known. For causal identification with non-experimental data, causal assumptions are crucial. In particular, researchers must assert explicit causal assumptions about the process that generated the observed data (for example, see Elwert 2013).

In sum, Bayesian networks use DAGs for the qualitative representation of probabilistic dependencies. In the context of causal identification, the arc's direction in DAGs explicitly states causality, as opposed to only representing a probabilistic dependency in a Bayesian network. Note that the causal effect estimation can take two main forms: first, a causal DAG (CDAG) that represents the qualitative part of the data generating process, followed by a classical regression that quantifies the relationships and performs the effect estimation; second, a causal Bayesian network, which combines a CDAG with parameter estimates. The latter is an integrated approach and the focus of the current study.

5.6.1 Identifying a true causal DAG

To identify a true causal DAG, various criteria have been adopted. Namely:

1. All Parent-Child nodes should not be statistically independent of each other (based on the *Chi-square test of independence*). That is,

$$
P(x_i|pa_i) \neq 0. \tag{16}
$$

Note that, in BayesiaLab, the Chi-square test of independence between two variables is displayed in the form of an occurrence matrix.

2. Any DAG with a negative *correlation coefficient* between parent and child node should be eliminated. That is,

$$\rho(pa_i x_{i)} = \frac{\sigma pa_i x_i}{\sigma pa_i \sigma x_i}\} positive \quad (17)$$

3. A true causal DAG should fulfil all the implied *conditional independencies*.
4. The $P(x)$ should be the same in both Model 1 and Model 2. This is in line with Equations (8) and (9).
5. A true causal DAG, when exposed to two distinct datasets, that is, from Kenya and Malaysia, should remain *invariant*.

5.7 Quantitative Analysis

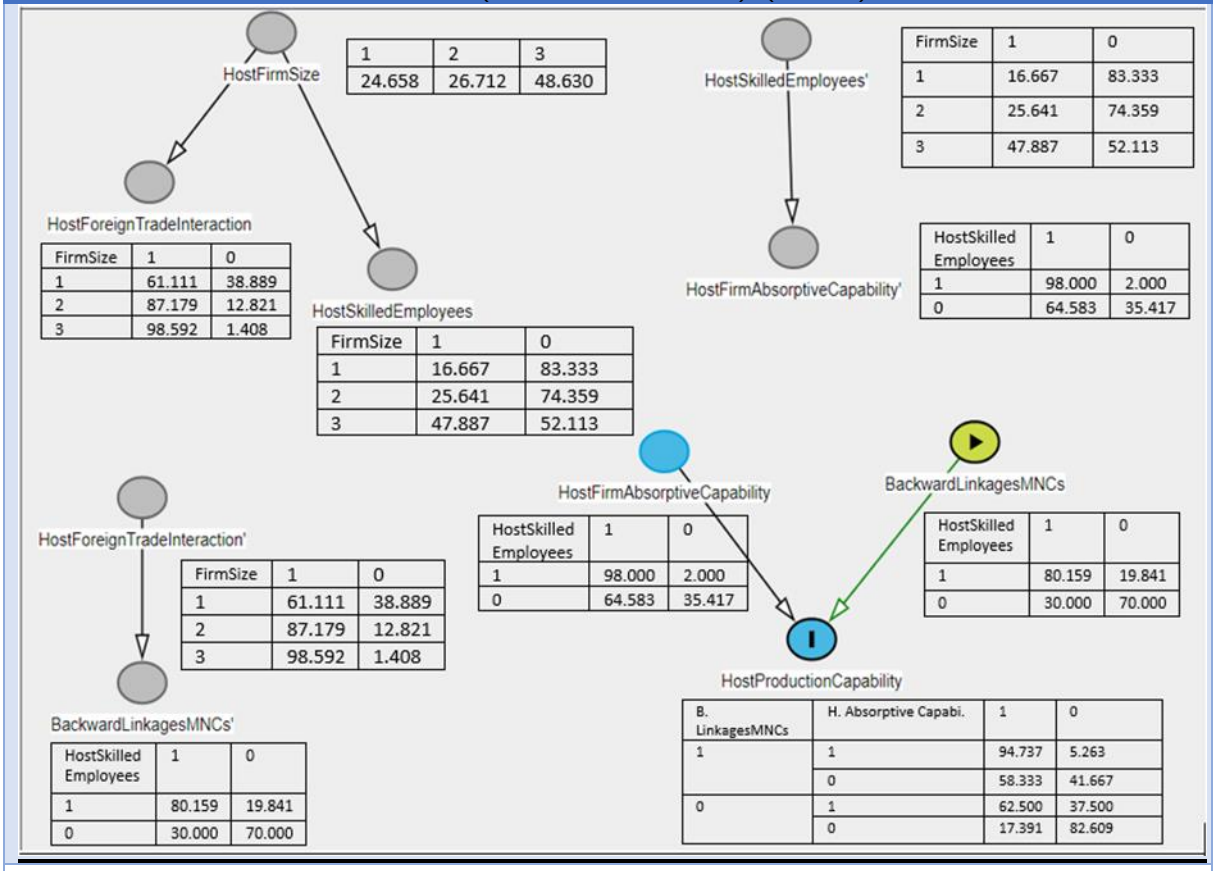
5.7.1 Conditional Independent Table

A conditional probability table refers to a specification of the conditional probability of each node given its "parents." (Note that the parents of a node are all the nodes that feed into it.)

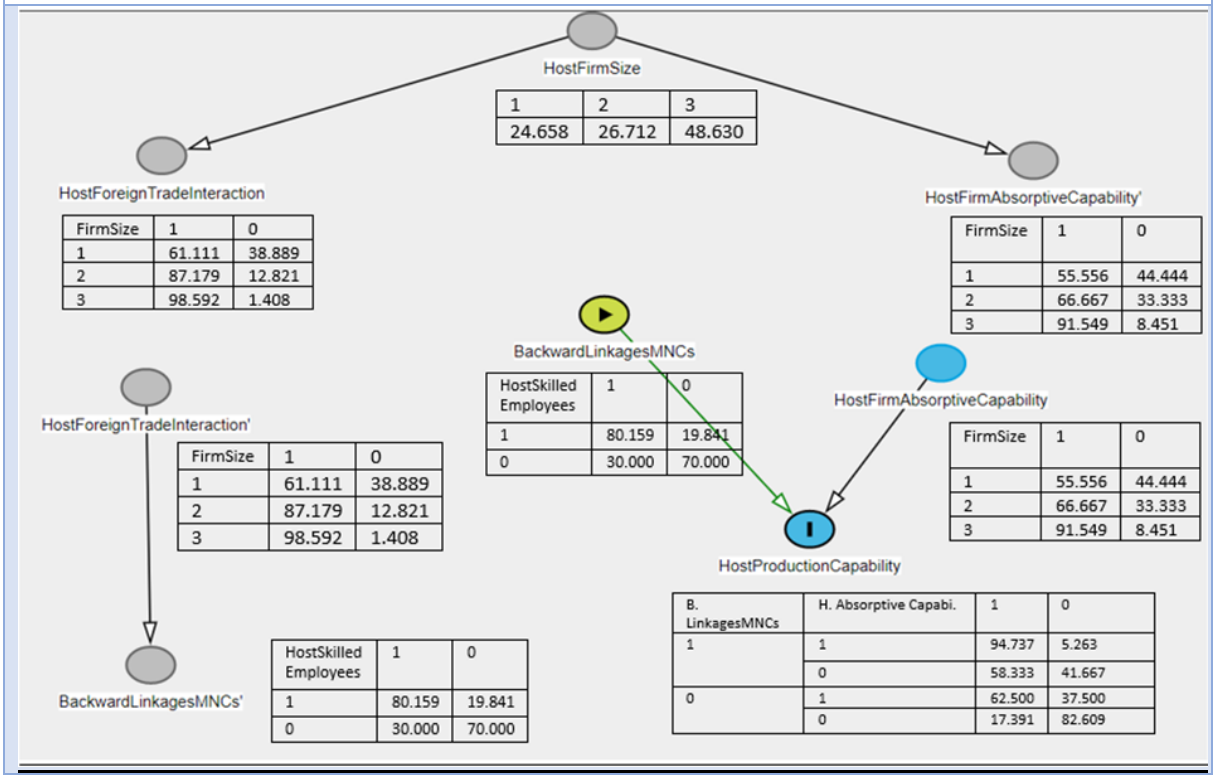
Using combined data from Kenya and Malaysia's electronics and electricals (E&E) and plastics and chemicals (P&C) sectors, we construct two conditional probability tables. See **Table 36**, associated with *Models 1 and 2*, respectively.

Table 29: Conditional Probability Table

Full Dataset (All countries/All Sectors): (Model 1)



Full Dataset (All countries/All Sectors): (Model 2)



Source: Author's compilation, 2019.

Information generated by the conditional probability tables will be applied in the following section to select a true/close-to-true model, based on the previously indicated criteria, for a firm's accumulation of production capabilities.

5.7.2 Model Selection

Note that discussion elsewhere in the current study used x, x_1, x_2, x_3, x_4, x_5 to represent HostProductionCapability, BackwardLinkagesMNCs, HostAbsorptiveCapability, HostSkilledEmployees, HostFirmSize, and HostForeignTradeInteraction, respectively. This section adopts a different notation, which is meant to be more concise and easily attributable to the variables in the model. See **Table 37** below.

Table 30: Variables and their Notations

Variable Name	Notation*
HostFirmSize	FS
HostForeignTradeInteraction	F
HostSkilledEmployees	E
HostAbsorptiveCapability	A
BackwardLinkagesMNCs	B
HostProductionCapability	P

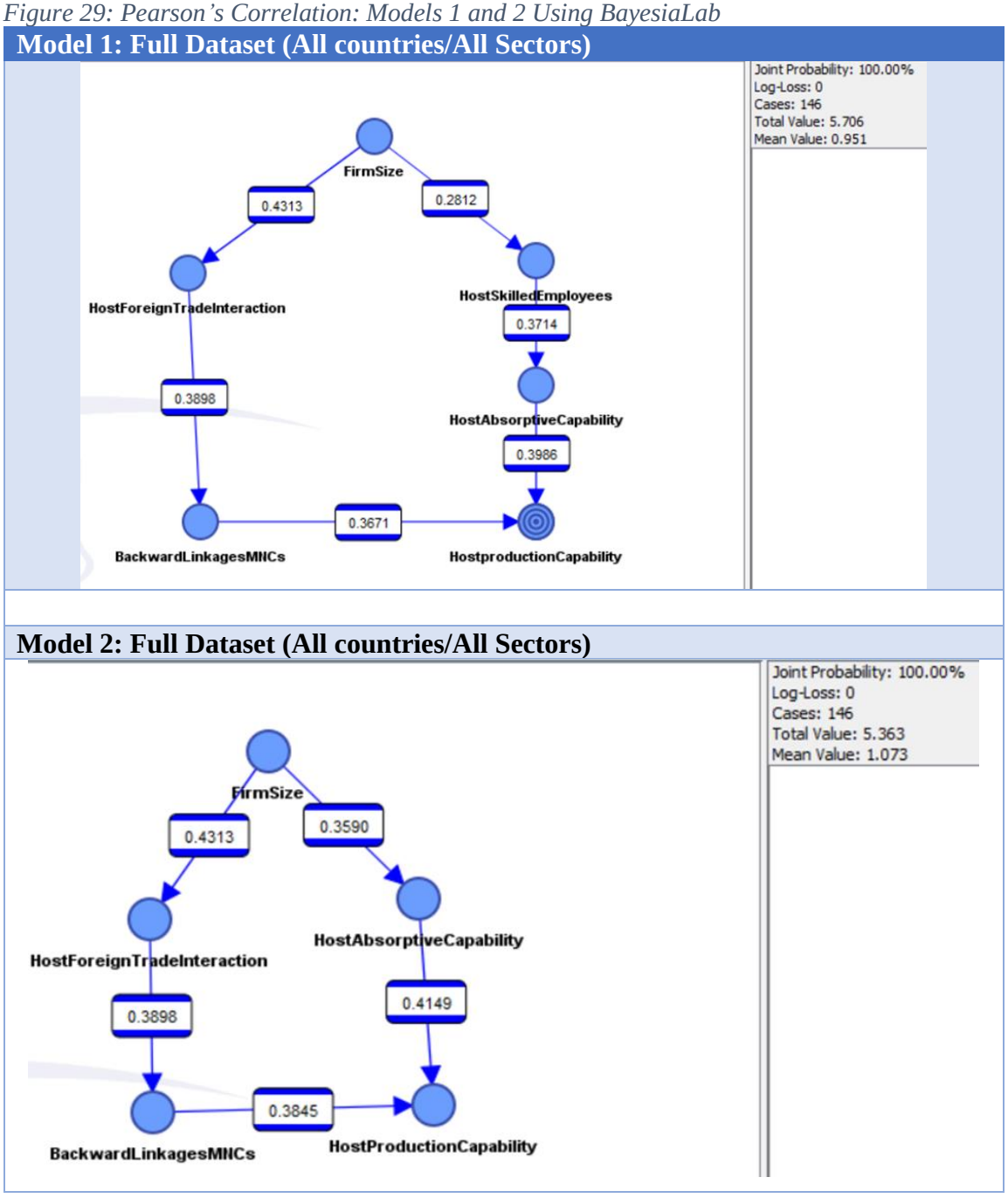
**The notations and full variable names will be used interchangeably, depending on the circumstance and space.*

5.7.2.1 Close examination of Models 1 and 2

The section that follows examines Models 1 and 2 from the lenses of the five criteria discussed elsewhere.

Pearson correlation coefficient: BayesiaLab Software

Figure 29: Pearson's Correlation: Models 1 and 2 Using BayesiaLab



The statistical significance of the correlation between any set of variables in Models 1 and 2 is elaborated under the section below.

5.7.2.2 Occurrence Matrix

The occurrence matrix graph displays a dimension table and the Chi-Square test or G test estimating the probability of independence between any two variables.

Table 31: Chi-Square Test or G Test (Full Dataset: Kenya and Malaysia/All Sectors)

Model 1

HostForeignTradeInteraction

	1	2	3	Σ
Σ	36	39	71	146
0	14	5	1	20
1	22	34	70	126

FirmSize

Independence Test: G
G = 28.14479
df = 2
p(G) = 0.00008%
G at 5% = 5.99146
G at 1% = 9.21034

HostSkilledEmployees

	1	2	3	Σ
Σ	36	39	71	146
0	30	29	37	96
1	6	10	34	50

FirmSize

Independence Test: G
G = 12.51252
df = 2
p(G) = 0.19184%
G at 5% = 5.99146
G at 1% = 9.21034

HostProductionCapability

	1	0	Σ
Σ	107	39	146
0	10	25	35
1	97	14	111

BackwardLinkagesMNCs

Independence Test: G
G = 43.46291
df = 1
p(G) = 0.00%
G at 5% = 3.84146
G at 1% = 6.6349

BackwardLinkagesMNCs

	1	0	Σ
Σ	126	20	146
0	25	14	39
1	101	6	107

HostForeignTradeInteraction

Independence Test: G
G = 19.49048
df = 1
p(G) = 0.00101%
G at 5% = 3.84146
G at 1% = 6.6349

HostProductionCapability

	1	0	Σ
Σ	111	35	146
0	11	24	35
1	100	11	111

HostAbsorptiveCapability

Independence Test: G
G = 45.52101
df = 1
p(G) = 0.00%
G at 5% = 3.84146
G at 1% = 6.6349

HostAbsorptiveCapability

	1	0	Σ
Σ	50	96	146
0	1	34	35
1	49	62	111

HostSkilledEmployees

Independence Test: G
G = 26.22148
df = 1
p(G) = 0.00003%
G at 5% = 3.84146
G at 1% = 6.6349

Model 2

HostForeignTradeInteraction

	1	2	3	Σ
Σ	36	39	71	146
0	14	5	1	20
1	22	34	70	126

FirmSize

Independence Test: G
G = 28.14479
df = 2
p(G) = 0.00008%
G at 5% = 5.99146
G at 1% = 9.21034

HostAbsorptiveCapability

	1	2	3	Σ
Σ	36	39	71	146
0	16	13	6	35
1	20	26	65	111

FirmSize

Independence Test: G
G = 20.58464
df = 2
p(G) = 0.00339%
G at 5% = 5.99146
G at 1% = 9.21034

BackwardLinkagesMNCs

	1	0	Σ
Σ	126	20	146
0	25	14	39
1	101	6	107

HostForeignTradeInteraction

Independence Test: G
G = 19.49048
df = 1
p(G) = 0.00101%
G at 5% = 3.84146
G at 1% = 6.6349

HostProductionCapability

	1	0	Σ
Σ	111	35	146
0	11	24	35
1	100	11	111

HostAbsorptiveCapability

Independence Test: G
G = 45.52101
df = 1
p(G) = 0.00%
G at 5% = 3.84146
G at 1% = 6.6349

HostProductionCapability

	1	0	Σ
Σ	107	39	146
0	10	25	35
1	97	14	111

BackwardLinkagesMNCs

Independence Test: G
G = 43.46291
df = 1
p(G) = 0.00%
G at 5% = 3.84146
G at 1% = 6.6349

Source: Author's compilation, 2019.

Both **Figure 29** and **Table 38** provide information for testing our hypotheses by examining how likely the null hypothesis is, that is, there is no relationship between any given set of variables. Note that P varies from 0 to 1. By convention, we consider $P < 0.05$ as the significant level of the test.

Backward linkages from MNCs and Production Capability: both *Models 1 and 2* show $P = 0.00\%$, and that substantially below $P < 0.05$, suggesting that we have strong evidence that there is a statistically significant relationship between backward linkages from MNCs and production capability accumulation, therefore rejecting the null hypothesis. Firms with backward linkages from MNCs reported higher levels of production capability accumulation.

Absorptive Capability and Production Capability: *Models 1 and 2* report $P = 0.00\%$, which is below $P < 0.05$. This indicates that we have very strong evidence that there is a statistically significant relationship between absorptive capability and production capability within the E&E and P&C sectors of both Kenya and Malaysia. Firms that indicated a presence of absorptive capability also reported a higher level of production capability accumulation.

Skilled Workforce and Firm Size: *Model 1* indicates $P = 0.192\%$, which is higher than the set threshold of $P < 0.05$, suggesting that we have no evidence at all that there is any relationship between skilled workforce and firm size within the E&E and P&C sectors of both Kenya and Malaysia.

Foreign Trade Interactions and Backward Linkages from MNCs: *Models 1 and 2* report $P = 0.00\%$, a value lower than our alpha $P < 0.05$. This indicates that there is a statistically significant relationship between a firm's foreign trade interaction and its level of forming backward linkages with MNCs within the E&E and P&C sectors of both Kenya and Malaysia. Firms that reported participation in foreign trade also reported a high level of forming backward linkages with locally based MNCs.

Absorptive Capability and Skilled Workforce: *Model 1* indicates $P = 0.00\%$, which is lower than the set threshold of $P < 0.05$. This suggests that we have strong evidence of a statistically significant relationship between absorptive capability and skilled workforce within the E&E and P&C sectors of both Kenya and Malaysia. This way, firms that reported a presence of absorptive capability also reported a more skilled workforce.

Absorptive Capability and Firm Size: *Model 2* reports a $P = 0.00\%$, which is below $P < 0.05$. This indicates that we have very strong evidence that there is a statistically significant

relationship between absorptive capability and firm size within the E&E and P&C sectors of both Kenya and Malaysia. Large firms reported a higher level of absorptive capability.

Overall, all our hypotheses, except the relationship between a skilled workforce and firm size, have thus been confirmed. A takeaway point from the analysis is that while Model 2 seems a suitable candidate, Model 1 already suffers fundamentally in terms of the proposed structure and the relationship with variables, specifically "skilled workforce" and "firm size". However, we do not wish to dismiss Model 1 at this stage, but rather carry out other analyses. More importantly, we will check whether the implied conditional independencies in the models are met.

5.7.2.3 Implied Conditional Independencies

Table 32: Implied Conditional Independence: Models 1 and 2

Model	Conditional Independence
Model 1	$B \perp\!\!\!\perp FS, E \mid F, A, P$
	$P \perp\!\!\!\perp E, F, FS \mid B, A$
	$A \perp\!\!\!\perp B, F \mid P, FS, E$
	$F \perp\!\!\!\perp E, A, P \mid B, FS$
	$E \perp\!\!\!\perp P, B, F \mid A, FS$
	$FS \perp\!\!\!\perp P, B, A \mid F, E$
Model 2	$B \perp\!\!\!\perp FS, E \mid F, A, P$
	$P \perp\!\!\!\perp E, F, FS \mid B, A$
	$A \perp\!\!\!\perp F \mid P, B, FS$
	$F \perp\!\!\!\perp A, P \mid B, FS$
	$FS \perp\!\!\!\perp P, B \mid F, A$

Note: For the conditional independence test applying the full dataset (Kenya and Malaysia – all sectors), see Appendix 2.

As demonstrated in **Appendix 2**, all the implied conditional independencies are satisfied in both models. Satisfying this condition means our proposed models are correct, and therefore, we can proceed to carry out a causal analysis. Note that so far, Model 2 has passed 4 out of the 5 tests. Thus, this model is our best candidate for analysis, but we need to further expose the model to test 5 after generating the causal effects of the backward linkages from MNCs on the accumulation of production capabilities by the host firm.

5.7.2.4 Path Analysis

Considering that there is a complete Bayesian network, BayesiaLab can help a researcher understand the implications of the structure of this network. For example, one can verify the paths in the network. Once a target node is determined, one can examine the possible paths in *Models 1 and 2*.

We set $HostProductionCapability$ as the target node and select $BackwardLinkagesMNCs$ as the treatment.

Table 33: Influence Paths: Model 1

Influence Path Between BackwardLinkagesMNCs and HostProductionCapability				
Path	Causal	Length	Score	Description
0	☐	5	15.52	$BackwardLinkagesMNCs \leftarrow HostForeignTradeInteraction \leftarrow FirmSize \rightarrow HostSkilledEmployees \rightarrow HostAbsoptiveCapability \rightarrow HostProductionCapability.$
1	☒	1	3.05	*BackwardLinkagesMNCs→HostProductionCapability*

Table 34: Influence Paths: Model 2

Influence Path Between BackwardLinkagesMNCs and HostProductionCapability				
Path	Causal	Length	Score	Description
0	☐	4	11.85	$BackwardLinkagesMNCs \leftarrow HostForeignTradeInteraction \leftarrow FirmSize \rightarrow HostAbsoptiveCapability \rightarrow HostProductionCapability.$
1	☒	1	3.05	*BackwardLinkagesMNCs→HostProductionCapability*

The *Influence Paths to Target* identifies the paths between the selected variable and the *Target Node*. It is based on the analysis of the structure but also considers any evidence that opens or blocks information flows (*d-separation criteria*)[52].

In addition to reporting the paths and their lengths, a score quantifies the information that is lost from the selected node to the *Target Node:*

$$S = \log_2\left(\prod_{a \in p} I_{SN}(a_1, a_0)\right) \tag{18}$$

Whereby a is an arc of the path p.

From **Tables 40** and **41**, the "strongest" path is Path 1 (*BackwardLinkagesMNCs→HostProductionCapability*), which is also the shortest one with a length of 1.

[52] A Path p is said to be d-separated (or blocked) by a set of nodes Z if and only if (iff): 1. p contains a chain $i \rightarrow m \rightarrow j$ or fork $i \leftarrow m \rightarrow j$ such that the middle node m is in Z, or 2. p contains an inverted fork/collider $i \rightarrow m \leftarrow j$ such that the middle node m is not in Z and such that no descendant of m is in Z. A set Z is said to d-separate X $from$ Y iff Z blocks every path from a node in X to a node in Y. Pearl (2009: 17)

5.7.3 Intervention as a Surgery: Pearl's Graph Surgery

> *Intervention amounts to a surgery on equations (guided by a diagram) and causation means predicting the consequences of such a surgery* (Pearl 2009:417).

Graph surgery is based on the notion that a causal network represents a multitude of autonomous relationships between parent and child nodes (variables) in a system. Each node is only "listening" to its parent nodes, in that, the child node's values are only a function of a value of its parents, not of any other nodes (variables) in the system. This model of intervention leads to a formal definition of causation: "Y is a cause of Z if we can change Z by manipulating Y, namely, if after surgically removing the equation for Y, the solution Z will depend on the new value we substitute for Y" (Pearl 2009:417).

