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UNDERSTANDING TECHNOLOGICAL COMPETITIVENESS AND SUPPLY CHAIN DEEPENING IN PLASTIC AUTO COMPONENTS IN THAILAND: POSSIBLE LESSONS FOR SOUTH AFRICA

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Abstract

The sectoral study conducted during the first year of the Industrial Development Think Tank identified Thailand as a major international automotive hub to utilise as an effective comparator (see Black, et al., 2018). In particular, Thailand was reported as an example to look at with regard to auto policies, supply chain and cluster development, and for relatively high technological competitiveness. The present paper explores all these dimensions along with understanding the extent of the roles of multinational capital and state bargaining as well as the presence of a strong regional market. This is done in an attempt to derive policy lessons that can aid in the strengthening of South Africa's local auto supply chain. Along these lines, the current debates on the fourth industrial revolution (4IR), and on its application to an ideal *smart factory*, brings to the fore a need to understand a broad range of technologies as well as their implications for the gains to productivity in different industries. Thus, 4IR has been seen as having the potential to create entirely new markets, and with them new jobs, that did not exist before. Furthermore, it is seen as potentially facilitating the fast-tracked deepening of supply chains, which can allow for greater levels of integration into international markets.

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1. Introduction

The sectoral study conducted during the first year of the Industrial Development Think Tank identified Thailand as a major international automotive hub to utilise as an effective comparator (see Black, et al., 2018). In particular, Thailand was reported as an example to look at with regard to auto policies, supply chain and cluster development, and for relatively high technological competitiveness. The present paper explores all these dimensions, and tries to derive lessons for South Africa.

The creation of viable automotive industries has been crucial in many countries, due to the role the sector can play within the larger economy, and the spillover effects it can generate. Barnes, et al. (2015) highlight how processes and spillovers created by the auto industry can positively affect other industries within an industrial ecosystem. Most nations that managed to develop a successful auto industry did so through significant support and incentives, aimed at attracting foreign investors and help domestic firms face global competition. Today, within a highly globalised auto industry, countries wishing to build, or maintain, a competitive auto sector are faced with the task to secure a local supply chain, to favourably integrate within the global auto space, and to develop technological niches allowing for an active participation in the fourth industrial revolution (4IR).

The debate on the fourth industrial revolution (4IR), and on its application to an ideal *smart factory*, brings to the fore a need to understand a broad range of technologies as well as their implications for the gains to productivity in different industries. The 4IR entails a convergence of a range of developments in previously disjointed fields, such as artificial intelligence and machine-learning, robotics, nanotechnology, 3-D printing, virtual and augmented reality, and genetics and biotechnology.³ It is important to note that though some of the technologies that characterise 4IR are relatively old, there have been significant improvements over time with wider applications, and the business models linked to the 4IR bring them together in an unprecedented way. For example, 3D printing, which plays an important role in prototyping and production of manufacturing components today, has been in existence since the early 1980s.⁴

As such, 4IR has the potential to create entirely new markets, and with them new jobs, that did not exist before. Furthermore, it is seen as potentially facilitating the fast-tracked deepening of supply chains, which can allow for greater levels of integration into international markets. This can be through a fully-realised digital supply chain that interacts seamlessly with the various upstream and downstream players. Ultimately, one of the most significant challenges for firms and policymakers is understanding and developing the skills that are required by the new *smart* technologies as well as being adequately prepared to internalise

³ Schwab (2016) describes 4IR as “a range of new technologies that are fusing the physical, digital and biological worlds, and impacting all disciplines, economies and industries”. (See other articles on this such as <https://www.weforum.org/reports/the-future-of-jobs>)

⁴ Similarly, the advent of computers and robotics, which also dates back to the 1980s, has revolutionised the way business is conducted and has greatly improved the productivity of workers in different ecosystems. See <https://www.autodesk.com/redshift/history-of-3d-printing/> for a discussion on the history of 3D printing.

the transition to the industry 4.0. This is likely to entail the need to reskill and reallocate the workers who may otherwise lose their current employment.⁵

In this regard, building on comparative research, the present work seeks to understand the reasons behind Thailand's relative technological advancement, and its success in building an auto supply chain that is now able to compete with the changes brought about by the fourth industrial revolution. It does so by focusing on a specific productive niche, that of plastic auto components, identified as a particularly fertile ground for the implementation of smart technologies, and a segment where South Africa could build local competitiveness. The empirical focus on plastic auto components is also due to the potentially strong forward and backward linkages that plastic products have with many related industries.

Overall, considering South Africa's need/interest to deepen the auto value chain, and the way the country's policy framework has been inspired by Thailand, understanding the success of the Thai auto supply chain and how Thailand built a competitive auto cluster is relevant. Here, the paper investigates several factors, identified as key 'enablers' of Thailand's success. These include its policy framework, the country's clustering experience, the dynamics of State-MNCs bargaining, institutional coordination, and the presence of a regional market. These factors will be analysed building on an underlying theoretical discussion, which focuses on how Thailand's integration into the automotive global value chain occurred through both vertical and horizontal integration. As such, we look at how the use of clustering as a tool to grow its local production base positioned Thailand as a global leader in automotive assembly and component production.

In turn, such theoretical considerations will draw on a comparative, empirical investigation, which includes direct accounts from plastic component manufacturers in both countries. Six case are reported here: they are used to inform conclusion on technological competitiveness and the transition to a smart factory in the two different contexts. Ultimately, this is done with a view towards understanding what South African policymakers can learn from the Thai case. Overall, the paper aims at better understanding the potential, but also the risks and possible obstacles, associated with the transition to a *smart* factory. It also seeks to understand how South Africa can leverage these new technologies and processes to deepen the domestic automotive supply chain and enhance its integration in the global automotive value chain.