Note that the parent and child nodes relationships remain invariant regardless of any values that other nodes in the network take on. Should a node in the network be exposed to an outside intervention, the natural relationship between this node and its parents would be severed. This variable (node) no longer naturally "obeys" inputs from its parent nodes; rather, an external force fixes the node to a new value, regardless of what the values of the parent nodes would normally indicate. Notwithstanding this disruption, the structure of the other parts of the network remains unaffected.

The overall idea of intervention as surgery is to consider the causal effect estimation as simulated interventions in the given system. Removing the arrow going into $BackwardLinkagesMNCs$ implies that all the non-causal paths between $BackwardLinkagesMNCs$ and the effect, $HostProductionCapability$, no longer exist without blocking the causal path.

What has already been presented in this study indicates a causal network as a computational device, that is, the Bayesian network, which can simulate what happens upon application of the cause. Applying the cause is like an intervention on a node (variable) in the network.
In the context of the current research, the aim is to determine the effect of $BackwardLinkagesMNCs$, the cause, on $HostProductionCapability$, the asssumed effect.

In its natural state, $BackwardLinkagesMNCs$ is a function of its parent $HostForeinTradeInteraction$.

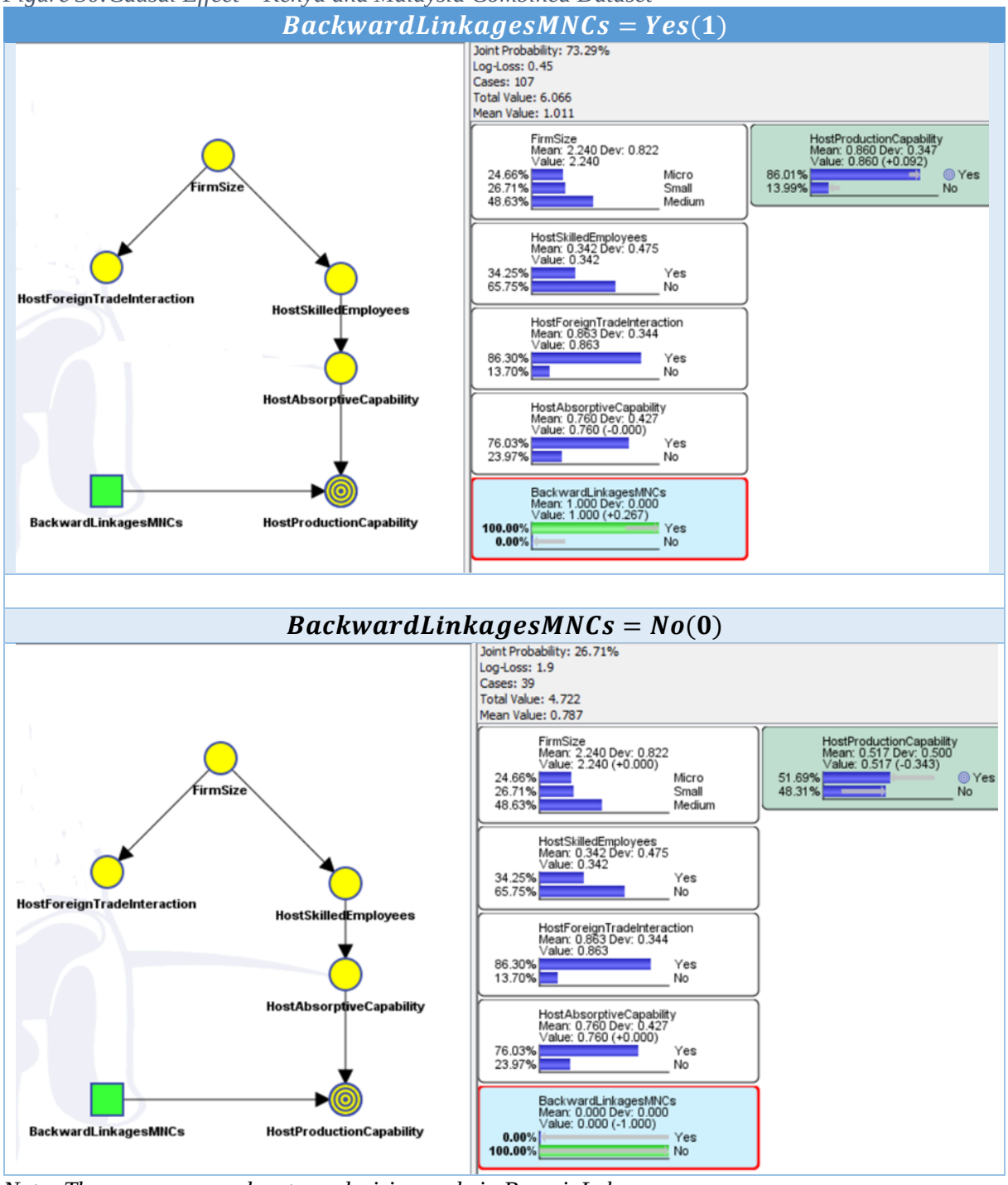
To simulate the cause, we intervene on $BackwardLinkagesMNCs$ and set it to specific values, that is, "Yes(1)" or "No(0)", regardless of what $HostForeinTradeInteraction$ would have induced. This is equivalent to randomly splitting the population of the firms into two sub-populations of equal size, forcing the first sub-population of firms to supply inputs/goods to locally based MNCs and withholding the supply to MNCs from the second sub-population of firms. Such a random selection detaches the association between $BackwardLinkagesMNCs$ and $HostForeinTradeInteraction$. This cuts off the inbound arrow from $HostForeinTradeInteraction$ to $BackwardLinkagesMNCs$ as though it were "surgically" detached. Nevertheless, all the other properties remain invariant, that is, the distribution of $HostForeinTradeInteraction$ and all the other arrows, including the arrow between $BackwardLinkagesMNCs$ and $HostProductionCapability$. This means, after performing the graph intervention, setting $BackwardLinkagesMNCs$ to any value in the intervention, any effects must be causal (Pearl 2009; Conrady and Jouffe 2015). Although one could perform graph surgery manually on a given network, this function is automated in BayesiaLab.

5.8 Causal Effects: Results

5.8.1 Dataset: Kenya and Malaysia – All Sectors

5.8.1.1 Model 1 (DAG 1)

Figure 30:Causal Effect – Kenya and Malaysia Combined Dataset



Note: The green square denotes a decision node in BayesiaLab.

<u>Graph Surgery: Manually</u>

More formally, we can express the interventions in **Figure 30** with the do operator [do(.)].

$$P\left(HostProductionCapability = "Yes(1)" \middle| do(BackwardLinkagesMNCs = "Yes(1)")\right)$$

$$= 86.01$$

$$P\left(HostProductionCapability = "Yes(1)" \middle| do(BackwardLinkagesMNCs = "No(0)")\right) = 51.69$$

As a result, the causal effect of $BackwardLinkagesMNCs$ on $HostProductionCapability$ is **34.32% (0.3432)**.

Graph Surgery: BaysiaLab

Table 35: Total Effects on HostProductionCapability – Full Dataset

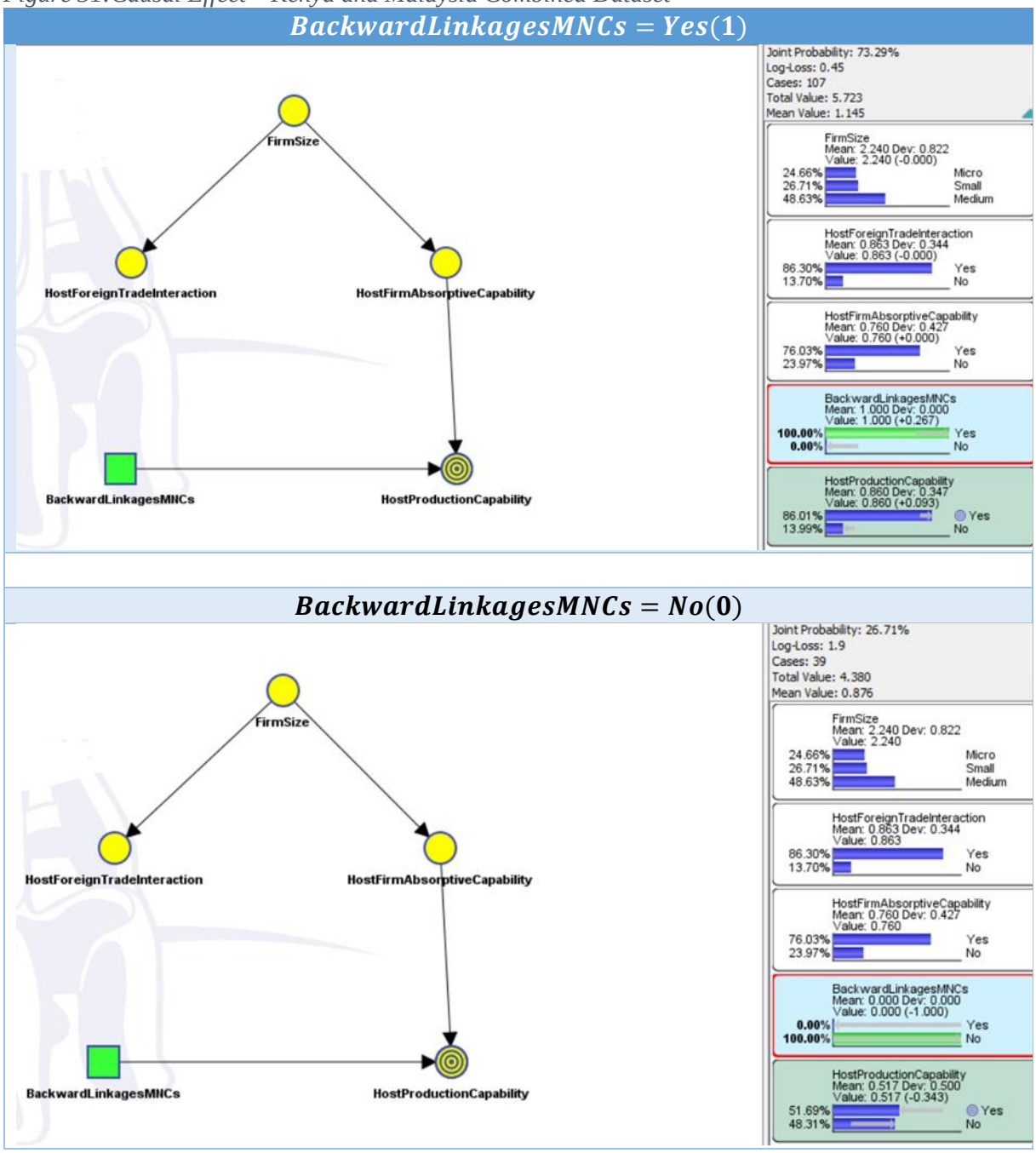
Total Effects on Target HostProductionCapability									
Node	Prior Value/Mean	Standardized Total Effects	Total Effects	G-test	df	p-value	G-test (Data)	df (Data)	p-value (Data)
BackwardLinkagesMNCs →	0.7329	0.3600	0.3432	17.3820	1	0.0031%	43.4629	1	0.0000%

Please note the arrow symbol (→) in the results (Table 42). This indicates that the Intervention Mode was active on $BackwardLinkagesMNCs$.

As demonstrated above, whether one does graph surgery manually or using BayesiaLab, the causal effect remains the same.

5.8.1.2 Model 2 (DAG 2)

Figure 31:Causal Effect – Kenya and Malaysia Combined Dataset



Note: The green square denotes a decision node in BayesiaLab.

Graph Surgery: Manually

More formally, we can express the interventions in *table 25* with the do operator [do(.)].

$$P\left(HostProductionCapability = "Yes(1)" \middle| do(BackwardLinkagesMNCs = "Yes(1)")\right)$$

$$= 86.01$$

$$P\left(HostProductionCapability = "Yes(1)" \middle| do(BackwardLinkagesMNCs = "No(0)")\right)$$

$$= 51.69$$

As a result, the causal effect of $BackwardLinkagesMNCs$ on $HostProductionCapability$ is **34.32% (0.3432)**.

Graph Surgery: BaysiaLab

Table 36: Total Effects on Target HostProductionCapability

Total Effects on Target HostProductionCapability									
Node	Prior Value/Mean	Standardized Total Effects	Total Effects	G-test	df	p-value	G-test (Data)	df (Data)	p-value (Data)
BackwardLinkagesMNCs →	0.7329	0.3600	0.3432	17.3820	1	0.0031%	43.4629	1	0.0000%

Please note the arrow symbol (→) in the results (table 44). This indicates that the Intervention Mode was active on $BackwardLinkagesMNCs$.

The causal effect of $BackwardLinkagesMNCs$ on $HostProductionCapability$ is the same, **34.32%**, in both Model 1 and Model 2. However, we realise that the absence of $HostSkilledEmployees$ in Model 2 does not affect the distribution of $HostFirmAbsorptiveCapability$, rendering the node redundant. Based on this reasoning and the fact that Model 1 did not satisfy the proposed relationship between "firm size" and "skilled employees," we reject it in favour of Model 2. The latter is argued to be the true causal model for the accumulation of production capabilities by firms.

5.9 Quantitative Results

1. Probability of a Firm's Accumulation of Production Capabilities

Table 37: Probabilities: Individual Firm's Accumulation of Production Capabilities

```
> predict(mymodel1,newData, type="prob")
        1         2         3         4         5         6         7         8         9        10        11
0.1201923 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.5929695 0.9566791 0.6743591 0.6743591 0.9566791
       12        13        14        15        16        17        18        19        20        21        22
0.9566791 0.1201923 0.6743591 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791
       23        24        25        26        27        28        29        30        31        32        33
0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.5929695 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791
       34        35        36        37        38        39        40        41        42        43        44
0.9566791 0.9566791 0.1201923 0.5929695 0.9566791 0.9566791 0.5929695 0.9566791 0.1201923 0.5929695 0.9566791
       45        46        47        48        49        50        51        52        53        54        55
0.9566791 0.9566791 0.9566791 0.9566791 0.1201923 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791
       56        57        58        59        60        61        62        63        64        65        66
0.1201923 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.1201923 0.9566791 0.6743591 0.9566791 0.9566791
       67        68        69        70        71        72        73        74        75        76        77
0.6743591 0.9566791 0.9566791 0.1201923 0.1201923 0.9566791 0.9566791 0.6743591 0.6743591 0.9566791 0.5929695
       78        79        80        81        82        83        84        85        86        87        88
0.1201923 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.5929695 0.6743591 0.9566791 0.9566791
       89        90        91        92        93        94        95        96        97        98        99
0.1201923 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791 0.5929695 0.9566791 0.5929695
      100       101       102       103       104       105       106       107       108       109       110
0.9566791 0.9566791 0.9566791 0.9566791 0.1201923 0.5929695 0.9566791 0.9566791 0.9566791 0.9566791 0.9566791
      111       112       113       114       115       116       117       118       119       120       121
0.6743591 0.9566791 0.5929695 0.9566791 0.9566791 0.1201923 0.9566791 0.9566791 0.9566791 0.1201923 0.9566791
      122       123       124       125       126       127       128       129       130       131       132
0.1201923 0.1201923 0.6743591 0.1201923 0.6743591 0.6743591 0.9566791 0.9566791 0.9566791 0.9566791 0.1201923
      133       134       135       136       137       138       139       140       141       142       143
0.1201923 0.1201923 0.1201923 0.5929695 0.1201923 0.9566791 0.6743591 0.1201923 0.1201923 0.9566791 0.9566791
      144       145       146
0.6743591 0.6743591 0.9566791
```

Source: Author's compilation, 2019: Data Source: Manufacturing Survey: Kenya and Malaysia 2018/19

The results indicated in **Table 46** show the probabilities of accumulating production capabilities by all 146 Kenyan and Malaysian firms surveyed. From the table, we note that 65.1 per cent of the firms recorded the highest probability, 0.96, of accumulating production capabilities, while 16.4 per cent of the firms reported the lowest probability, 0.12, of accumulating production capabilities.

2. The relationships between the variables in the suggested causal models.

Table 38: Chi-Square Test (Models I and 2)

Variables	HostFirmSize	HostForeignTradeInteraction	BackwardLinkagesMNCs	HostAbsorptiveCapability	HostSkilledEmployees	HostProductionCapability
	Model 1					
HostFirmSize		P=0.000***			P=0.192*	
HostForeignTradeInteraction			P=0.001***			
BackwardLinkagesMNCs						P=0.000***
HostAbsorptiveCapability						P=0.000***
HostSkilledEmployees				P=0.000***		
	Model 2					
HostFirmSize		P=0.000***		P=0.003***		
HostForeignTradeInteraction			P=0.001***			
BackwardLinkagesMNCs						P=0.000***
HostAbsorptiveCapability						P=0.000***

*Source: Author's compilation, 2019. ***Strong evidence of statistically significant relationship between variables. *No evidence of a statistically significant relationship between variables.*

From **Table 47**, we establish that while all the suggested causal relations in Model 2 are significant, this is not true for Model 1. Indeed, Model 1 shows that there is no statistically significant relationship between *HostFirmSize* and *HostSkilledEmployees*, $P = 0.192\%$, which is higher than the set threshold of $P < 0.05$. Hence, we reject our null hypothesis that there is a statistically significant relationship between skilled workforce and firm size within the E&E

and P&C sectors of both Kenya and Malaysia.[53] As such, we choose Model 2 as the best candidate for our causal analysis.

3. Causal Path Analysis (Model 2) for the Accumulation of Production Capabilities

Based on our Model 2, we show the causal path for the firm's accumulation of production capabilities.

Table 39: Influence Paths: Model 2

Influence Path Between BackwardLinkagesMNCs and HostProductionCapability				
Path	Causal	Length	Score	Description
0	☐	4	11.85	$BackwardLinkagesMNCs \leftarrow HostForeignTradeInteraction \leftarrow FirmSize \rightarrow HostAbsoptiveCapability \rightarrow HostProductionCapability.$
1	☒	1	3.05	*BackwardLinkagesMNCs→HostProductionCapability*

As demonstrated in **Table 48**, the "strongest" causal path between backward linkages from MNCs to the production capability accumulation by firms is "Path 1" (*BackwardLinkagesMNCs→HostProductionCapability*), which is also the shortest one with length 1.

4. Total Causal Effects of Backward Linkages from MNCs on Production Capability Accumulation within Kenya and Malaysia's Firms.

Table 40: Total Effects on Target HostProductionCapability

Total Effects on Target HostProductionCapability								
Node	Prior Value/Mean	Standardized Total Effects	Total Effects	G-test	df	p-value	G-test (Data)	df (Data)	p-value (Data)
BackwardLinkagesMNCs →	0.7329	0.3600	0.3432	17.3820	1	0.0031%	43.4629	1	0.0000%

Please note the arrow symbol (→) in the results (table 49). This indicates that the Intervention Mode was active on $BackwardLinkagesMNCs$.

Table 49 shows that the total causal effect of backward linkages from MNCs on the accumulation of production capabilities within Kenyan and Malaysian firms is 34.32 per cent. This implies that there are other factors accounting for 65.68 per cent that have a total causal effect on the firms' accumulation of production capabilities.

The causal effect of $BackwardLinkagesMNCs$ on $HostProductionCapability$ is the same, **34.32%**, in both Model 1 and Model 2. However, we realise that the absence of $HostSkilledEmployees$ in Model 2 does not affect the distribution of $HostFirmAbsorptiveCapability$, rendering the node redundant. Based on this reasoning and the fact that Model 1 did not satisfy the proposed relationship between "firm size" and "skilled employees," we reject it in favour of Model 2. So far, the latter is argued to be the true causal

[53] As demonstrated elsewhere, we have evidence from our data that all the other null hypotheses are true.

model for the accumulation of production capability by firms. However, we expose our Model 2 to the 5th selection criterion, whereby the causal effects generated from a true causal model are expected to remain invariant across data sets.

5.10 The Invariant Causal Prediction

The invariant causal prediction is a step further in testing the argument that Model 2 is the true causal model for firms' accumulation of production capability. The way it works is that we split the datasets into various categories: (1) country and all sectors combined ([Kenya: E&E, and P&C] [Malaysia: E&E, and P&C]), and (2) country and distinct sectors ([Kenya E&E and Kenya P&C] [Malaysia E&E, and Malaysia P&C]). The expectation is that a true causal model should be invariant when exposed to the split dataset. In particular, the causal effect of $BackwardLinkagesMNCs$ on $HostProductionCapability$ should be similar, given the split datasets. If there is a difference among the different datasets (statistically different estimates), then the proposed causal model (DAG) cannot be the true causal model. T**able 49** shows the results of exposing Model 2 to different datasets.

Table 41: The Invariant Causal Prediction – Model 2

Model	Dataset	Total Causal Effect $BackwardLinkagesMNCs \rightarrow HostProductionCapability$
Model 2	Kenya: E&E, and P&C	0.3177***
	Kenya: E&E	0.2096
	Kenya: P&C	0.4691**
	Malaysia: E&E, and P&C	0.3622***
	Malaysia: E&E	0.0783
	Malaysia: P&C	0.4580**

*Note: *** sig.1%., and ** sig.5%.*

Considering the statistically significant estimates only, **Table 50** indicates that Model 2 varies across different datasets at an arguably low margin of between 1 per cent to 4 per cent (0.01 to 0.04). This variation might be explained by a combination of the presence of unobserved common causes (confounders) within the model as well smaller sample sizes in the split dataset. More importantly, however, the data indicated that firm size varied considerably in the two countries, with most responses in Malaysia dominated by small and medium firms, while those in Kenya were dominated by medium and large firms. As indicated elsewhere in this research, the size of the firm matters in analysing innovativeness.[54] These reasons may lead to a situation

[54] We recommend that future research should control for firm size in their firm analysis of the causal effect of backward linkages from MNCs on the host firm's accumulation of production capabilities. In our case, we would not have realised significant survey responses if we had restricted ourselves to a particular firm size.

where all or some of the implied *conditional independencies* in the DAG are not fulfilled. Detailed information of the possible confounding bias is shown in **Table 51**.

Table 42: Summary of Models 1 and 2 Based on the Selection Criteria

Dataset	Variables	Occurrence Matrix: p(G)	Conditional Independence Test	Pearson Correlation (G)	Total Causal Effect (B→P)
DAG 1 (Model 1)					
Kenya +Malaysia	FS &F	0.00008***	Satisfied	0.4313	
	FS &E	0.19184	Satisfied (P)	0.2812	
	F&B	0.00101***	Satisfied	0.3898	
	E&A	0.00003***	Satisfied	0.3714	
	A&P	0.00000***	Satisfied	0.3986	
	B&P	0.00000***	Satisfied	0.3671	0.3432***
Kenya (E&E, P&C)	FS &F	0.10905	Satisfied	0.5351	
	FS &E	1.63295	Satisfied (P)	0.3056	
	F&B	24.15374	Satisfied	0.1544	
	E&A	0.02500**	Satisfied	0.3720	
	A&P	0.00000***	Satisfied	0.6151	
	B&P	0.00044***	Satisfied	0.3192	0.3177***
Kenya E&E	FS &F	0.10264	Satisfied	0.7167	
	FS &E	9.9098	Satisfied (P)	0.3470	
	F&B	8.84512	Satisfied	0.3415	
	E&A	0.58752	Satisfied	0.4198	
	A&P	0.00841**	Satisfied	0.6877	
	B&P	4.60299	Satisfied	0.2234	0.2096
Kenya P&C	FS &F	62.99263	Satisfied	-0.0580	
	FS &E	3.41747	Satisfied (P)	0.2875	
	F&B	45.17329	Satisfied	-0.0945	
	E&A	1.67325	Satisfied	0.3264	
	A&P	0.00151***	Satisfied	0.3955	
	B&P	0.00061***	Satisfied	0.4922	0.4693***
Malaysia(E&E, P&C)	FS &F	0.19309	Satisfied	0.3482	
	FS &E	3.58164	Satisfied (P)	0.2903	
	F&B	0.00134***	Satisfied	0.5090	
	E&A	0.03190**	Satisfied	0.3628	
	A&P	0.00282***	Not Satisfied	0.2675	
	B&P	0.00019***	Satisfied	0.4014	0.3622***
Malaysia E&E	FS &F	27.29935	Satisfied	0.1179	
	FS &E	82.13567	Satisfied (P)	0.0792	
	F&B	46.78621	Satisfied	0.1260	
	E&A	12.44403	Satisfied	0.2263	
	A&P	0.08246*	Not Satisfied	0.4751	
	B&P	1.01350	Satisfied	0.0800	0.0783
Malaysia P&C	FS &F	1.10407	Satisfied	0.4121	
	FS &E	0.28878	Satisfied (P)	0.5362	

	F&B	0.00618***	Satisfied	0.6086	
	E&A	0.02256**	Satisfied	0.5000	
	A&P	0.87745*	Satisfied	0.1265	
	B&P	0.04334**	Satisfied	0.5119	0.4580**
DAG 2 (Model 2)					
Kenya + Malaysia	FS &F	0.00008***	Satisfied	0.4313	
	FS &A	0.00339***	Satisfied (P)	0.3590	
	F&B	0.00101***	Satisfied	0.3898	
	A&P	0.00000***	Satisfied	0.4149	
	B&P	0.00000***	Satisfied	0.3845	0.3432***
Kenya (E&E, P&C)	FS &F	0.10905	Satisfied	0.5351	
	FS &A	2.49752	Satisfied (P)	0.3475	
	F&B	24.15374	Satisfied	0.1544	
	A&P	0.0000***	Satisfied	0.6190	
	B&P	0.00044***	Satisfied	0.3274	0.3177***
Kenya E&E	FS &F	0.10264*	Satisfied	0.7167	
	FS &A	60.72376	Satisfied (P)	0.1868	
	F&B	8.84512	Satisfied	0.3415	
	A&P	0.00841***	Satisfied	0.6923	
	B&P	4.60299	Satisfied	0.2381	0.2096
Kenya P&C	FS &F	62.99263	Satisfied	-0.0580	
	FS &A	0.182470	Satisfied (P)	0.6262	
	F&B	45.17329	Satisfied	-0.0945	
	A&P	0.00151***	Satisfied	0.3970	
	B&P	0.00061***	Satisfied	0.4933	0.4691***
Malaysia(E&E, P&C)	FS &F	0.19309	Satisfied	0.3482	
	FS &A	0.05169**	Satisfied (P)	0.3618	
	F&B	0.00134***	Satisfied	0.5090	
	A&P	0.00282***	Satisfied	0.2878	
	B&P	0.00019***	Satisfied	0.4153	0.3622***
Malaysia E&E	FS &F	27.29935	Satisfied	0.1179	
	FS &A	0.31661	Satisfied (P)	0.4899	
	F&B	46.78621	Satisfied	0.1260	
	A&P	0.08246*	Satisfied	0.4761	
	B&P	1.0135	Satisfied	0.0844	0.0783
Malaysia P&C	FS &F	1.10407	Satisfied	0.4121	
	FS &A	3.3328	Satisfied (P)	0.2331	
	F&B	0.00618**	Satisfied	0.6086	
	A&P	0.87745*	Satisfied	0.1140	
	B&P	0.04334**	Satisfied	0.5106	0.4580**

Green Letters: Markov blanket considered for the Conditional Independence Test.[55] **** sig.1%., ** sig.5% and * sig.10%.*
Note: The Markov blanket of any given node contains all the nodes that, if we know their states, that is, we have hard evidence

[55] The Markov blanket of a target node consists of all nodes that make this target conditionally independent of all the other nodes in the model.

for these nodes, will shield that node from the rest of the network, making that node independent of all the other nodes given its Markov blanket.[56]

Overall, our analysis of Model 2 has not demonstrated total invariance in the different datasets. Nevertheless, and based on the results in **Table 51**, we are convinced that Model 2 is closer to a true causal model and the total causal effect of backward linkages from MNCs on the host firms' production capability generated, *34.32 per cent*, is closer to the true result.

5.11 Conclusion

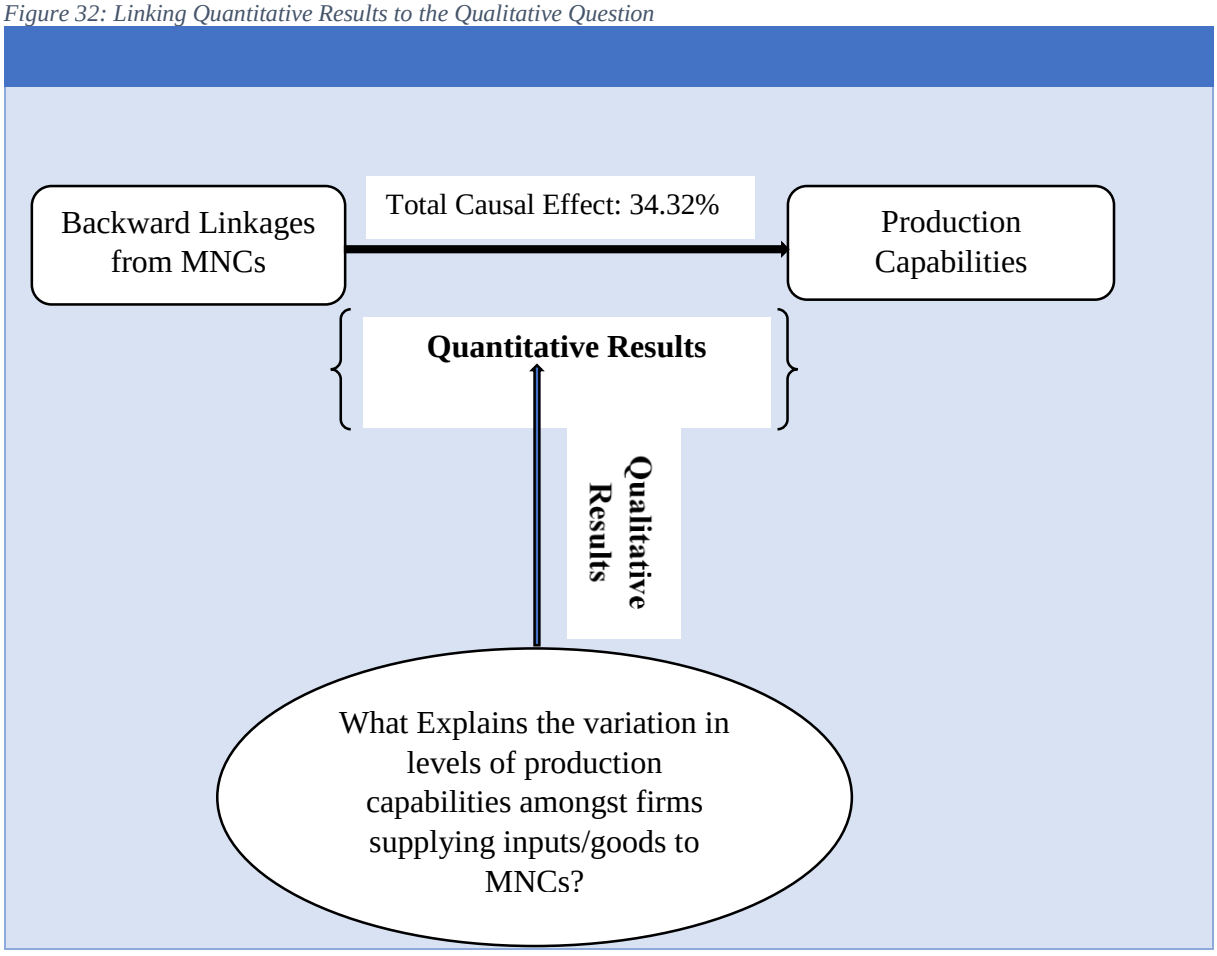
Based on the existing literature, we operationalised the main variables in our study, including backward linkages from MNCs and the accumulation of production capabilities. Moreover, using causal Bayesian networks, we specified two competing causal models of how firms accumulate production capabilities. The aim was to finally identify, out of the two models, that which is truly causal. These models were quantified using data from the electronics and electricals (E&E) and plastics and chemicals (P&C) sectors within Kenya and Malaysia. After exposing the proposed models to a series of tests, we rejected Model 1 in favour of Model 2. Regarding the relationship between backward linkages from MNCs and the accumulation of production capabilities, our model established $P = 0.00\%$, a value below $P < 0.05$, suggesting very strong evidence that there is a statistical relationship between backward linkages from MNCs and the accumulation of production capabilities. Specifically, firms with backward linkages from MNCs reported higher levels of production capability accumulation. Causally, our findings suggest a direct causal link between backward linkages from MNCs and production capability accumulation by the host firms. Indeed, we established that the total causal effect of $BackwardLinkagesMNCs$ on $HostProductionCapability$ is 34.32 per cent, with a value of $P = 0.00\%$. Those firms that reported the presence of backward linkages from MNCs demonstrated that the linkages had a total causal contribution of *34.32 per cent* to the firm's efforts to accumulate production capability, with the difference explained by other factors.

By examining **Tables 40** and **41**, we learn that the shortest causal path from the proposed causal model is *BackwardLinkagesMNCs→HostProductionCapability*) and that the total causal effect of backward linkages from MNCs on the accumulation of production capabilities is 34.32 per cent. From the theory of the firm perspective, the accumulation of production capabilities takes place through a learning process in the sense that, through their long-term interaction with their MNC customers, local firms are exposed to various learning opportunities geared toward necessitating a shift from production of low-value products to high-value-added goods.

[56] Using Hard Evidence means that one would exclusively try out sets of evidence consisting of nodes with one state set to 100%, that is, a probability of 1.

However, it is well established that there exists a variation in production capability levels among local firms supplying locally based MNCs. While some firms can diversify their products, the products of other firms remain less diversified. In order to investigate this variation, we selected some firms from across both Kenya and Malaysia, which took part in the quantitative survey for a follow-up with qualitative interviews. The aim of the qualitative phase is to offer explanations for our quantitative results. We expect to integrate and offer a detailed discussion of the results generated in these two phases at a later stage. For a visual representation of the link between quantitative results and qualitative question, see **Figure 32**.

Figure 32: Linking Quantitative Results to the Qualitative Question



Source: Author's compilation, 2019.

Chapter 6: Phase 2: The Qualitative Phase

6.1 Introduction

The analysis of qualitative data can be a demanding task. However, there are three widely used coding methods that can make the analysis systematic. As described by Saldaña (2015), these methods are descriptive coding, in vivo coding, and emotion coding.

Due to the focus of the current study on hypothesis testing, the researcher has adopted the descriptive coding technique and implements it on interview data collected from selected firms across Kenya and Malaysia. The data analysis is executed using MAXQDA 2018 software and employs a hypothetico-deductive approach.

6.2 Phase Two: Qualitative Analysis

Target firms for the qualitative phase were identified from **Tables 52** and **53**. These tables are drawn from the quantitative-phase, as represented in **Table 46**, which lists the conditional probabilities of all the 146 survey observations.

Table 43: Probability of Production Capability Accumulation – Kenya

Probability: Kenya: E&E Sector									
0.9566791	0.9566791	0.956679	0.9566791	0.9566791	0.5929695	0.9566791	0.9566791	0.9566791	0.9566791
0.9566791	0.9566791	0.9566791	0.1201923	0.5929695	0.9566791	0.9566791	0.5929695	0.9566791	0.1201923
0.5929695	0.9566791	0.9566791	0.6743591	0.1201923	0.1201923	0.9566791	0.9566791	0.6743591	0.6743591
0.9566791									

Probability Frequency (E&E sector)			
Probability Category	**Total Frequency**	**Follow Up=No***	**Reminder**
0.9566791**	20	2	18
0.6743591	3	1	2
0.5929695	4	1	3
0.1201923**	4	1	3
Total	**31**	**5**	**26**

P&C Sector									
0.9566791	0.9566791	0.9566791	0.9566791	0.9566791	0.9566791	0.9566791	0.1201923	0.9566791	0.9566791
0.9566791	0.9566791	0.9566791	0.9566791	0.1201923	0.9566791	0.9566791	0.9566791	0.9566791	0.9566791
0.1201923	0.9566791	0.6743591	0.9566791	0.9566791	0.6743591	0.9566791	0.9566791	0.1201923	0.1201923
0.9566791	0.9566791	0.6743591	0.6743591	0.9566791	0.9566791				

Probability Frequency (P&C sector)			
Probability Category	**Frequency**	**Follow Up=No***	**Reminder**
0.9566791**	27	3	24
0.6743591	4	4	0
0.1201923**	5	2	3
Total	**36**	**9**	**27**

*Source: Author's compilation, 2019. *Refers to the quantitative survey question that asked surveyed firms if they would be willing to participate in the second round of interviews. **Categories for simple random sampling.*

Table 44: Probability of Production Capability Accumulation – Malaysia

Probability: Kenya: E&E Sector									
0.9566791	0.9566791	0.956679	0.9566791	0.9566791	0.5929695	0.9566791	0.9566791	0.9566791	0.9566791
0.9566791	0.9566791	0.9566791	0.1201923	0.5929695	0.9566791	0.9566791	0.5929695	0.9566791	0.1201923
0.5929695	0.9566791	0.9566791	0.6743591	0.1201923	0.1201923	0.9566791	0.9566791	0.6743591	0.6743591
0.9566791									

Probability Frequency (E&E sector)			
Probability Category	**Total Frequency**	**Follow Up=No***	**Reminder**
0.9566791**	20	2	18
0.6743591	3	1	2
0.5929695	4	1	3
0.1201923**	4	1	3
Total	**31**	**5**	**26**

P&C Sector									
0.9566791	0.9566791	0.9566791	0.9566791	0.9566791	0.9566791	0.9566791	0.1201923	0.9566791	0.9566791
0.9566791	0.9566791	0.9566791	0.9566791	0.1201923	0.9566791	0.9566791	0.9566791	0.9566791	0.9566791
0.1201923	0.9566791	0.6743591	0.9566791	0.9566791	0.6743591	0.9566791	0.9566791	0.1201923	0.1201923
0.9566791	0.9566791	0.6743591	0.6743591	0.9566791	0.9566791				

Probability Frequency (P&C sector)			
Probability Category	**Frequency**	**Follow Up=No***	**Reminder**
0.9566791**	27	3	24
0.6743591	4	4	0
0.1201923**	5	2	3
Total	**36**	**9**	**27**

*Source: Author's compilation, 2019. *Refers to the quantitative survey question that asked surveyed firms if they would be willing to participate in the second round of interviews. **Categories for simple random sampling.*

6.3 Selection Criteria for Firms to be Included in the Qualitative Survey

1. The probability categories need to be present in all the sectors both countries.
2. Both firms that supply to MNCs and those that that do not will be included in the selection process.
3. Only firms that want to participate in the second round of interviews will be considered for selection in each category (see **Appendix 1**).
4. One firm will be randomly selected from each category using simple random sampling.

The selection of the firms for the qualitative interviews was limited to 8 firms, that is, 4 firms from Kenya and 4 from Malaysia; see **Table 54**.

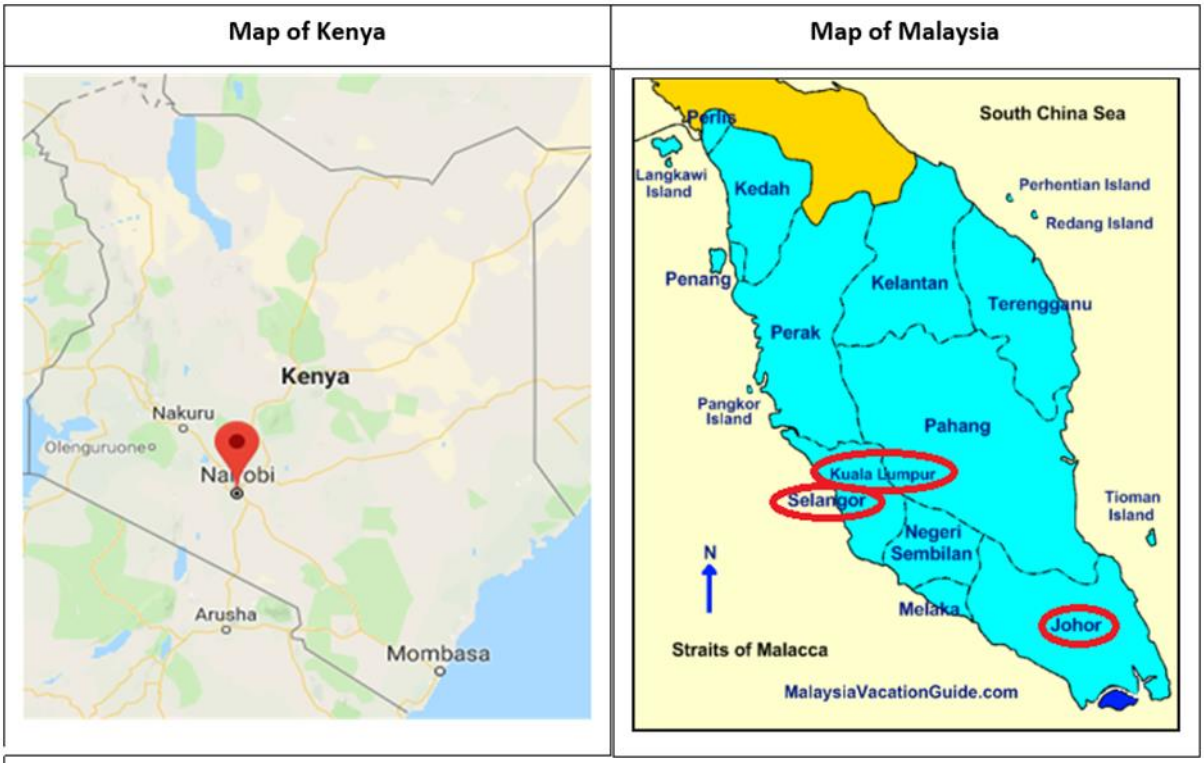
Table 45: Selected Cases for the Qualitative Data

Firm	Year Established	Firm Size	Subsector
Kenya			
A. **Noormohamed**	1995	Medium	P&C
B. **Maina**	2000	Medium	P&C
C. **Kariuki**	1991	Medium	E&E
D. **Panchal**	1979	Medium	E&E
Malaysia			
E. **Almakki**	2017	Small	E&E
F. **Ghani**	2014	Medium	E&E
G. **Amin**	2013	Medium	P&C
H. **Kent**	2016	Small	P&C

Source: Author's compilation, 2019.

Open-ended and guided interviews were administered on-site to the managers of the selected firms. Details of the guided interviews will be provided in the following section. Based on the abovementioned selection criteria, eight (8) firms were selected in Kenya and Malaysia. In each sector, two firms were randomly selected, namely those with a 96 per cent and a 12 per cent chance of production capability accumulation, respectively. In total, four (4) firms were randomly selected from each country. While all of the selected firms in Kenya are located in Nairobi, the ones selected from Malaysia are located in the states of Selangor, Kuala Lumpur, and Johor. See the maps in **Figure 33** for more detail.

Figure 33:Cities hosting Targeted Firms (Kenya and Malaysia)

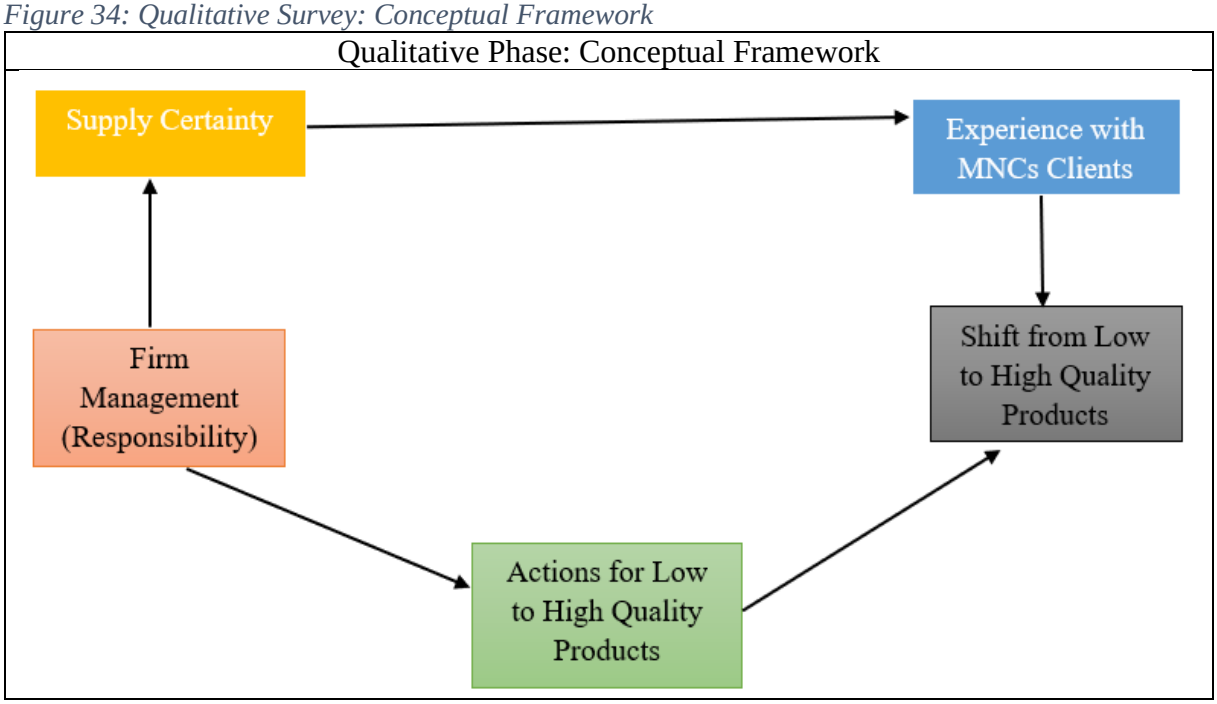


Source: Author's compilation, 2019

6.4 The Conceptual Framework

The conceptual framework reflects the researcher's theoretical understanding of what is already covered within the literature review. As such, the decisions made by the firm management affect the ability of the firm to identify and handle fluctuations in the production process (supply certainty) as well as the actions for the shift of the firm from the production of low-quality products to high-quality goods. Furthermore, interacting with MNC customers as well as the actions put together by a firm (for example, internal trainings) affect the shift of a firm from the production of low-quality products to those of higher quality. This conceptual framework depicts important themes guiding the data collection. Moreover, the framework shows a relationship between themes, in terms of who is affecting what. Overall, and inspired by the quantitative phase of the current study, the selected themes will be the major focus of the qualitative data collection and analysis (for details, see **Figure 34**).

Figure 34: Qualitative Survey: Conceptual Framework



Source: Author's compilation, 2019

Research Question

i. How do local firms that interact with MNC customers increase their changes of shifting from the production of low-quality products to high-quality goods?
ii. What can explain the variations in the levels of production capabilities among host firms supplying inputs/goods to locally based MNCs?

6.5 Designing and Conducting Semi-Structured Interviews

6.5.1 Brief Literature Review on Semi-Structured Interviews

This section first offers a definition of an interview guide. It further explores various literature materials that guide the creation of semi-structured interview questions. To begin with, an interview guide is defined by Whiting (2008) and Krauss et al. (2009) as a list of questions which directs conversation toward the research topic during the interview (Åstedt-Kurki and Heikkinen 1994; Krauss et al. 2009; Cridland et al. 2015).

According to Kallio et al. (2016), well-formulated research questions in the guide should have four main components: participant-oriented (Louise Barriball and While 1994); not leading, but also clearly worded (Åstedt-Kurki and Heikkinen 1994; Turner 2010), single-faceted, (Cridland et al. 2015; Baumbusch 2010); and open-minded (Dearnley 2005; Krauss et al. 2009; Turner 2010; Chenail 2011). Moreover, questions in the semi-structured interview guide are of two

levels: main themes and follow-up questions. The main themes cover the major content of the research subject, and with them, interviewees are encouraged to speak freely about their perceptions and experiences (Kallio et al. 2016). Furthermore, the order of the main themes could be progressive and logical (Krauss et al. 2009). They could also be used to build a rapport between the interviewer and the interviewee (Whiting 2008; Krauss et al. 2009; Rabionet 2011; Cridland et al. 2015). These questions could be about issues that are familiar to the interviewee, yet central to the research subject (Whiting 2008).

The order of the main themes could progress from the lighter ones to those that are more emotional and in-depth, see (Whiting 2008; Baumbusch 2010; Cridland et al. 2015), and then end on lighter themes (Baumbusch 2010). Follow-up questions are used to make the main themes easier for the interviewee to understand and to direct the conversation towards the research subject (see Turner 2010; Baumbusch 2010). The aim of the follow-up questions is to maintain the flow of the interview (Whiting 2008) and obtain accurate (Louise Barriball and While 1994; Whiting 2008; Baumbusch 2010; Rabionet 2011) and optimal information (Turner 2010).

Follow-up questions can be pre-designed (Whiting 2008; Rabionet 2011), spontaneous or based on the interviewee's answers (Whiting 2008; Turner 2010; Chenail 2011). According to Krauss et al. (2009), pre-designed follow-up questions could be advantageous in increasing the consistency of the subjects covered by interviews carried out by different interviewers.

In sum, the above discussion provides key information and guidelines for crafting guided interviews. In the section that follows, this information will be applied in the context of the current study.

6.5.2 Semi-Structured Interviews in Context

In the current study, the semi-structured interviews are used for explanatory purposes, in the sense that the interviewer asks the selected cases to supply information on various themes already captured in the quantitative phase of the study. The interviewee is expected to:

1. Identify the ability of the firm to handle fluctuations in the production process. This is important in three main aspects: (a) creating awareness of the supplier-buyer involvement in problem-solving pertaining to the orders; (b) highlighting how flexible the supplier is in responding to the buyer requests; and (c) demonstrating the

commitment to the supplier-customer contractual agreement. By responding to this question, the firm's transaction costs associated with production can be assessed.

2. Describe how the firm perceives its interaction with MNC customers. Does the firm engage more deeply with MNCs to the extent that they become partners? Addressing this question is crucial as it highlights the degree of external learning that the firm is exposed to. Indeed, MNCs are mainly at the frontier of technology and act as potential knowledge transfer agents.
3. Identify from the production process, logistics, organisational and marketing methods where the firm is strongly positioned. Answering this question allows the researcher to assess the status of production capabilities within the firm.
4. Reflect on whether there were any specific actions, events or points in time that were favourable for the formation of the strong position. This question allows the researcher to assess the causes of the firm's strong position from the perspective of the interviewee. In fact, this question is crucial as it addresses issues in relation to the causes of the firm's production capabilities, which are the focus of the overall study.
5. Identify, within the firm, who is responsible for the initiation of actions that can lead to a strong position. This last question allows the researcher to understand the views of the interviewee on the responsibility for actions within the firm.

6.5.2.1 Crafting the Interview Guide

The literature already covered above, as well as numerous other books, articles and journals, have documented how to best approach this stage. The converging point among the existing studies is that the interview guide or protocol, as referred to by Rabionet (2011), has two important components. First, how does the interviewer introduce himself or herself to the interviewee? And second, what are the questions to be asked?

The first component is intended to establish a rapport, to create a favourable environment, and to elicit reflection and truthful comments from the interviewee. According to many researchers, for example, Rabionet (2011), the opening statement has to be written by the researcher in order to establish the line of communication that will evoke the "stories". When an interviewer is introducing him- or herself, the interview guide should include statements of confidentiality, consent, options to withdraw, and the ultimate use and scope of the results (Rabionet 2011).

Based on the above discussion and literature review, an interview guide was designed. The interviews were contacted in Kenya (*01.08.2019 to 30.08.2019)* and Malaysia (*01.09.2019 to*

31.09.2019), and all responses were recorded. The interviewer observed all ethical guidelines as stipulated in Kvale (2008). For the detailed interview guide, see **Appendix 3**.

6.5.3 Analysing the Interview Data

6.5.4 Method

This section covers the data analysis after the data have been collected and is not based on the grounded theory approach, whereby the data are coded early in order to inform the next step in the data collection process and which applies the constant comparative methods. The main reference material is the work of Saldaña (2015), the coding manual for qualitative research.

According to Saldaña (2015), coding in qualitative interviews is not a precise science but is primarily an interpretive act. To that extent, Saldaña defines a *code* in qualitative enquiry as "most often a word, or short phrase that symbolically assigns a summative, salient essence-capturing and/or evocative attribute for a portion of language-based or visual data" (Saldaña 2015:3). Coding breaks down the data to the smallest unit, or idea, that can stand alone. To illustrate what this means, think of bestselling novels—a good novel's title captures the essence of what the novel is about, reflecting what the author has interpreted as significant to the story and gives meaning to the content.

Moreover, coding goes beyond labelling. Richards and Morse (2007) state that coding is not just labelling but also involves linking in the sense that it can lead a researcher from the data to the idea, and from the idea to all the data pertaining to that idea. Researchers do this because what they seek from the data are *patterns*, and vice-versa. *Patterns* are the links in the data that tell the researcher something significant about the research question. These patterns allow researchers to develop *themes*, which are theoretical constructs supported by the data. As Seal (2016) described, "a *theme* reflects a significance of a pattern within the data in relation to the research question." To get from the codes to the themes, researchers use *categories* to help narrow down and identify the patterns. Some concise definitions for codes, categories and themes are presented in the following.

Considering that codes are more than mere labels, Seal (2016) provides a short and concise definition: A code is a descriptor of a data segment that assigns meaning. For example, if in a researcher's interview data, a respondent who was a manager said "I give up", then the researcher might code this as *manager resignation*. Supposing a researcher has dozens of codes, then he/she might discover that several of them can be grouped under one category. Categories are more conceptual and abstract than codes, as Saldaña (2015) has stated, and it is for the

researcher to determine how he/she categorises the codes. There are techniques that can help the researcher find their path, such as writing *analytical memos*. As an example, in terms of categories, let us take the *manager resignation code* that we established earlier. A researcher might also have two more codes: *manager happy* and *manager striking*. All of these might be grouped under the category of *manager behaviour*. As for *themes*, which in turn develop out of patterns, Seal (2016) sees them as theoretical *constructs* that explain similarities or variations across codes. DeSantis and Ugarriza go deeper and define a theme as "an abstract entity that brings meaning and identity to recurrent pattern experience and its variant manifestation. As such, a theme captures and unifies the nature or basis of the experience into a meaningful whole" (DeSantis and Ugarriza 2000:362). Here, the emphasis is on *meaning*.[57] A theme, therefore, develops out of the codes via the categories.

6.5.5 Coding Methods

There are three widely used coding methods, for which Saldaña (2015) provides the following definitions:

Descriptive coding: This method assigns labels to data to summarise, in a word, a short phrase or often a noun, the basic topic of a passage of qualitative data.

In vivo coding: This method uses words or short phrases from the participant's own language in the data record as codes. May include folk or indigenous terms within a culture, sub-culture or micro-culture in order to suggest the existence of the group's cultural categories.

Emotion coding: This method labels the emotions recorded and/or experienced by the participants, which are inferred by the researcher about a participant.

The following example is a short extract from a response to an interview question used in the current study.

> *Where do you see this firm's current (production process, logistics and supporting activities, organizational and marketing methods) strongly positioned?*

Respondents were asked this question for the purpose of creating interview data to be used in analysing how firms shift from the production of low-value-added goods toward the production of high-value-added goods. This question is part of the current research project.

Borrowing from Saldaña (2015), *descriptive coding* summarises, in a word or short phrase, most often as a noun, the basic topic of a passage of qualitative data. Descriptive coding is one

[57] Note the addition of the dimension of the "whole".

of the most basic coding techniques and is useful for all sorts of data and all coding experiences. As demonstrated in **Table 55**, the description of how the respondent's firm is hospitable to customers to the point of becoming partners is very interesting.

Table 46: Descriptive Coding

Descriptive Coding	
Extract	**Descriptive Coding**
Noormohamed: At Complast Ltd, we have a competitive advantage as far as marketing is concerned. Its our culture of *Swahilism* that has brought out the best of us in marketing. We build relationships to a level where we become partners. We become partners, its not about making profits, its not about satisfying, it goes beyond, in English we use the word customer centric. But I think this was developed by our *Swahili* culture where we are very hospitable people. So that has given us the edge. Customer centric is something that came recently, but our hospitality, the very Kenyan hospitality, has given us the edge as far as marketing is concerned. Because we know how to welcome people, we know how to treat people, we know how to weigh people in and make sure they are comfortable.	• Firm competitive in marketing • Culture promotes competitiveness in marketing • Firm partners with customers • Profits not main goal but customer satisfaction • Firm hospitable to customers

Charmaz (2008), when writing about coding techniques for grounded theories, describes in vivo coding as helping us to preserve participants' meanings of their views and actions in the coding itself. This is especially important when collecting data from cultures or sub-cultures that are using a different terminology or slang language. In vivo codes are rarely final codes requiring further analytical elevation. In the example shown in **Table 56**, the respondent's the use of *Swahilism* is particularly interesting because he demonstrates the culture within the firm that has led to a marketing advantage, and he is very proud of it.

Table 47: In Vivo Coding

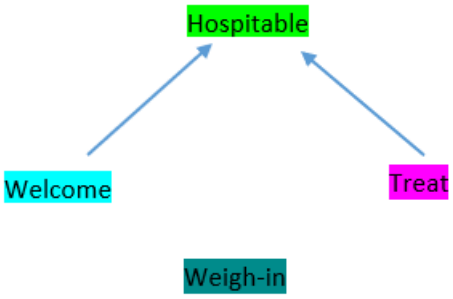
In Vivo Coding

Extract	In Vivo Coding
Noormohamed: At Complast Ltd, we have a competitive advantage as far as marketing is concerned. Its our culture of *Swahilism* that has brought out the best of us in marketing. We build relationships to a level where we become partners. We become partners, its not about making profits, its not about satisfying, it goes beyond, in English we use the word customer centric. But I think this was developed by our *Swahili* culture where we are very hospitable people. So that has given us the edge. Customer centric is something that came recently, but our hospitality, the very Kenyan hospitality, has given us the edge as far as marketing is concerned. Because we know how to welcome people, we know how to treat people, we know how to weigh people in and make sure they are comfortable.	• "competitive advantage as far as marketing is concerned" • "Its our culture of *Swahilism* that has brought out the best of us in marketing" • "we become partner" • "very hospitable people"

Emotion coding is an effective coding technique, and Saldaña describes it as labelling the feelings that participants may have experienced or are inferred by the researcher about the participants. Note that in **Table 57**, emotions are used in coding can be seen in the use of "hospitable", "welcome", "treat" and "weigh-in." Indeed, codes are present in the sense that "hospitable" is a consequential emotion, and the triggering emotions that precede it include "considerate." This is evident when the respondent repeatedly comments with "welcome", "treat" and then progresses to "hospitable".

Table 48: Emotions Coding

Emotions Coding

Extract	Emotions Coding
Noormohamed: At Complast Ltd, we have a competitive advantage as far as marketing is concerned. Its our culture of *Swahilism* that has brought out the best of us in marketing. We build relationships to a level where we become partners. We become partners, its not about making profits, its not about satisfying, it goes beyond, in English we use the word customer centric. But I think this was developed by our *Swahili* culture where we are very hospitable people. So that has given us the edge. Customer centric is something that came recently, but our hospitality, the very Kenyan hospitality, has given us the edge as far as marketing is concerned. Because we know how to welcome people, we know how to treat people, we know how to weigh people in and make sure they are comfortable.	

6.5.5.1 Comparison of the Three Coding Techniques

As demonstrated in **Tables 55, 56** and **57**, the three coding techniques highlight "hospitality" over competitiveness in marketing as an aspect that is caused by the culture of *Swahilism*. The correlation of competitiveness and hospitality is something a researcher would be interested in exploring further, in particular, the aspect of **culture** in how firms shift from the production of low-value-added goods toward the production of high-value-added goods. In this case, **culture** might be treated as a category.

Overall, and based on the discussion about coding techniques, there is no standardised way of coding in qualitative research. However, a researcher might decide whether something is important to code for the following reasons: It is repeated in several places; it surprises him/her; the interviewee explicitly states that it is important; he/she has read something similar in previously published reports (for example, scientific articles); it reminds him/her of a theory or a concept; or for some other reason that he/she thinks is relevant. Indeed, a researcher can: (a) Use preconceived theories and concepts, or can be more open-minded; (b) aim for a description of things that are superficial; or (c) aim for a conceptualisation of underlying patterns.

The focus of the current study is hypothesis testing. The researcher uses preconceived theories and concepts to guide the coding of the qualitative data, thus adopting a descriptive coding technique.

6.6 Data Management

The intention of the current study is to test from the data the hypothesis that there exists a causal link between backward linkages from MNCs and a firm's accumulation of production capabilities; therefore, a *hypothetico-deductive method* was adopted. To transcribe all the voice-recorded interviews, the researcher searched for a leading qualitative data analysis (QDA) software that was not only supported on Windows but also counted among the most comprehensive programs in the field. MAXQDA 2018 software[58] was selected because it met these requirements. The analysis started with the creation of a new project in MAXQDA 2018. The researcher had eight audio files, four from Kenya and four from Malaysia, which were all successfully transcribed in MAXQDA 2018. After all necessary files were transferred, the next step was coding, referring to the process of putting together extracts across documents that are related to each other; see **Table 58**.

Table 49: Major Codes and Their Meanings

Adopted Codes and their Meaning

Code	Title	Memo text
Supply Certainty	Supply Certainty	Aims at obtaining information on how a firm ensures supply certainty to their customers, an essential requirement for the formation of backward linkages with MNCs.
Experience with MNCs	Experience with MNCs	The interviewee portrays how he/she perceives locally based MNCs as well as the role they play in the firm in question.
Production Capability	Production Capability	This includes the firm's current [(production process for goods, logistics and supporting activities), (organizational and marketing methods)]
Actions for Strong Position	Actions for Strong Position	Serves to make interviewee reflect on whether there are any specific actions, events or points in time, which where favourable to the formation of the strong position.
Threats	Threats	Requires the interviewee to reflect on what future threat to the current strong position would be.
Responsibility for Actions	Responsibility for Actions	Aims at understanding the interviewee's views on the responsibility of the initiation of actions within the firm.
Envisaged Barriers	Envisaged Barriers	Aims at understanding the interviewee's views on the future barriers and the firm's preparedness to mitigate them.

Note: The descriptive statistics of the above codes are presented in Appendices 4 to 10

Since analysis was driven by a hypothetico-deductive approach, all the transcript files were read in detail and interesting excerpts were coded into designated themes. Two categories were created out of the major codes: (1) Production capability (high, medium low) and (2) exposure

[58] MAXQDA is a software program designed for computer-assisted qualitative and mixed methods data, text and multimedia analysis in academic, scientific and business institutions.

to multinational corporations (design, production, operations, logistics). **Tables 59** to **61** provide details of how the categories were determined.

Table 50: Production Capability - Constituents and Frequency

	Organization		Operation		Marketing		Design		Production		Logistics		Total	
Cases	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak
Almaki	☐	☒	☐	☒	☒	☐	☐	☒	☒	☐	☐	☒	2	4
Kent	☒	☐	☒	☐	☒	☐	☐	☒	☒	☐	☒	☐	5	1
Amin	☒	☐	☐	☒	☒	☐	☐	☒	☐	☒	☐	☐	2	3
Ghani	☐	☒	☒	☐	☒	☐	☒	☐	☐	☒	☒	☐	4	2
NoorM	☒	☐	☒	☐	☒	☐	☐	☒	☒	☐	☐	☐	4	1
Maina	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐	6	0
Kariuki	☒	☐	☒	☐	☐	☒	☒	☐	☒	☐	☐	☐	4	1
Panchal	☒	☐	☒	☐	☐	☒	☒	☐	☒	☐	☐	☒	4	2

Source: Author's compilation, 2019.

As demonstrated in the total column in **Table 59**, a higher value under "strong" means a higher level of a firm's productive capability, and vice-versa. Additionally, a higher value under "weak" signifies that a firm has a lower level of production capability.

6.6.1 Choosing Production Capability Categories

From the total column, we can observe the following trend: 2,2,4,4,4,4, 5,6

- All 2s were grouped to form the **Low** Production Capability
- All 4s formed the **Medium** Production Capability, and
- The 5 and 6 created the **High** Production Capability

These categories are detailed in **Table 60**.

Table 51: Document Variable: Production Capability Accumulation (Kenya and Malaysia)

Firm Name	Subsector	Production Capability
Malaysia		
Almakki	E&E	Low
Kent	P&C	High
Amin	P&C	Low
Ghani	E&E	Medium
Kenya		
Noormohamed	P&C	Medium
Maina	P&C	High
Kariuki	E&E	Medium
Panchal	E&E	Medium

Source: Author's compilation, 2019. Data source: Interview data collected in Kenya and Malaysia, 2019.

For the categories detailing exposures to MNCs, see **Table 61**. As depicted in the table, all responses from the eight firms that took the interview converged on four aspects, namely design, production, operations, and logistics.

Table 52: Exposure to MNC Customers

	MNC Customers			
Case	**Design**	**Production**	**Operations**	**Logistics**
Almakki	☐	☒	☐	☐
Kent	☐	☐	☒	☐
Amin	☐	☐	☐	☒
Ghani	☐	☐	☒	☐
Noormohamed	☐	☒	☐	☐
Maina	☒	☐	☐	☐
Kariuki	☒	☐	☐	☐
Panchal	☒	☐	☐	☐
Total	**3**	**2**	**2**	**1**

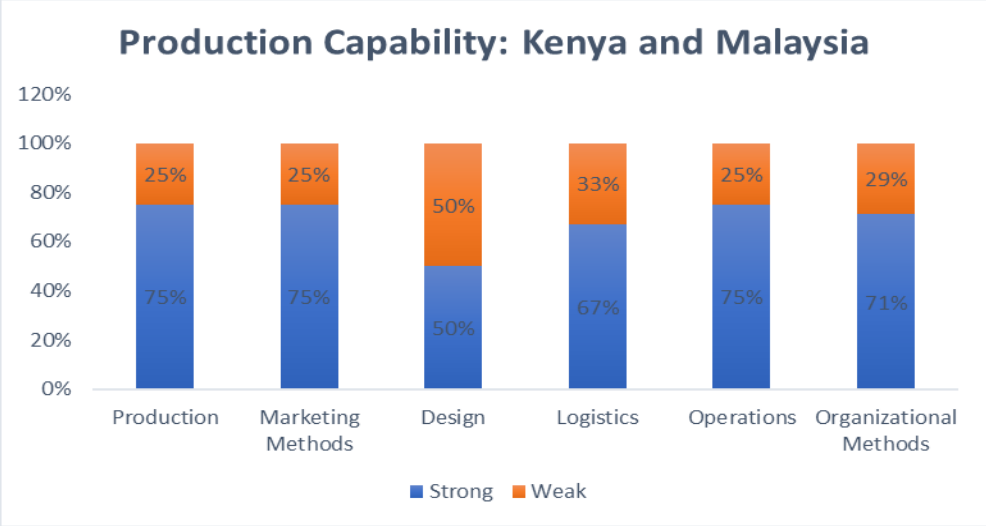
Source: Author's compilation, 2019.

6.7 Qualitative Analysis

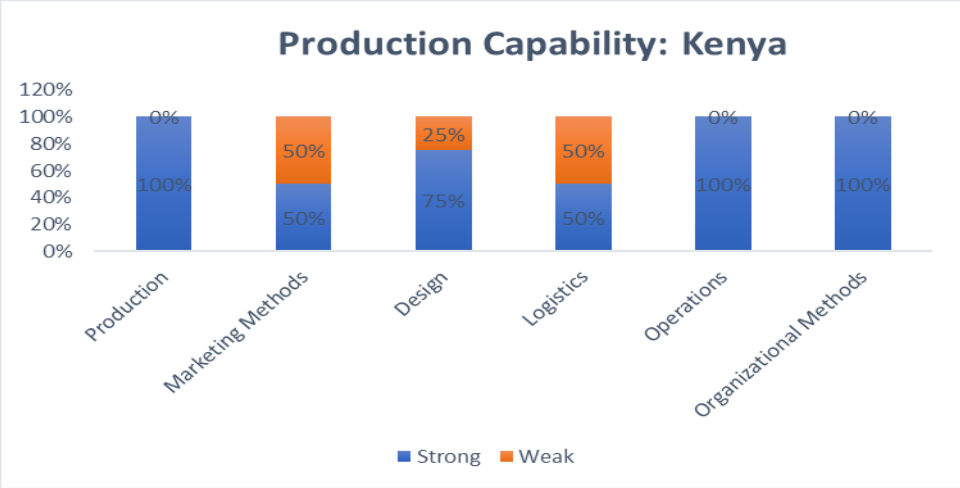
After the categories were formed, the reports and charts were created. The two main codes, *production capability* and *actions for a strong position*, were converted into variables using MAXQDA, allowing for an in-depth analysis. To begin with, the initial coding of the production capability allowed for various sub-codes: *production, organisational, and marketing methods*, *design, logistics, and operations*. Responses to questions about production capabilities were assigned either a strong or weak position in the respective sub-codes, depending on their answers. **Table 62** provides production capability code statistics. From **Table 62**, and examining data from both Kenya and Malaysia, firms reflect a stronger position (*75 per cent*) on production, marketing methods and operations, with the design recording the weakest at *50 per cent*. When data is split into countries, we observe that Kenyan firms record a higher score, at *75 per cent* in design, compared to Malaysian firms, which record *25 per cent* for the same. On one hand, these results tell us that Kenyan firms are better in design, operations and production compared to their Malaysian counterparts. On the other hand, the results suggest that Malaysian firms are better in marketing methods than the Kenyan ones.

Table 53: Thematic Analysis of Production Capability – Kenya and Malaysia

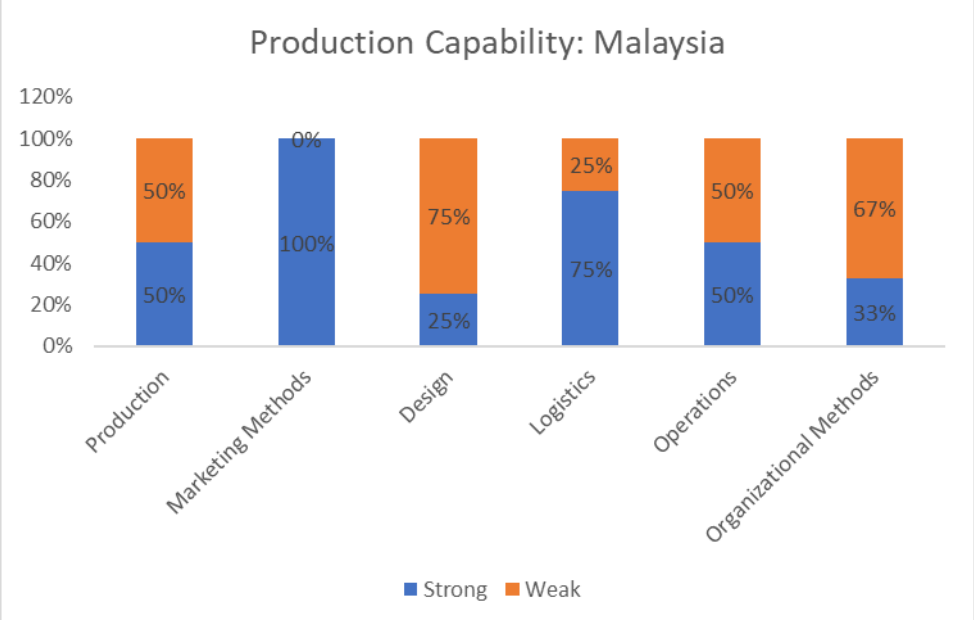
Production Capability: Kenya and Malaysia Combined



Production Capability: Kenya

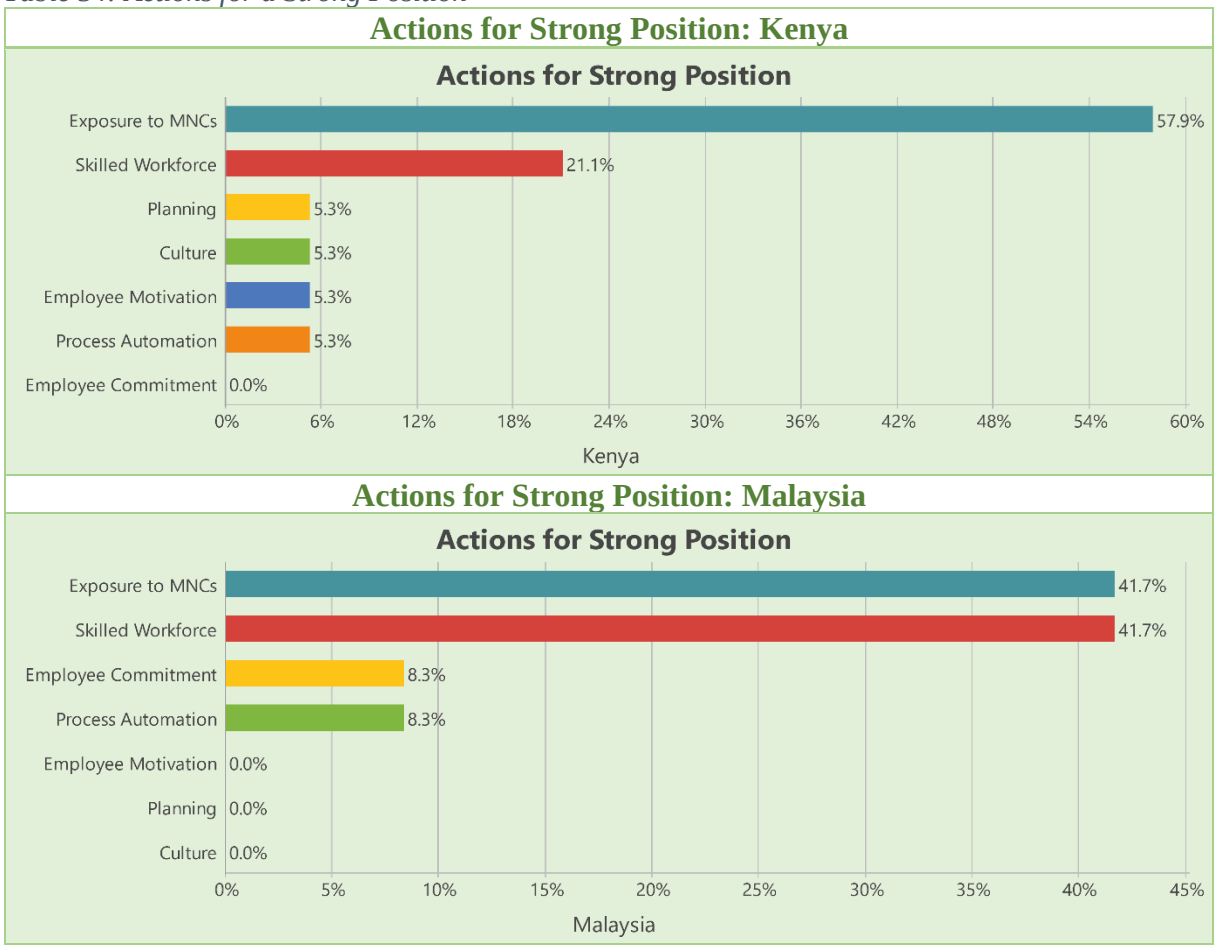


Production Capability: Malaysia



Regarding the actions for the strong position, exposure to MNCs came first, with *57.9 per cent* and *41.7 per cent* reported by firms in Kenya and Malaysia, respectively. See **Table 63** for details.

Table 54: Actions for a Strong Position



Below are some statements from the interviews that demonstrated how the firms interacted with the MNC customers.

> *MNCs require quality and timely delivery, improving our production and operations process has helped us meet these requirements.*

> *MNCs encourage us to be innovative, for example, if you have supplied products for a long term, they insist for improved quality, and the focus now is products that are environmentally friendly. The exposure to our MNC clients has helped us achieve innovations.*

> *… interacting with MNCs, especially from Germany and the USA, has helped us to set higher standards in our production processes. We have extended these standards to the rest of the customer base.*

Overall, the data suggest a link between the accumulation of production capability and the exposure of firms to MNCs. The following section further investigates this connection.

6.7.1 Closer Scrutiny: Production Capability and Exposure to MNCs

In order to investigate the link between production capabilities and the exposure of firms to MNCs, we adopt the categories created from these two codes. We would like to explore whether high production capabilities in firms appear to connect in any way with exposure to MNCs. The MAXQDA 2018 Crosstabs function offers an aggregated overview of the number of coding in certain categories in the Code System in each of the three levels of the production capability variable. The production capability characterisations are shown in the columns on the *x*-axis, and the exposure to MNC categories are shown in the rows on the *y*-axis. Using production capability, the Crosstabs function could count the number of times that firms with low and medium production capabilities mention exposure to MNC sub-categories in comparison to the number of times firms with high production capabilities talk about the sub-categories. **Table 64** demonstrates that out of the firms that took part in the interviews, two recorded low production capability. Moreover, these firms reported that one of the actions that led to their current production capability was the interaction with their MNC customers in the logistics and productions processes.

Table 55: Production Capability = Low

Crosstab

	Number of coded segments =	Production Capability = Low
Exposure to MNCs		
Design		
Production		1
Operations		
Logistics		1
Production Capability		
High		
Medium		
Low		2
N = Documents	0 (0.0%)	2 (100.0%)

Furthermore, **Table 65** shows that four firms reported a medium production capability. Two of these firms were exposed to design from their MNC clients, with each of the remaining firms being exposed to either operations or production processes.

Table 56: Production Capability = Medium

Crosstab

	Number of coded segments =	Production Capability = Medium
Exposure to MNCs		
Design		2
Production		1
Operations		1
Logistics		
Production Capability		
High		
Medium		4
Low		
N = Documents	0 (0.0%)	4 (100.0%)

Lastly, **Table 66** shows that only two firms reported having a high production capability. These firms interacted with their MNC customers in either design or operations.

Table 57: Production Capability = High

Crosstab

	Number of coded segments =	Production Capability = High
Exposure to MNCs		
Design		1
Production		
Operations		1
Logistics		
Production Capability		
High		2
Medium		
Low		
N = Documents	0 (0.0%)	2 (100.0%)

6.7.2 Qualitative Results

a. Level of production capability accumulation within firms in Kenya and Malaysia

Table 58: Document Variable: Production Capability Accumulation (Kenya and Malaysia)

Firm Name	Subsector	Production Capability
Malaysia		
Almakki	E&E	Low
Kent	P&C	High
Amin	P&C	Low
Ghani	E&E	Medium
Kenya		
Noormohamed	P&C	Medium
Maina	P&C	High
Kariuki	E&E	Medium
Panchal	E&E	Medium

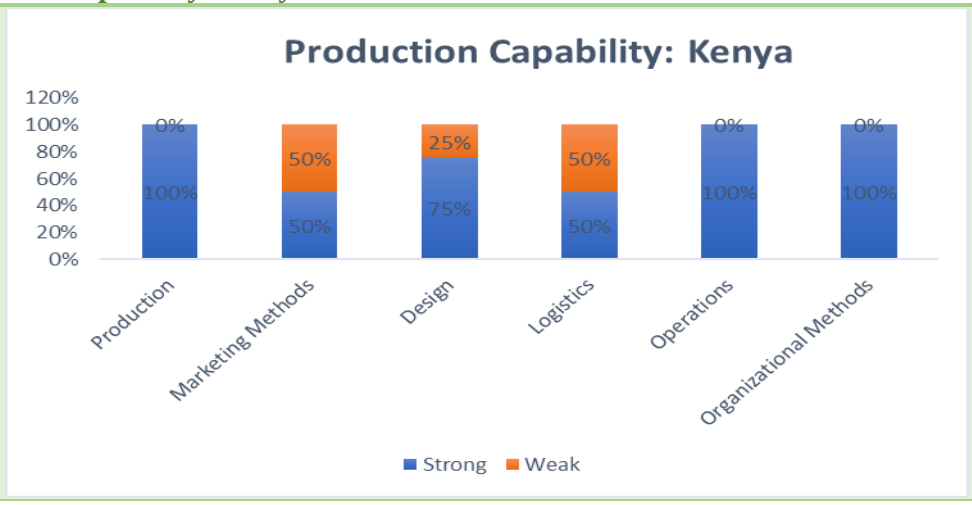
Source: Author's compilation, 2019. Interview data collected in Kenya and Malaysia, 2019.

From the results presented in **Table 67**, we establish that Kenya's firms reported a higher level of production capabilities as opposed to their Malaysian counterparts. In particular, the P&C firms in Kenya reported the best results, that is, a medium to high level of production capabilities. The worst performing firm in the level of production capability accumulation was reported in Malaysia's E&E subsector.

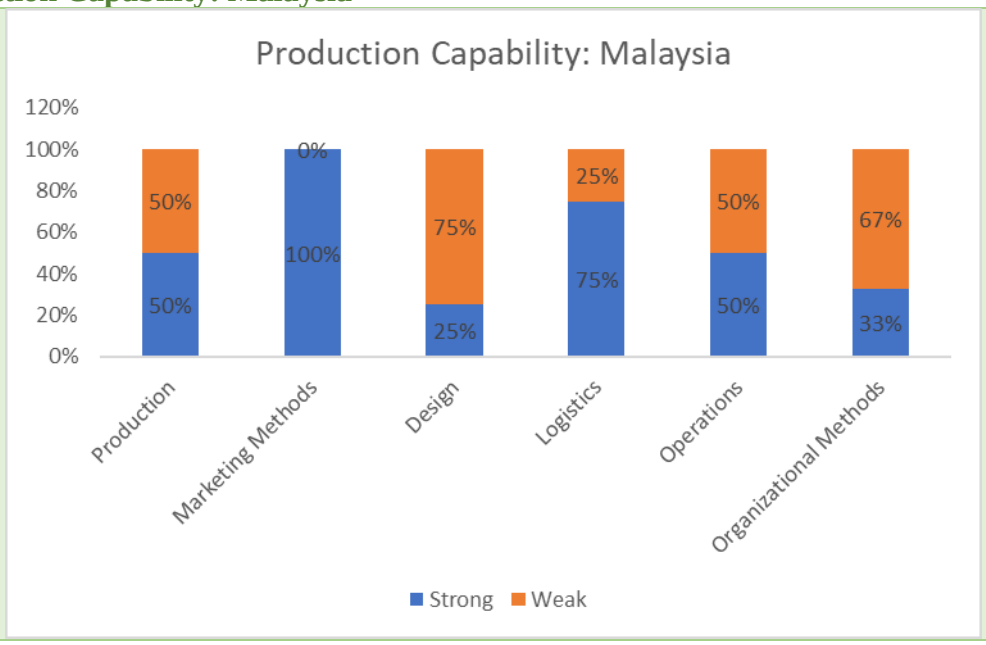
b. Thematic analysis of production capabilities

Figure 35: Thematic Analysis of Production Capability Accumulation – Kenya and Malaysia

Production Capability: Kenya



Production Capability: Malaysia



Data source: Interview data collected in Kenya and Malaysia, 2019.

As shown in **Figure 35**, all the interviewed Kenyan firms report having a strong position in production, operations and organisation. In these areas, Kenyan firms perform better than their Malaysian counterparts. In addition, *75 per cent* of Kenyan firms also report having a strong position in design, as opposed to *25 per cent* among Malaysian firms. Moreover, the Malaysian firms, in comparison with their Kenyan counterparts, report a stronger position in marketing methods and logistics.

c. The nature of interactions between local firms and MNC customers

Table 59: Nature of Exposure to MNCs and Production Capability Accumulation

		Design	Production	Operations	Logistics
Production Capabilities Level	Low	☐	☒	☐	☒
	Medium	☒	☒	☒	☐
	High	☒	☐	☒	☐

Source: Author's compilation, 2019. Data source: Interview data collected in Kenya and Malaysia, 2019.

Table 68 presents a match between the level of production capability accumulation among the selected firms and the nature of the interactions with their MNC customers. The table indicates that those firms reporting low production capabilities mainly learn from their MNCs in areas of production. Moreover, firms reporting a medium level of production capabilities are involved by their MNCs in aspects of design, production and operations. Lastly, firms with high-level production capabilities report that their MNC customers involve them in joint design and operation activities.

Overall, the qualitative analysis indicates that firms interacting with their MNC clients in design are more likely to record a higher production capability than those that are merely interacting on process improvements and organisational aspects. Indeed, some researchers have established that technological diffusion from MNCs to indigenous firms in most developing countries rarely involve a significant amount of exposure to research and design, but rather focus on the process of upgrading skills, such as efficiency, and the reorganisation of production systems (Giroud and Scott-Kennel 2009; Giroud et al. 2012; Amendolagine et al. 2017). To that extent, the firms that were exposed to design aspects by their MNC customers emerged to rank highly in their production capability levels. Therefore, the qualitative data support the hypothesis that there exists a causal link between backward linkages from MNCs and a firm's accumulation of production capabilities. With firms that interact with their MNC clients in design more likely to record a higher production capability than those that are merely interacting on process improvements and organisational aspects.

Chapter 7: Integrating Quantitative and Qualitative Results

This study conducted mixed method research, applying an explanatory sequential design. The quantitative results demonstrated that out of the firms that participated in the survey, 65.1% recorded a high probability of production capability accumulation, and 16.4% recorded a low probability of production capability accumulation.

A chi-test on the relationship between backward linkages from MNCs and production capability generates a result of $P = 0.00\%$, which is far below $P < 0.05$, therefore providing very strong evidence of a statistically significant relationship between backward linkages from MNCs and the accumulation of production capabilities. We, therefore, reject the null hypothesis. This evidence supports the view, based on the existing literature, that host firms with backward linkages from MNCs have a higher likelihood of benefiting from knowledge and technology transfers from those MNCs (for example, see Harding and Javorcik, 2011; Swenson and Chen 2014; Javorcik et al. 2015).

Our results also reveal that the relationship between absorptive capability and production capability is statistically significant at $P = 0.00\%$. Therefore, firms that report the presence of absorptive capability have a higher level of production capability accumulation. The existing studies and empirical evidence are supported by our findings. For example, Kostopoulos et al. (2011) found a statistically significant relationship between a firm's absorptive capabilities and its level of knowledge adoption.

The current study fails to establish a statistically significant relationship between skilled workforce and firm size. Our tests indicate $P = 0.192\%$, which is higher than the set threshold of $P < 0.05$. Hence, we have no evidence at all that there is any relationship between skilled workforce and firm size within the E&E and P&C sectors in either Kenya or Malaysia. This finding contradicts existing studies, which find a statistically significant relationship between employees' skills and firm size (Loan-Clarke et al. 1999; Kotey and Slade 2005; Cardon and Valentin 2017).

Moreover, a test of the relationship between foreign trade interactions and backward linkages from MNCs results in $P = 0.00\%$, confirming that this relationship is statistically significant. Thus, there exists a statistically significant relationship between a firm's foreign trade interactions and its level of forming backward linkages with MNCs within the E&E and P&C sectors in both Kenya and Malaysia. This finding is not unique, as it is in line with the existing literature and empirical research. For example, studies have established that local firms

involved in imports or exports have a higher likelihood of supplying inputs to the locally-based MNCs (Battat et al. 1996; Dimitratos et al. 2010; Yeung and Coe 2015; Amendolagine et al. 2019b). Indeed, intensive participation in exports or imports exposes local firms to the essentials of international markets and more sophisticated demand, and to learning opportunities via the knowledge and technology transfer from global technology leaders to local supplier firms within the value chain. Moreover, upstream participation in global value chains, such as exports, for example, suggests local specialisation in the production of intermediate inputs or components available for MNCs to purchase.

The chi-square test also reveals a statistically significant relationship, $P = 0.00\%$, between absorptive capability of a host firm and the level of the skilled workforce. Thus, we have strong evidence that firms reporting the presence of absorptive capability also report a higher skill level within their workforce. This position is supported by the existing literature in that there is consensus among innovation researchers that organisations require a skilled workforce to create and diffuse the knowledge necessary for successful innovation (for example, see Jones and Grimshaw, 2012). A skilled workforce in local firms can facilitate the transfer of knowledge from their MNC customers, whether that happens through collaboration on R&D and technical problem-solving or through facilitating the acquisition of MNC-specific knowledge in complex models of outsourcing. What emerges is a more real-world notion of local firms learning from MNC customers through long-term interaction.

Additionally, we establish a statistically significant relationship, $P = 0.00\%$, between absorptive capability and firm size within the E&E and P&C sectors in both Kenya and Malaysia, in the sense that large firms report a higher level of absorptive capability. Existing research supports this finding; for example, Lane et al. (2001), Lichtenthaler (2009), and Daspit and D'Souza (2013) all argue that larger firms are more likely to have more knowledge-based resources than smaller firms.

Overall, the data gathered in this study confirms all of our hypotheses except the relationship between a skilled workforce and firm size. What emerges from the discussion of the hypothesis is a network of statistically significant relationships involving host firm size, foreign trade interaction, host firm absorptive capability, backward linkages from MNCs, and production capability accumulation. This network reflects our proposed Model 2. In building Model 2, it was key to establish the causal effects of backward linkages from MNCs on a host firm's accumulation of production capabilities. Our results indicate that the total causal effect of backward linkages from MNCs on the production capability accumulation of the host firms is

34.32%. That is, firms that supply inputs to locally based MNCs can use the supply interactions to contribute to 34.32% of production capability accumulation, with 65.68% coming from other sources. To the best of our knowledge, there is no other study that has attempted to find the total causal effects of these two variables. As such, we engaged some selected firms that participated in our survey in order to conduct follow-up inquiry, which involved a one-on-one interview to further resolve two main questions. First, do local firms that interact with MNC customers increase their tendency to shift from the production of low-quality to higher-quality products? Second, what can explain the variations in levels of production capabilities among host firms supplying inputs/goods to locally-based MNCs?

Our qualitative findings confirm that MNCs are critical in enabling local suppliers in both countries to shift from the production of low value-added products to that of high value-added goods; that is, MNCs help to boost the production capability accumulation of local firms. This view is consistent with the quantitative results and with previous research, which also showed that local firms that supplied to locally-based MNCs had a higher likelihood of accumulating production capabilities. Overall, in comparison to Malaysian firms, their Kenyan counterparts reported a higher production capability in the qualitative phase. This finding was in line with the quantitative results, but it conflicted with the existing literature review and empirical evidence on the backward linkages and knowledge and technology transfer in both countries (see, for example, Kinuthia 2013; Kinuthia 2016). We argue that the age of the firms in the sample was crucial to explaining this contradictory finding. As shown elsewhere in this research, all the firms that took part in the second round of interviews had existed for less than 10 years. In fact, the oldest firm in Malaysia's qualitative sample was established six years prior, and the newest had been established two years prior to the start of this study. In Kenya, the oldest firm was established 40 years prior to this study, and the newest 19 years prior. It was difficult to include the age of the firm as a selection criterion, as many firms did not answer the survey question asking them to report their year of establishment. However, this information was gathered during the qualitative phase. It has become apparent that the significant differences in firm age between Kenya and Malaysia in the selected sample might have contributed to the results that conflicted with our expectations. Indeed, a firm's age is shown to influence knowledge acquisition and internalisation, given that more established firms often have enhanced social links and refined knowledge acquisition processes (for example, see Autio et al. 2000; Jansen et al. 2005). According to Cohen and Levinthal (1990), a firm's absorptive capability develops over time and is therefore domain-specific as well as path- or history-dependent. The Kenyan firms that were interviewed were older and more established compared

to their Malaysian counterparts, thus having more historical experience from which they could learn from the MNCs.

The qualitative analysis establishes that those firms reporting a higher level of production capabilities can be distinguished from the ones reporting low production capability accumulation by the fact that the former interact with their MNC customers mainly by collaborating in product design or product development. This finding is supported by the existing literature and empirical research (see, for example, Giroud and Scott-Kennel 2009; Giroud et al. 2012; Amendolagine et al. 2017). In fact, technological activities such as joint design activities facilitate explicit and tacit knowledge flows from the MNCs to their local suppliers in the host countries.

Overall, after the qualitative and quantitative analysis with respect to local firms and MNCs, four main themes emerge, namely: backward linkages, production capability accumulation, learning, and joint design. We have established that the total causal effect of backward linkages from MNCs on host firm's production capability is 34.32%. Therefore, backward linkages from MNCs cause local suppliers to accumulate production capability by 34.32%. The accumulation of production capabilities by local firms requires long-term learning from their MNC customers. The learning process that involves joint design activities allows for production capability accumulation from the MNCs to the local suppliers. Thus, regarding the learning process, whether or not local firms are involved in joint design work with their MNCs customers can explain the variation in the levels of production capabilities among firms supplying inputs and goods to locally-based MNCs. Therefore, local firms supplying to MNCs have a higher likelihood of accumulating production capabilities than firms that do not. In turn, local firms that are involved in joint design activities by their MNCs register higher production capabilities than local firms that do not.

From a theoretical perspective, a link of two theories – namely, the new trade economics and capability theory of the firm – can explain firms' accumulation of production capabilities. The explanation will assume that local firms in host countries are aware that MNCs possess a production technology advantage.

MNCs set up in a host country through either vertical or horizontal strategy, and the main driving force is a low cost of production. These MNCs possess special advantages such as advanced technology. With the knowledge of the competitive advantages possessed by MNCs, local firms in the same industry as the MNCs decide on the best production strategy to ensure they are not forced out of business. For example, local firms may hire more qualified employees

and adhere to more effective and efficient production processes. The result is reduced production costs and fair prices for their products. The internal strategy that local firms adopt determines their success in a competitive market.

In the long run, the transportation costs incurred by MNCs through the import of intermediate goods rise, forcing them to source locally. The competitive local firms in the same industry as the MNCs form supply relationships with these MNCs. The local suppliers of MNCs strategise and organise activities into a firm focusing on economies of scale rather than one-off transactions. Achieving economies of scale would allow the local firms to further reduce their production costs and hence to charge reasonable prices for their goods. Over time, MNCs make decisions based on costs associated with controlling goods from their local suppliers. They decide to involve their suppliers in training, mainly focused on operational activities and efficiency. In turn, the local firms strategise and internalise this know-how, with the result being quality improvements of the intermediate goods supplied to the MNCs.

Since MNCs are linked to the technological leaders in the global value chain and technology is dynamic, MNCs plan and diversify the requirements of the intermediate products that they source locally. They are forced to present the new models/samples to their local suppliers, and if these are too complex for the locals to implement, MNCs involve them in a joint design process to meet the new requirements. Through repeated interactions and learning over a long period of time, the local suppliers, depending on their absorptive capability, accumulate enough know-how to facilitate the shift from production of low value-added to high value-added products.

In sum and as can be theoretically explained by the new trade economics and capability theory of the firm, the results in this study confirm that backward linkages from MNCs have a causal effect on the accumulation of production capabilities by the supplier firms in the host country.

Chapter 8: Conclusions

Our approach to modelling the causal effect of backward linkages from MNCs on the accumulation of production capability in host countries is intended to enrich the existing research surrounding FDI and knowledge transfer. Analysing the causal effects of backward linkages from MNCs on a host firm's production capabilities provides new perspectives and potentially generates a renewed academic discourse.

In order to properly understand the interactions between MNCs and their suppliers in the host country, it is necessary to conduct a firm-level analysis and find out how the local firms have been impacted by their MNC customers. In pursuit of a better understanding of the experiences of host firms when dealing with MNCs, we go beyond the survey data and investigate host firms' strengths and weaknesses, which can uncover interesting information on the nature of their interactions with MNCs. Therefore, a firm-level approach to exploring the causal effect of backward linkages from MNCs on the production capability accumulation of local firms can greatly increase our understanding of the variation in production capabilities among firms supplying inputs to MNCs.

MNCs and local firms both have their justified reasons for forming backward linkages. However, this does not mean that forming backward linkages with MNCs always generates the desired production capability for the local firms. Some backward linkages with MNCs do not allow local firms to make a substantial shift from the production of low value-added goods to high value-added goods. The reasons for this are complex and diverse, ranging from government policies to firm-specific issues. In countries that are suffering from systemic socialpolitical or socialeconomic issues and corruption, individuals and local firms must take a decisive role and pursue their aspirations with the view of improving their attractiveness as potential suppliers for locally-based MNCs. In the conclusion of this dissertation, we will first summarise the preceding chapters and then lay the groundwork for future avenues of research.

Chapter 2 established a theoretical link between backward linkages from MNCs and the accumulation of production capabilities. The link was established through a nexus of two theories; namely, the new trade economics and the capability theory of the firm. Since MNCs that are establishing themselves in developing and emerging markets are primarily motivated by production costs and other financial concerns, they are inclined to source their inputs from local suppliers within the host country. Through the interactions of MNCs and local suppliers, over a long period of time, local firms can acquire knowledge through learning processes. Empirical research in this chapter does not address the causal relationship between backward

linkages from MNCs and production capability accumulation. Rather, it reports that stronger backward linkages from MNCs are formed within the manufacturing sector and lists the E&E and P&C manufacturing subsectors as the best candidates. Despite the informative existing literature on this subject, precise questions of the causal links between backward linkages from MNCs and production capability accumulation in the host suppliers have not been addressed. As such, Chapter 2 identifies the relationships between all the variables mentioned in the empirical studies and proposes a causal model. Based on the selected variables that are connected to the backward linkages from MNCs and the accumulation of production capabilities, the chapter also generates a set of hypotheses. The model and the generated hypotheses provide a starting point for a more focused investigation of the causal connection between backward linkages from MNCs and the accumulation of production capabilities.

Next, Chapter 3 introduces our country-specific cases: Kenya and Malaysia. Within these countries, we target the E&E and P&C manufacturing subsectors. The chapter investigates whether firms in these subsectors have substantial backward linkages with MNCs, and if so, the impact of backward linkages from MNCs to the production capabilities of the former. The existing literature reveals that there are backward linkages from MNCs in all subsectors and across both of the selected countries, but their numbers vary. Malaysia, due to the high amount of FDI, attracts larger backward linkages from MNCs compared to Kenya. As such, Malaysia's manufacturing sector, particularly the E&E subsector, has very diversified products in comparison with Kenya's manufacturing/E&E sector/subsector. Empirical research reveals that Malaysia attributes the success of its E&E subsector to the presence of backward linkages from MNCs. Studies also show that Kenya's P&C subsector is diversified and attracts a substantial number of backward linkages from MNCs. The growth of this sector is also attributed to the presence of backward linkages from MNCs.

Chapter 4 follows up on the proposed causal model proposed in Chapter 2, addressing the causal question through a mixed methods approach, applying an explanatory sequential design. The qualitative data is collected through a survey in Kenya and Malaysia's E&E and P&C subsectors.

Chapter 5 presents the quantitative phase of the research work. Causal Bayesian networks are used to address the question of whether backward linkages from MNCs have a causal effect on the production capability accumulation of the suppliers in the host firm. The results show that backward linkages from MNCs do in fact have a causal effect on the production capability accumulation of the host firm. All the generated hypotheses are also addressed here. Moreover,

this chapter seeks to find an explanation for the question of what explains the variation in the levels of production capabilities among firms supplying inputs to locally-based MNCs.

Chapter 6 is linked to Chapter 5 by the survey question asking respondents whether they would be willing to participate in the second round of interviews if their results turned out to be interesting. This chapter sets out to explain the quantitative results. Eight firms that gave an affirmative answer to the question, four from Kenya and four from Malaysia, were selected based on a set criteria. Face-to-face, guided interviews were then administered. We coded the interview transcripts using MAXQDA 2018, the themes were established, and we performed an analysis of the qualitative data. Kenyan and Malaysian firms alike reported that the presence of backward linkages from MNCs had enabled them to accumulate production capabilities. Furthermore, the Kenyan firms reported a higher production capability than the Malaysian firms. These results conflict with the existing literature and with empirical evidence on backward linkages and knowledge and technology transfer in both countries (for example, see Kinuthia 2013; Kinuthia 2016). We argue that the age of the firms in the sample was crucial to explaining this contradictory finding and that it is necessary to control for age when doing a firm-level analysis of the impact of backward linkages from MNCs. Overall, it was established that local firms that are involved in joint design activities by their MNCs register higher production capabilities than local firms that do not.

Chapter 7 integrates both quantitative and qualitative results and synthesizes the results from Chapters 5 and 6. To explain the quantitative results, we observe that the involvement, or lack thereof, of local firms in joint design work with their MNC customers can explain the variation in the levels of production capabilities among firms supplying inputs and goods to locally-based MNCs. The new trade economics and the capability theory of the firm can fully explain the results in this study, confirming the hypothesis that backward linkages from MNCs have a causal effect on the accumulation of production capabilities by the supplier firms in the host country.

In Chapter 6, where we attempt to a) build a transition into the ideas of avenues for future research and b) specify what the issue is. We address the question of the age of the firms and recommend controlling for this factor when analysing the effects of backward linkages from MNCs on a firm's accumulation of production capabilities, as the existing literature suggests. Any future research on backward linkages from MNCs and the production capability accumulation of firms should consider the age of the firm as one of its control variables. In particular, future surveys requesting information on the relationship between backward linkages

and production capability accumulation by firms should ensure that a question about the age of the firm is set in such a way that all firms must provide an answer.

Another implication for future research arises from Chapters 4 and 6. By focusing on local firms supplying to MNCs, we were better able to assess the level at which host firms have benefitted from their interactions with their MNC customers. However, we recommend that future research not only focus on the perspective of local firms supplying to locally-based MNC clients but that it also adopt an inclusive methodology that encompasses the perspective of the MNCs.

Overall, upon reflecting on all the issues addressed herein, including the qualitative interviews, some few recommendations can be made. For policymakers in the respective countries, our results provide comprehensive evidence of the important role MNCs play in harnessing the innovativeness of local supplier firms; thus, with favourable business regulatory reforms in emerging/developing markets, this potential could be harnessed. For MNCs, our message is that firms in developing markets/emerging markets have great potential to absorb technical know-how, and if supported, they can achieve greater innovations. When local suppliers to MNCs are innovative, then it can be expected that the latter will undertake local outsourcing of high-quality intermediate goods, thereby reducing the transport costs and custom taxes associated with importing such goods.

For the shareholders of companies, your threats and interventions often negatively affect companies' management incentives to innovate. It is true that innovation may cause stock price to reflect less accurate information about a firm's fundamental value, which makes company CEOs vulnerable to intervention. However, innovativeness comes with a cost and substantial long-term reward. Company CEOs threatened by intervention will be biased against innovation projects to minimise job termination risks. Since companies that are not innovative have little influence on global trade, you should allow your companies to try and implement new ideas.

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Appendix 1: The Questionnaire

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

Questionnaire

My name is Titus Ndunda. I am a PhD candidate at the Europa-Universität Flensburg, Germany, and the German Development Institute (D.I.E), Bonn. I am collecting information from purposively selected firms in this country. Your firm is one of those selected for this purpose.

This survey is being conducted in Kenya and Malaysia at the firm level to gather information directly from business owners and senior managers about the accumulation of production knowledge and productivity of their business, either with or without a supply relationship with locally based multinational corporations (MNCs). Your response, and those of other firms participating in the survey, will be used in a PhD dissertation and will feature the private sector's concerns about the current production knowledge, identify priorities for government action to improve the situation, and allow a comparison between sectors and countries.

The data you provide on this firm's activities will enable me to identify key constraints to improved private sector investment and the accumulation of production knowledge in this country. Another key focus of the survey is on supply chain linkages with MNCs. This will allow those firms that wish to do so to take advantage of my bench-marking services supporting capacity and capability self-assessment, potentially leading to local firms-MNCs linkages.

I would like to stress that all information you provide me with will remain strictly confidential and no individual firm information will be published.

Please note:

1. **In this questionnaire, financial year (FY) is based on the firm's accounting period.**
2. **All monetary values are expressed in the domestic currency.**

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

1. Please list

Name of this firm:	
Address of this firm:	
Start of Production Year for this firm:	

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

2. Please provide details of the person in charge of responding to this questionnaire.

(We may contact with the person if there are any queries regarding the information returned on this questionnaire)

Name:

Job title

E-mail

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

3. As of end of financial year (FY) 2017, how many regular persons were employed by this firm?

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

4. Please indicate the number of regular persons employed by this firm who have completed:

Secondary school

College education/1st degree

Master's degree in graduate school

PhD

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

5. Please select the sub-sector that best describes this firm's main manufacturing/business activity

- ◯ Electronics and Electrical
- ◯ Plastics and Chemicals
- ◯ Other (please specify)

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

6. Are any of the owners of this firm, its mother firm or its branches a relative of yours? (either by blood or by marriage?)

- ◯ Yes

No

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

7. Does this firm have a share of foreign ownership of 10 percent or more?

Yes

No

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8. Location of this firm

Kenya

Malaysia

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9. Total turnover for the FY 2017

Less or equal to KES 500,000

Between KES 500,000 and KES 5 million

Over KES 5 million

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10. Total turnover for the FY 2017 Less than RM 300,000

Between RM 300,000 and RM 15 million

Between RM 15 million and RM 50 million

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11. How does this firm produce products?

Through orders

◯ Produces and takes to market and customers buy at arms-length

◯ Both cases above

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12. Does this firm engage in imports, exports or cooperative projects with other foreign investors?

◯ Yes

◯ No

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* 13. Does this firm supply inputs/products to locally based multinational companies (MNCs)?

◯ Yes

◯ No

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14. Please indicate the extent to which the following aspects of products supplied to MNCs by this firm are relatively similar to other local firms operating in the same sub-sector or are significantly different from local firms operating in the same sub-sector (i.e. customized to suit requirements of the MNCs).

	Relatively Similar to Other Local Firms in the Related Sub-Sector	Moderate Similar	Significantly Customized to the Requirements of the MNCs
The extent of training required by staff	◯	◯	◯
The skill level of the employees working in the firm	◯	◯	◯
The MNCs workflows and routines	◯	◯	◯

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15. Please rate the match in technologies and competencies possessed by this firm and the technologies and competencies the orders from your MNC customers require?

◯ Poor

○ Fair

○ Good

○ Very Good

○ Excellent

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* 16. What was the total sales of this firm for the FY 2017? (amount in thousands)

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* 17. As of the end of FY 2017, what sales by value of this firm went to locally based MNC customers with whom this firm has a long-term relationship? (exclude products supplied for final consumption and only include intermediate goods used by MNCs as inputs in the production of final products) **(amount in thousands)**.

Sales to MNCs from Europe and North American Countries:	
Sales to MNCS from BRICS Countries:	
Sales to MNCs from ASEAN Countries:	
Sales to MNCs from other Countries:	

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18. What is the total number of MNC customers based in this country with whom this firm has long-term relationships?

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19. How many new locally based MNCs have been added to your buyer's list in the last three years?

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20. How frequently does this firm encounter disputes over quality with the MNCs you supply to?

- Very frequently
- Frequently
- Rarely
- Very Rarely
- Absolutely no disputes

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21. The MNC customers provide the following to this firm:

- [ ] Foreign licensing to produce their products
- [ ] Technical consultancies
- [ ] Other (please specify)

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22. Has this firm ever bought machinery to improve its productivity in production operations through a recommendation of the MNCs you supply to?

- Yes
- No

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

23. The MNC customers actively provide this firm with:

- [ ] Technical literature
- [ ] Product specifications
- [ ] Technical assistance
- [ ] Training of staff
- [ ] Other (please specify)

24. In general, how comfortable is this firm when exchanging information with its locally based long-term MNC customers? (Please take some time to rate).

- ○ Not Comfortable at all
- ○ Uneasy
- ○ Fairly Comfortable
- ○ Completely Comfortable

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

25. Please indicate where appropriate

	Never	Rarely	Sometimes	Often	Always
This firm organizes observation tours to the factories of the MNCs you supply to	○	○	○	○	○
This firm engage in joint-design of products with the MNCs it supplies to	○	○	○	○	○
The MNCs you supply to send their engineers to help engineers in this firm debug problems in engineering and manufacturing systems	○	○	○	○	○

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

26. Please state the position of your firm regarding the following

	Strongly disagree	Disagree	Agree	Strongly agree
This firm and their long-term customers work together to solve problems	○	○	○	○
This firm is flexible in response to requests made by established customers	○	○	○	○
When a supply agreement is made, this firm always fulfils customers' requirements	○	○	○	○

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

* 27. Does this firm have any activities for the introduction of new or significantly improved good(s)?

○ Yes

○ No

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

* 28. Please indicate the **extent** of the implementation of new or significantly improved activities within this firm

	To a small extent	To some extent	To a moderate extent	To a great extent	To a very great extent
Production process for goods	○	○	○	○	○
Logistics, delivery method, or distribution method for firm's intermediate inputs such as raw materials or components	○	○	○	○	○
Supporting activity for the firm's production processes or delivery methods, such as maintenance systems or operations for purchasing, accounting or computing	○	○	○	○	○

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

29. Please indicate the status of this firm concerning the presence of activities for the introduction or significant improvement of good(s)

- ◯ Activities abandoned or suspended before completion
- ◯ Activities still ongoing

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

* 30. Please indicate the **extent** of the implementation of new organizational and marketing methods within this firm

	To a small extent	To some extent	To a moderate extent	To a great extent	To a very great extent
Business practice in business execution methods or procedures	◯	◯	◯	◯	◯
Method in workplace organization, such as transfer of work responsibilities, work allocations, or formation	◯	◯	◯	◯	◯
Method in external relations with other firms or institutions	◯	◯	◯	◯	◯
Outward design of a good	◯	◯	◯	◯	◯
Medium or technique for product promotion	◯	◯	◯	◯	◯
Sales channel	◯	◯	◯	◯	◯
Method in product pricing (i.e. new strategies that the firm implemented when setting prices on its products)	◯	◯	◯	◯	◯

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

* 31. Who develops new or significantly improved goods, production methods, delivery methods or supporting activities?

- ◯ This firm by itself
- ◯ This firm together with MNCs

◯ This firm by adapting or modifying goods or services originally developed by other firms

◯ Other firms

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

32. Novelty of the introduction of a new or significantly improved product(s)

◯ New-to-firm good(s)
(not new ones for markets)

◯ New-to-market good(s)

◯ Both as listed above

Manufacturing Sector Survey: Kenya and Malaysia 2018/19

33. Please evaluate this firm in terms of the propositions below.

	Very Low	Below Average	Average	Above Average
Employees possess proper qualification to work in innovation projects	◯	◯	◯	◯
The firm heavily invests in research and development activities	◯	◯	◯	◯
Managers have appropriate knowledge for the development of their functions	◯	◯	◯	◯
The firm applies its accumulated knowledge to develop technology strategy	◯	◯	◯	◯
The firm is capable of incorporating technological knowledge in patents	◯	◯	◯	◯

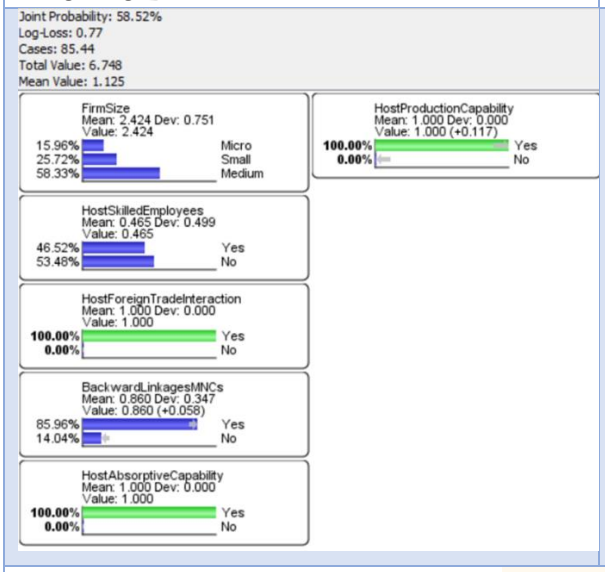
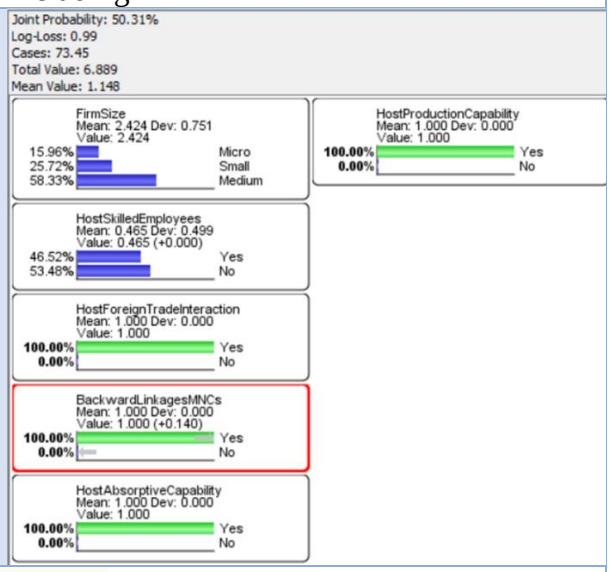
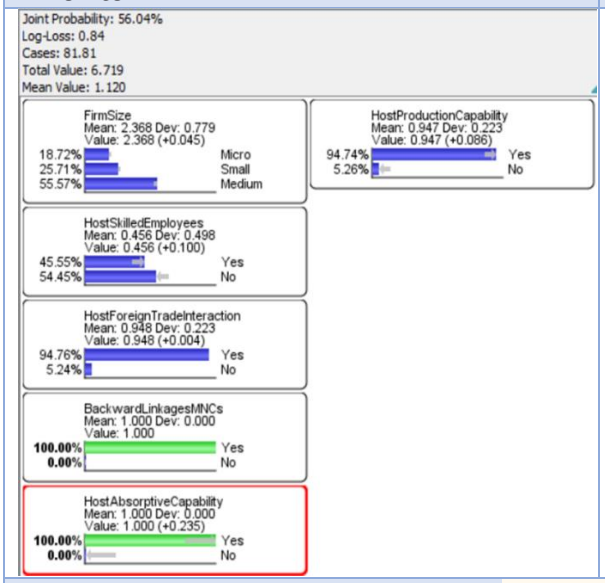
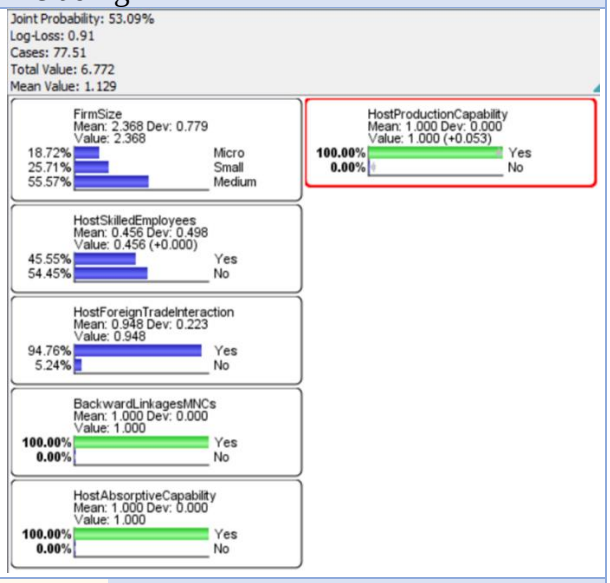
Manufacturing Sector Survey: Kenya and Malaysia 2018/19

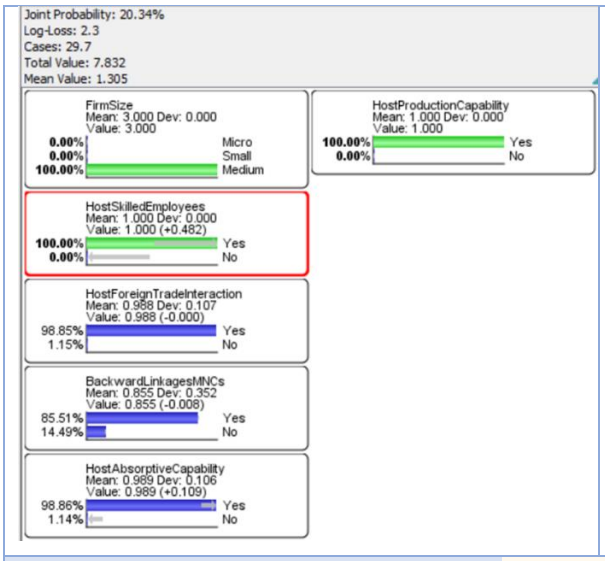
34. Hindering factors and reasons for no activity regarding the introduction of a new or significantly improved good(s), for the implementation of a new or significantly improved production process or delivery method, and for the implementation of new organizational and marketing methods

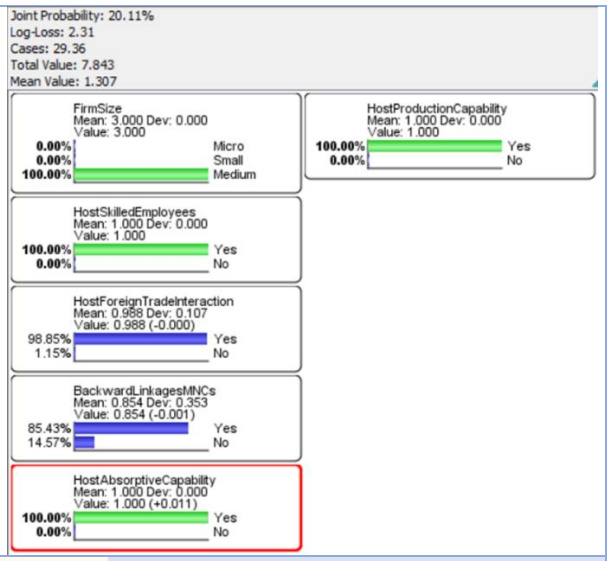
	Not Important	Low	Medium	High
Lack of sufficient finance	○	○	○	○
Lack of competent employees	○	○	○	○
Difficulties in finding co-operation partners	○	○	○	○
Uncertain market demand of new good or service	○	○	○	○
Limits of technological capabilities or know-how	○	○	○	○

35. This firm is willing to participate in the second round of the interview if it turns out to be an interesting case

Appendix 2: Conditional Independence Test

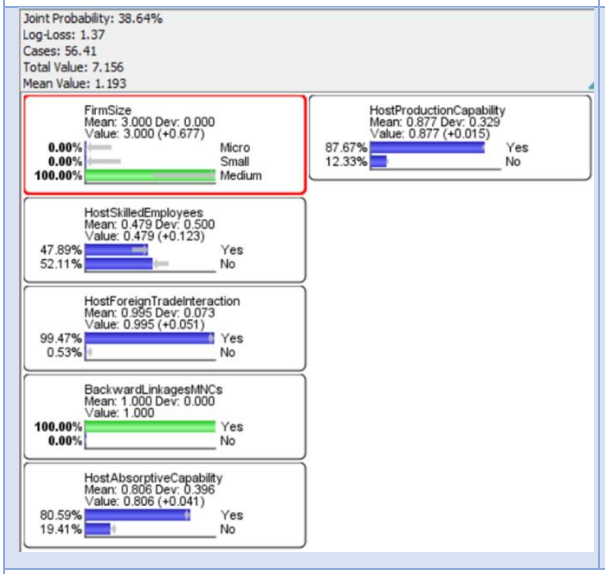
Model 1	
$B \perp\!\!\!\perp FS, E \mid F, A, P$	
Prior To B	Including B
	
$P \perp\!\!\!\perp E, F, FS \mid B, A$	
Prior to P	Including P
	
$A \perp\!\!\!\perp B, F \mid P, FS, E$	
Prior to A	Including A
Appendix 2: Continued	

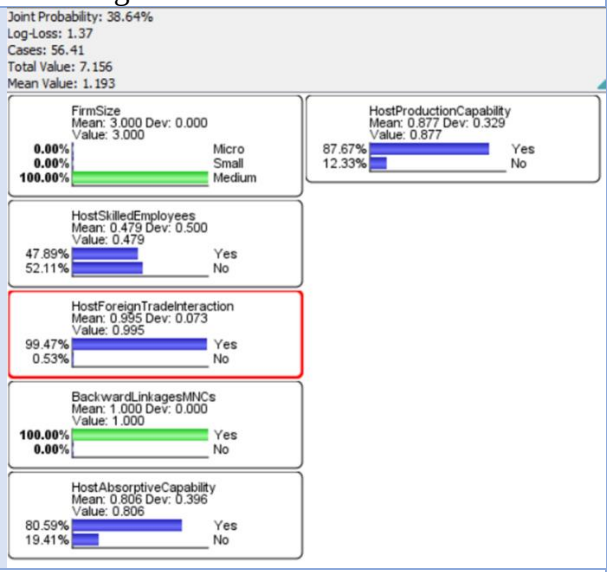




F ⫫ E, A, P|B, FS

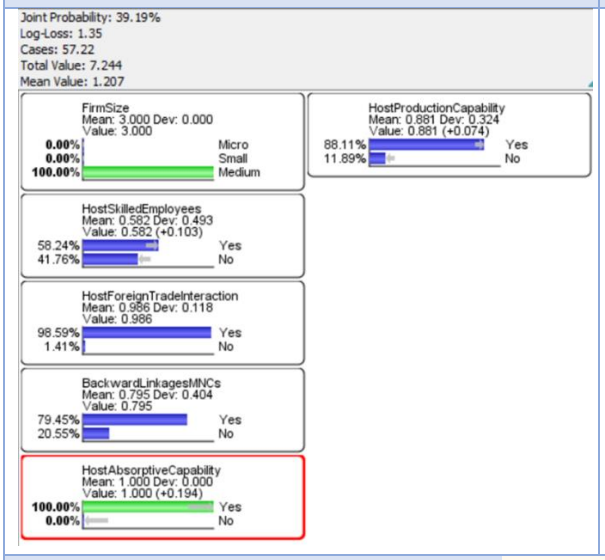
Prior to F	Including F

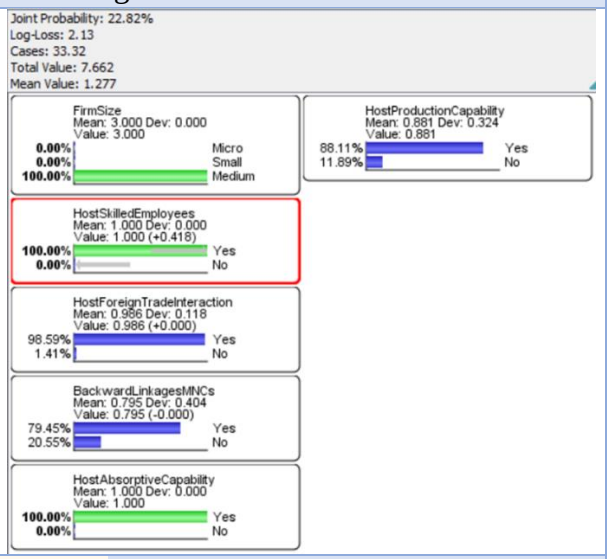




E ⫫ P, B, F|A, FS

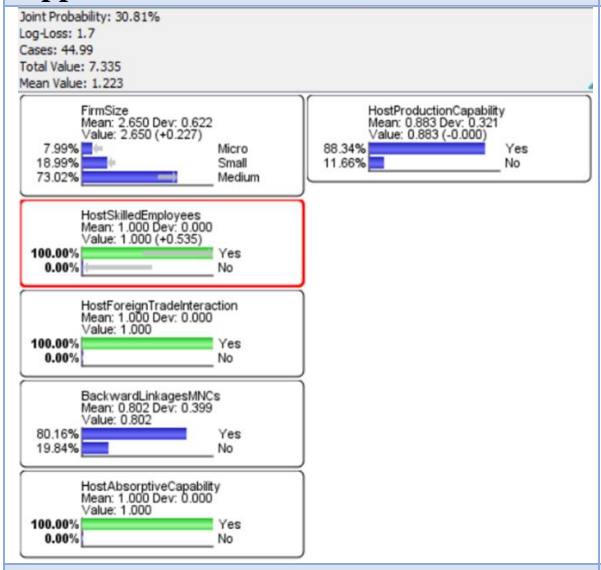
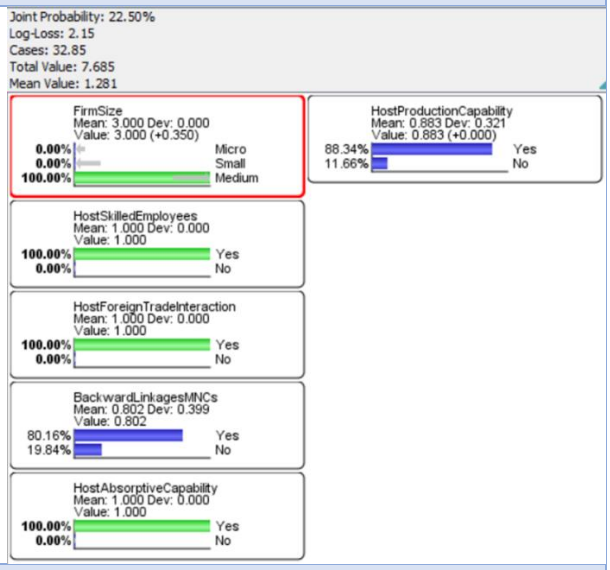
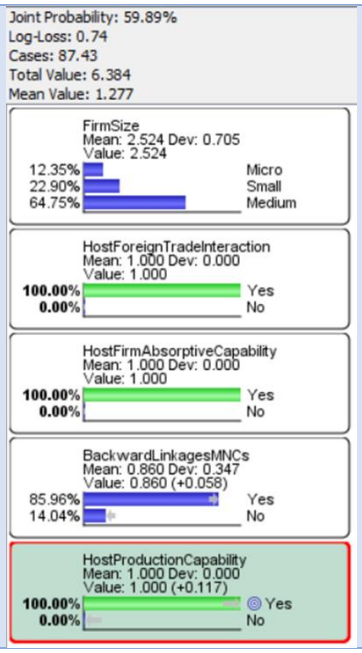
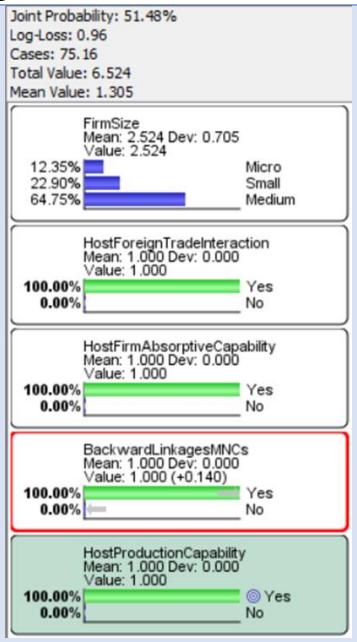
Prior to E	Including E

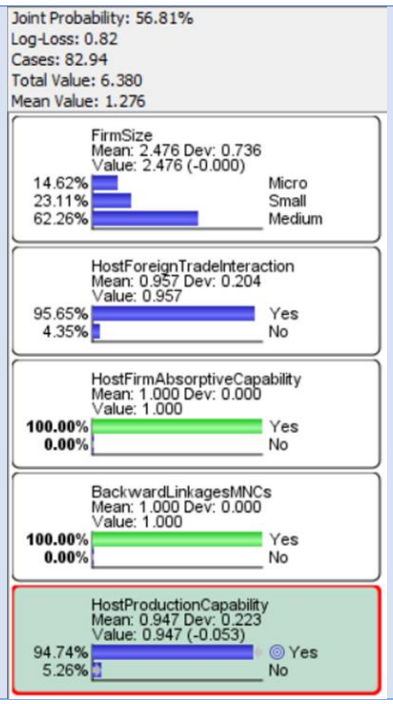


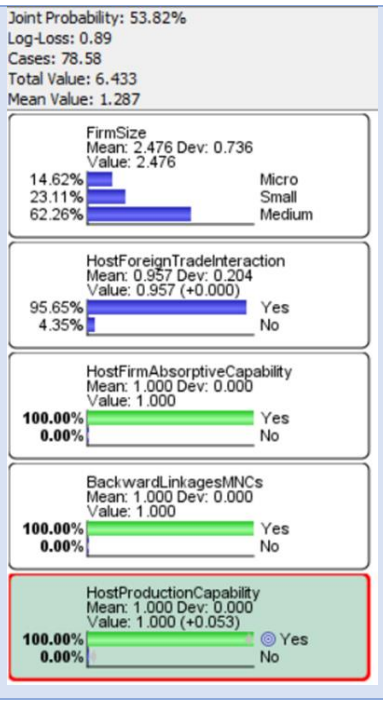


FS ⫫ P, B, A|F, E

Prior to FS	Including FS

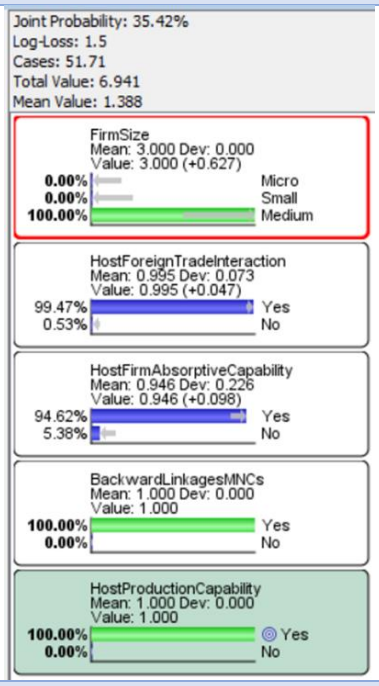
Appendix 2: Continued	
	
Model 2	
$\boldsymbol{B \perp\!\!\!\perp FS, E \mid F, A, P}$	
Prior to B	Including B
	
$\boldsymbol{P \perp\!\!\!\perp E, F, FS \mid B, A}$	
Prior to P	Including P
Appendix 2: Continued	

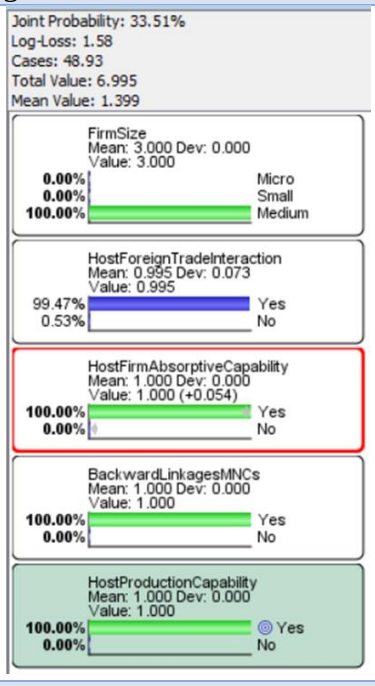




$A \perp\!\!\!\perp F|P, B, FS$

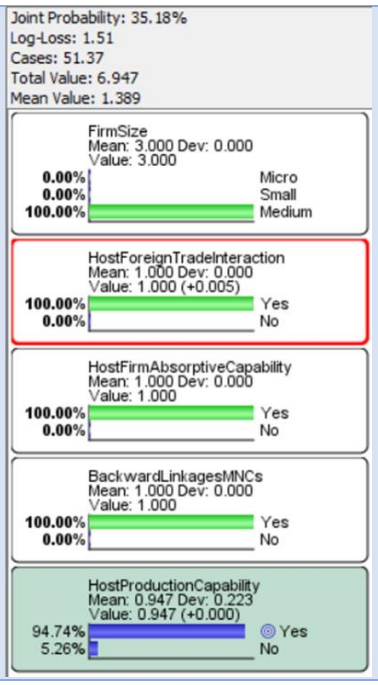
Prior to A	Including A



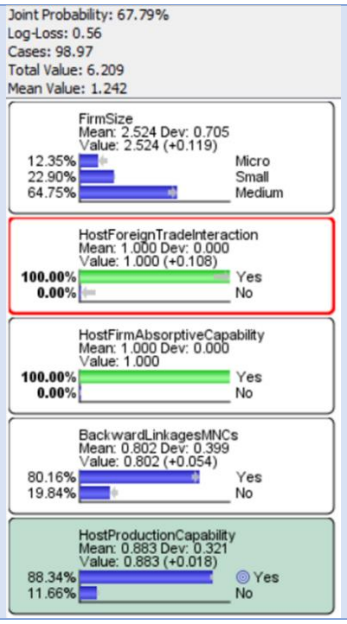


$F \perp\!\!\!\perp A, P|B, FS$

Prior to F	Including F



$$FS \perp\!\!\!\perp P, B | F, A$$



Appendix 3:Guided Interview-Qualitative Phase

I want to thank you for taking the time to meet me today. My name is Titus Ndunda and I would like to talk to you about your firm's experiences in the process of accumulating innovative knowledge. Precisely, as one of the components of this study's evaluation is assessing the effectiveness of supply relationships between native firms and locally based MNCs, in the context of local firm's accumulation of knowledge that facilitate the shift to the production of low-value added goods to high value-added goods. The assessment will facilitate the identification of the causal relationship between local firm's supply of goods to MNCs and the formers accumulation of knowledge for innovativeness.

The interview should take between forty-five minutes (45mins) to one hour. Although I will be taking some notes during the interview, it is impossible for me to write fast enough to capture all your comments. For this reason, and with your consent, I will be taping the session so as not to miss any of your comments.
All interview responses will be kept confidential. This means that any information included in the doctoral thesis does not identify you as the respondent. Remember you do not have to talk about anything you do not want to, and you may withdraw a comment, or end the interview at any time.
Are there questions about what I have just explained?
Are you willing to participate in this interview?

Interviewee Signature: ..... Date:.....

How does this firm make decisions on the choice of the way it produces goods [built-to-stock (production before demand) and built-to-order (production after the customer demands the product)]?

The question serves two purposes. First, is to identify the ability of firms to handle fluctuations and plan far enough ahead to smooth out production over periods of boom-and-bust. Second, it aims at obtaining information on how a firm ensures that customers are certain of supply of inputs/goods, an essential requirement for the formation of backward linkages with MNCs.

Has this firm interacted with the locally based MNCs, either as customers or otherwise? Please describe your experiences.

Without any prescribed direction by the interviewer, interviewee can portray how he/she perceive locally based MNCs. This question is an unbiased forerunner of question 3.

Where do see this firm's current [(production process for goods, logistics and supporting activities), (organizational and marketing methods)] strongly positioned?

This question sets the direction of interviewee's answers by asking where he/she perceives the firm is strongly positioned in terms of the production capabilities.

Please describe the actions or lack thereof that has led to this strong position?

This question serves to make interviewee reflect on whether there are any specific actions, events or points in time, which were favourable to the formation of the strong position.

In any of these strong positions, do you fear discontinuity?

This question requires the interviewee to reflect on what a future threat to the current strong position would be.

Where do see this firm's current [(production process for goods, logistics and supporting activities), (organizational and marketing methods)] weakly positioned?

At a similar structural level as question 3, question 6 asks the interviewee where he/she perceives the country weakly positioned in terms of production capabilities.

Please describe the actions or lack thereof that has led to this weak position?

This question serves to make interviewee reflect on whether there are any specific actions, events or points in time, which facilitated the formation of the weak position.

Who is responsible for initiating actions that ensure this firm's strong position?

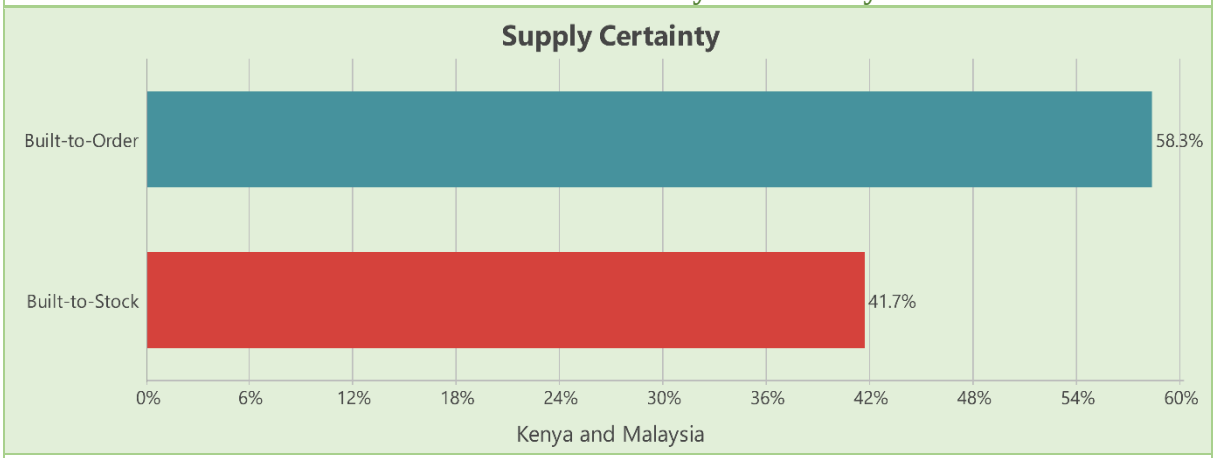
This question aims at understanding the interviewee's views on the responsibility of the initiation of actions.

What barriers do you envisage?
Is there anything more you would like to add?

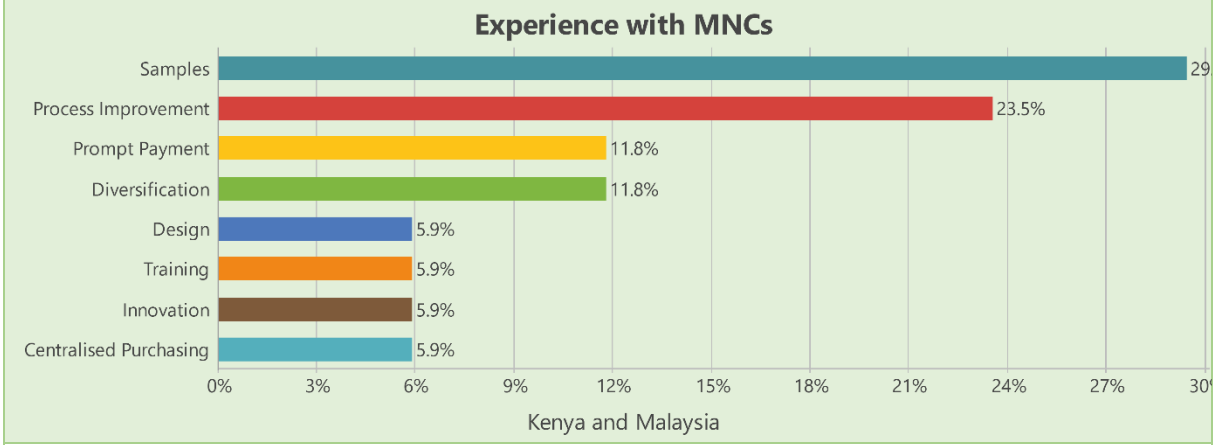
I will be analysing the information you and others gave me and submitting a draft of the analysis to my two PhD supervisors by November 2019. I will be happy to send you a copy to review at that time, if you are interested.
Thank you for your time.

Appendix 4:Codes Set1

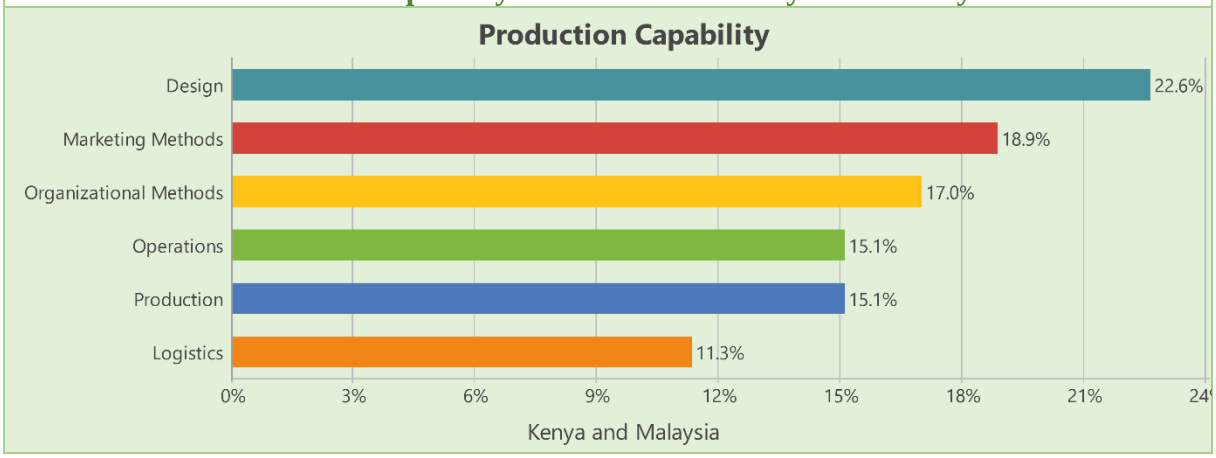
Decision on Production: Kenya and Malaysia



Experience with Multinational Corporations: Kenya and Malaysia

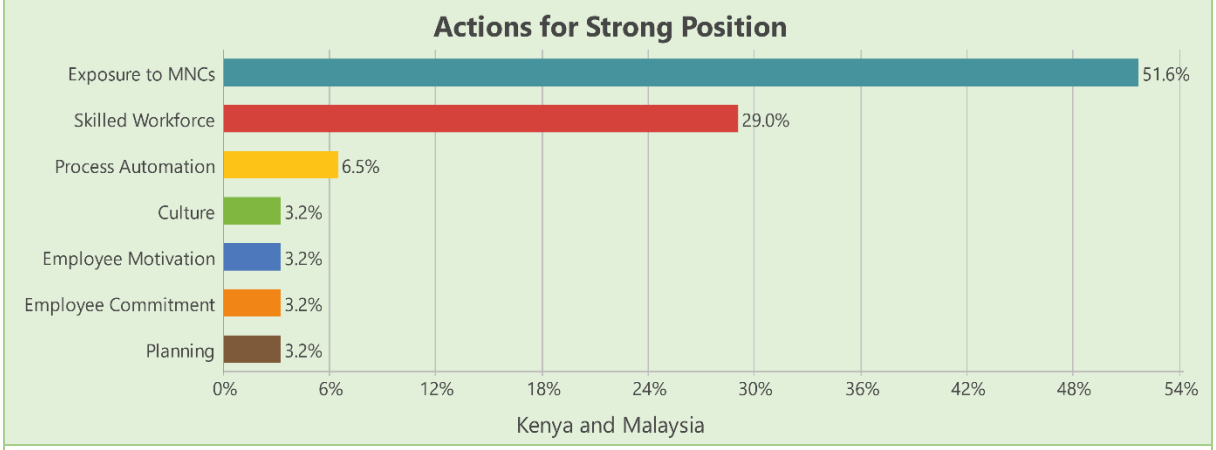


Production Capability Accumulation: Kenya and Malaysia

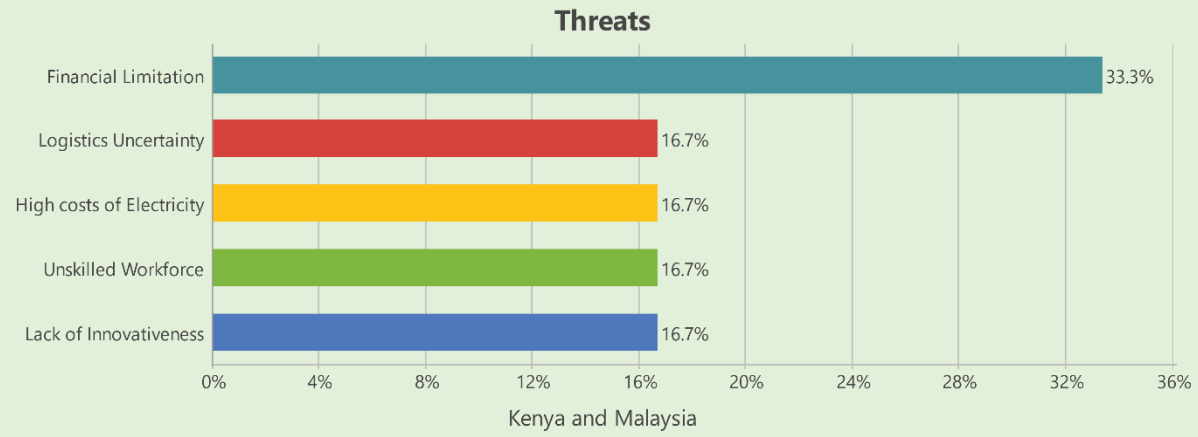


Appendix 5: Codes Set2

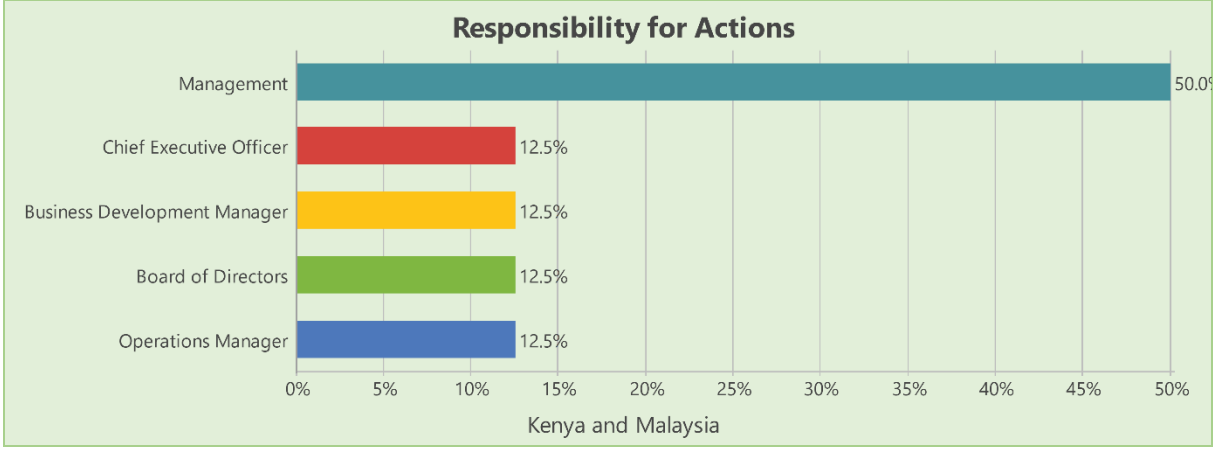
Actions for Strong Position: Kenya and Malaysia



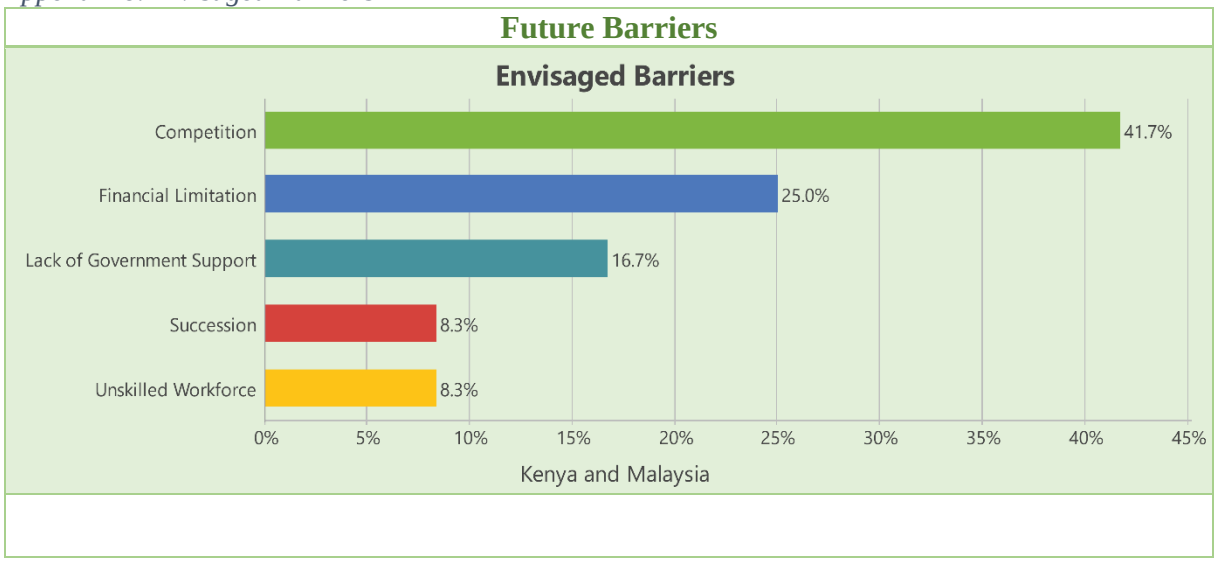
Fear of Discontinuity for the Strong Position: Kenya and Malaysia



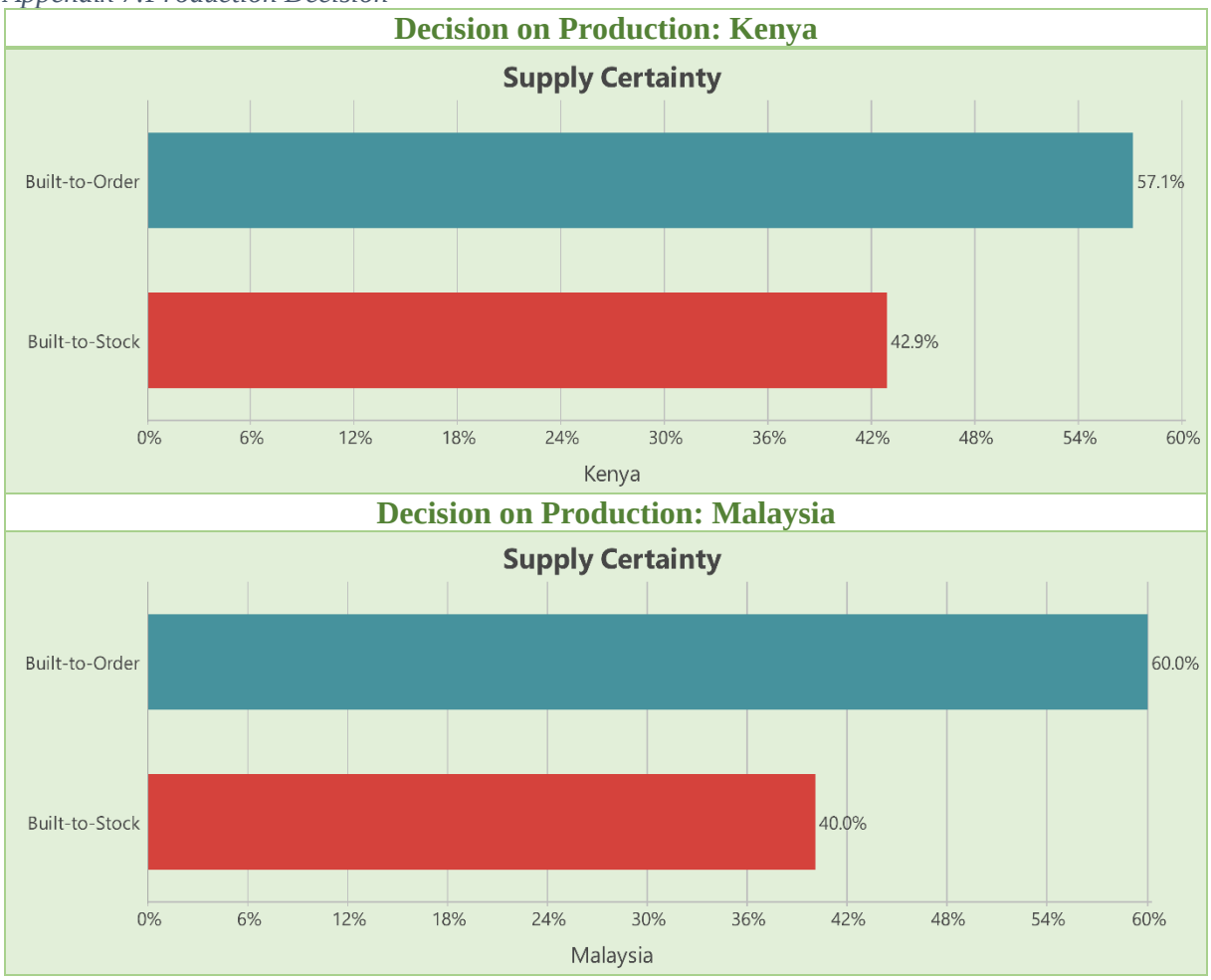
Responsibility to Ensuring Strong Position: Kenya



Appendix 6:Envisaged Barriers

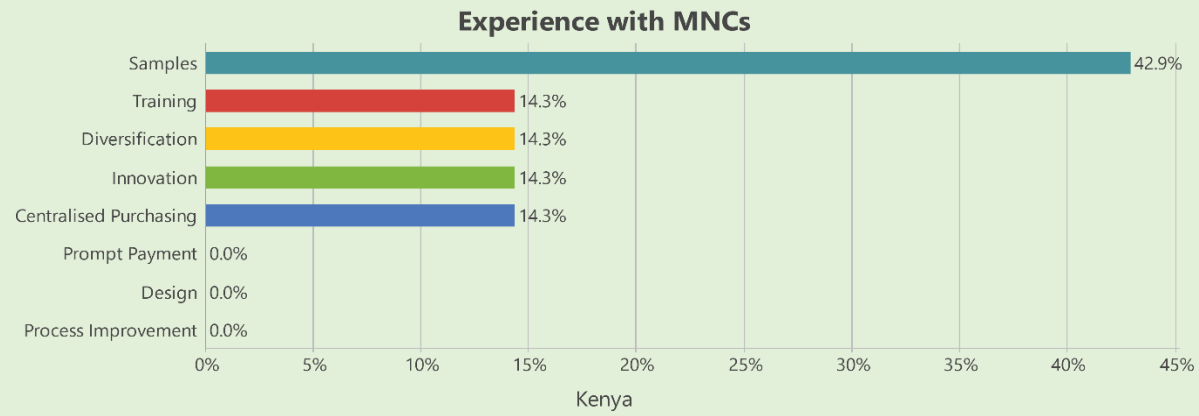


Appendix 7:Production Decision

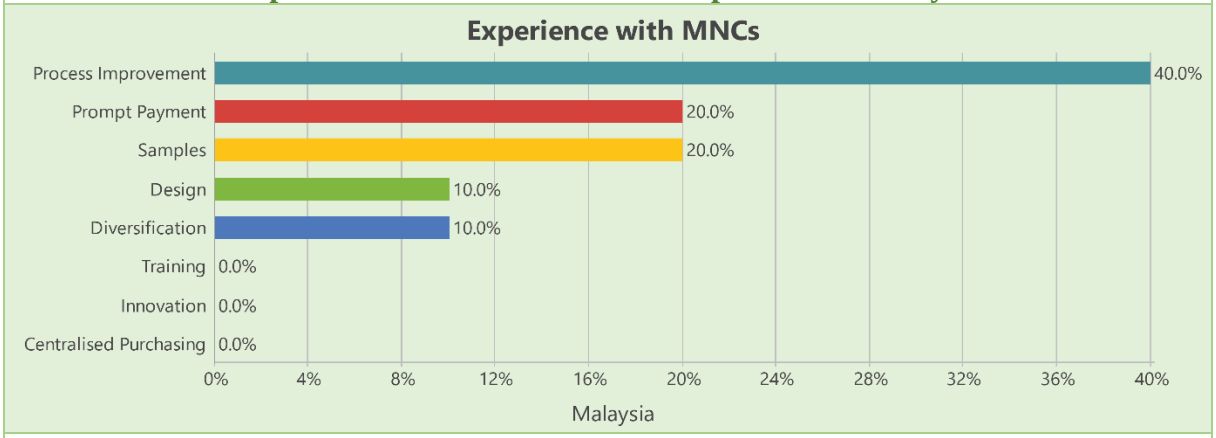


Appendix 8:Code Set3

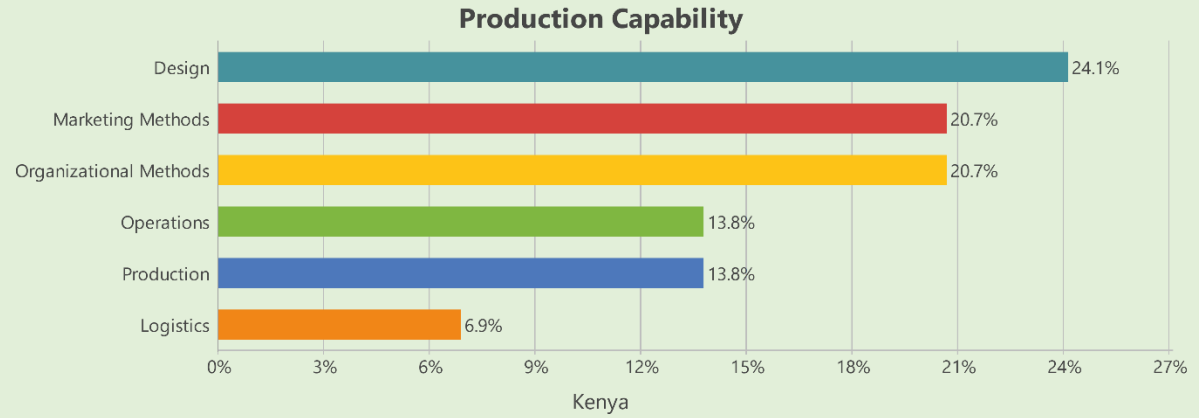
Experience with Multinational Corporations: Kenya



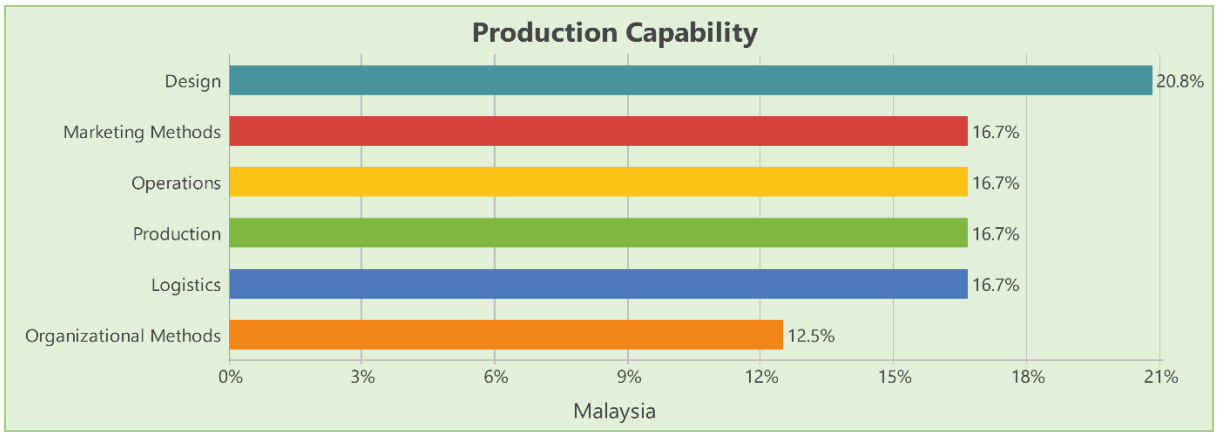
Experience with Multinational Corporations: Malaysia



Production Capability Accumulation: Kenya

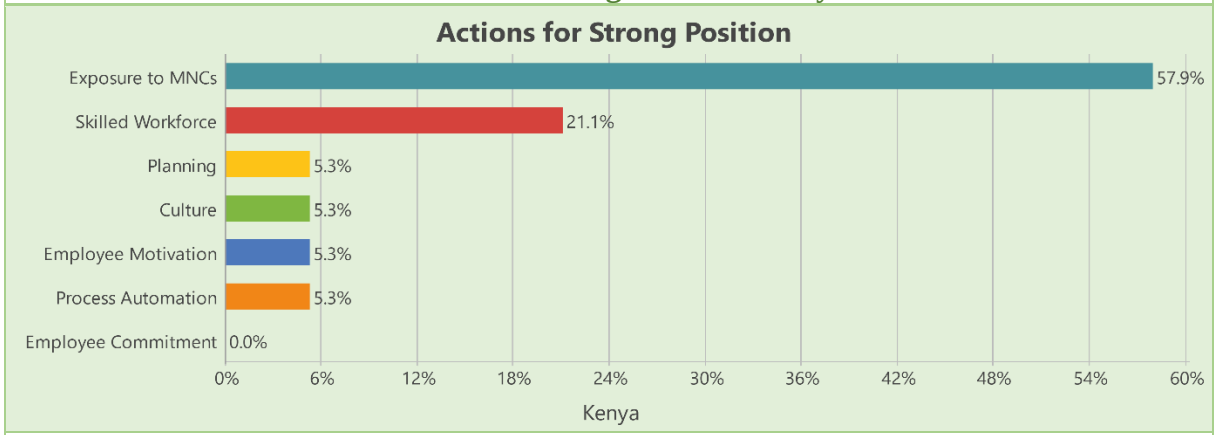


Production Capability Accumulation: Malaysia

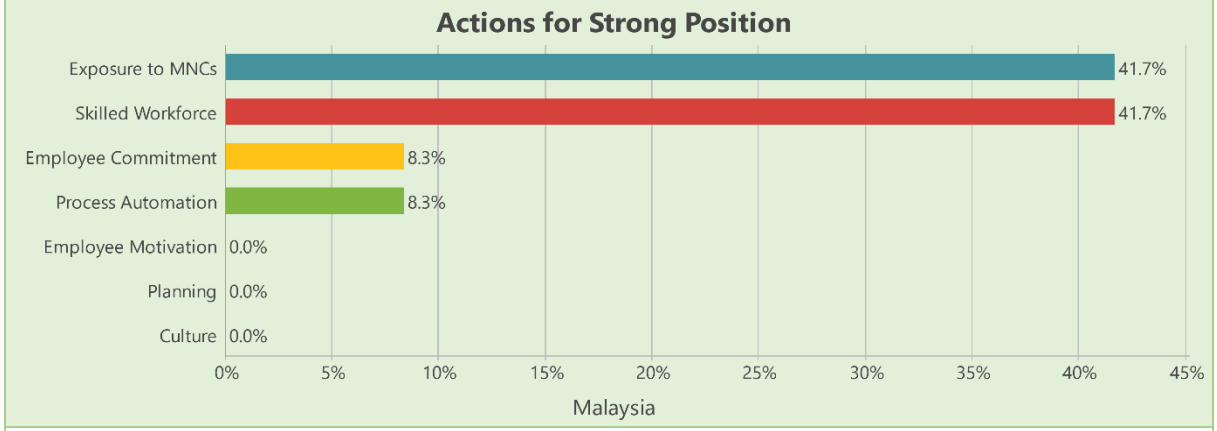


Appendix 9:Code Set4

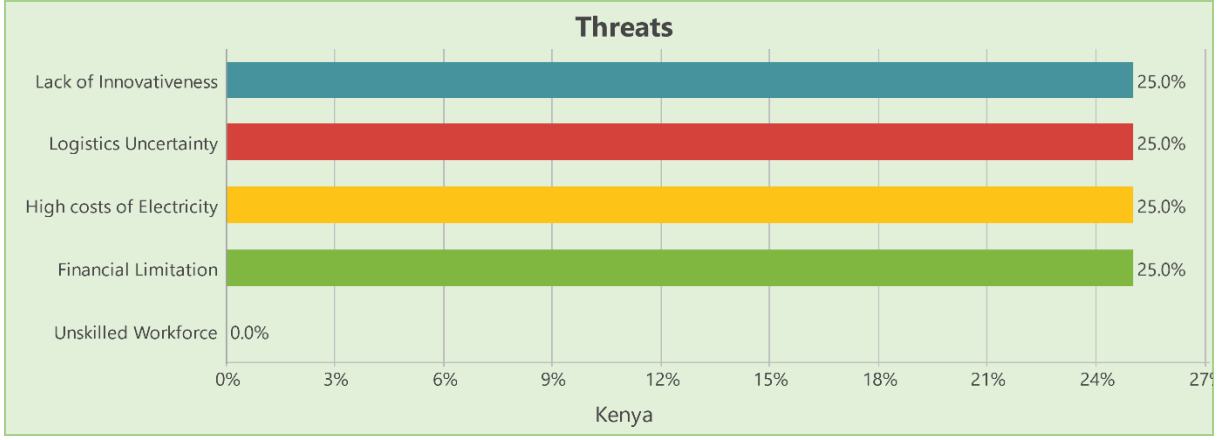
Actions for Strong Position: Kenya

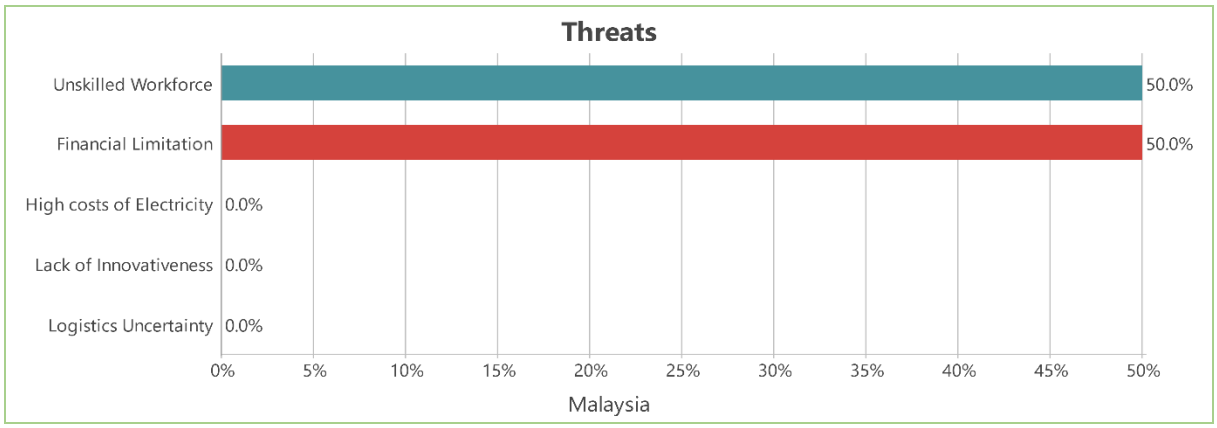


Actions for Strong Position: Malaysia



Fear of Discontinuity for the Strong Position: Kenya



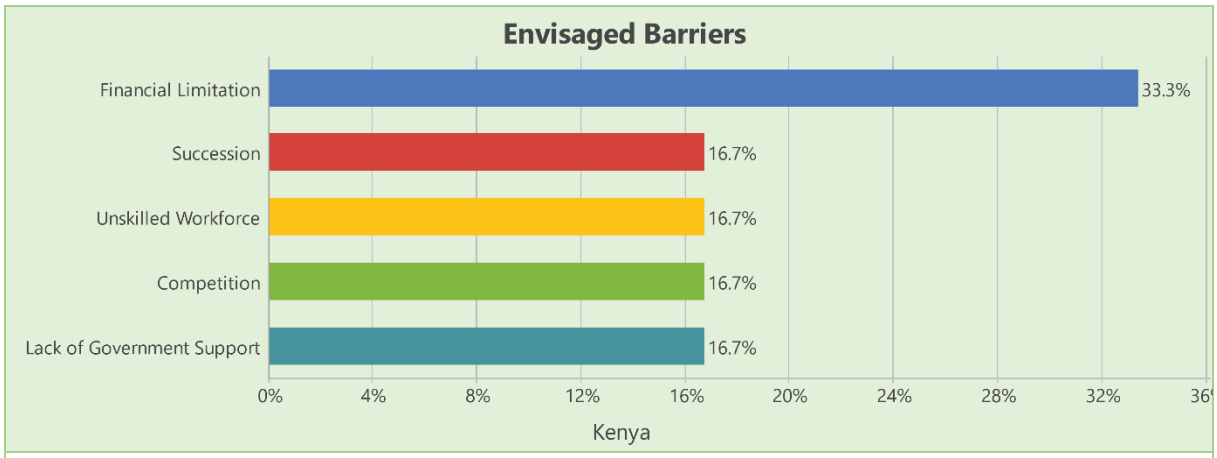


Appendix 10:Code Set5

Responsibility to Ensuring Strong Position: Kenya

Responsibility to Ensuring Strong Position: Malaysia

Future Barriers: Kenya



Future Barriers: Malaysia