Thus, the paper proceeds as follows. Section 2 reviews literature specifically focusing on technological upgrading within global value chains complemented with a deeper examination of the impact of clustering on this process. Section 3 outlines the global value chain for the automotive sector and briefly discusses the auto supply chain, automotive components sector, and the plastics sector of both Thailand and South Africa. Section 4 looks to explain the competitive advantage of Thailand's auto and parts sector compared to the South African sector, which is relatively underdeveloped. This section will examine five factors, which have been identified as strong proponents of Thailand's auto sector successful development. These include a comparison of the respective auto Masterplans as well as a policy discussion on each country's plastics sector; the role of, and success of, clustering; the interplay between the state and foreign multinational corporations; the coordination or fragmentation of the state in executing the various policy initiatives; and how the presence of a regional market assists in the development of the lower tiers of the auto supply chain. Section 5 will outline

⁵ <https://iiot-world.com/connected-industry/nine-challenges-of-industry-4-0/>

perspectives from interviews of plastics auto components firms in Thailand and South Africa. The aim of this section is to understand how the individual firms perceive their relative competitiveness in terms of current technological capabilities; their awareness and understanding of debates surrounding industry 4.0; and how they are preparing their firms to be able to effectively tackle the challenges of the future they identify. Lastly, section 6, will conclude and put forward policy recommendations for South Africa.

2. Technological Upgrading, GVCs, and Clusters

Since the mid-1990s, the African continent has experienced an increasing backward and forward integration into global value chains mainly led by the penetration of TNCs in the continent (Andreoni, 2018, forthcoming). However, in the majority of the African economies, this new industrialisation model (integration into GVCs) has not led to increasing domestic value addition. Much of Africa's participation in GVCs has developed in upstream production with African firms providing almost exclusively primary products to firms in countries further down the value chain, where value addition is concentrated.

TNCs exercise their power in global and oligopolistic markets and command enormous global market shares. This power is exercised in a systematic and strategic manner to capture value in the market by creating entry barriers in the forms of patents, quality standards, copyrights trademarks etc and by squeezing the supply chains. Firms in institutional environments with oligopolistic markets and state institutions of limited capacity, such as those where GVC suppliers thrive, rarely maximise their profits by seeking constant innovation and new demand niches. Rather they are more likely to seek stable market niches (Pipkin & Fuentes, 2017).

Upgrading in GVCs, usually involves moving into higher value-added activities, which is vital for economic development and job creation in the global economy (Cattaneo, et al., 2013). While the understanding of upgrading in GVCs has evolved over time, it still speaks to the myriad of ways in which firms can enhance their competitiveness through investments in productivity, specialisation and knowledge-intensity (Pipkin & Fuentes, 2017) in order to make better products more efficiently, or moving into more skilled activities (Giuliani, et al., 2005).

However, the GVC literature focusing on causes of technological upgrading has not significantly changed since the 1990s, still assuming that most of the determinants of developing economies' suppliers upgrades come from powerful buyer firms based in advanced countries (Yeung & Coe, 2015). The basic GVC models assume a fairly linear, additive, and positive relationship between each individual upgrade and the development trajectories of developing country firms (Pipkin & Fuentes, 2017). There exists deep disagreements about whether and when global buyers assist or impede developing country firms in the efforts to advance toward more sophisticated knowledge and higher value added (Humphrey & Schmitz, 2002) (Ponte & Ewert, 2009).

Governance forms a central part to any analysis regarding GVCs. It shows how corporate power exercised by large and lead firms shapes the distribution of profits and risks in an industry, and how this alters the upgrading prospects of firms in developed and developing economies that are included in (or excluded from) the supply chains that constitute each industry (Gereffi & Lee, 2012). Lead firms play a crucial role by defining the terms of supply of chain membership, by incorporating or excluding other actors and by shaping how, when, where, and by whom value is added (Gereffi & Lee, 2016).

Within the GVC framework, Humphrey and Schmitz (2002) identify four types of upgrading. The first being product upgrading and moving into more sophisticated product lines. Secondly, process upgrading: transforming inputs into outputs more efficiently by recognising the production system or introducing superior technology. Third, is functional upgrading, which entails acquiring new functions (or abandoning existing functions) to increase the overall skill content of the activities. Lastly, there is chain upgrading where firms move into new but often related industries. These four types of upgrading are thought, at least in the realms of GVC literature, to be sufficient for explaining the dynamics and interactions among firms in an industry, such as the automotive value chain, that is highly globalised and vertically oriented.

Yet, explaining technological upgrading and supply chain deepening within Thailand and South Africa only through the GVC framework has some issues. Firstly, is that GVC scholars (for example, Gereffi, et al., 2005) tend to focus on how pressure imposed by global buyers along with public and private governance processes facilitate the diffusion of global standards and how they affect economic and social upgrading in developing countries. Whereas writers on clusters (see Schmitz, 1995; Lund-Thomsen & Pillay, 2012), on the other hand, tend to focus more on inter-firm learning and institutions in localised areas. Gereffi and Lee (2016) argue that there is a need for an integrated framework that shows how GVCs and clusters are connected through a variety of globalisation processes. This is because the typologies of GVC and cluster governance need to be expanded to take into account both vertical and horizontal relationships and the complex interactions between public, social, and private forms of governance (Gereffi & Lee, 2016).

Secondly, GVC literature fails to account for the benefits of clustering. For example, cluster literature suggests that clusters matter for economic upgrading because of, firstly, the agglomeration of productive activities generates economies of scale and scope that are external to individual firms, but which are internal to clusters. Secondly, clusters facilitate local joint action by cluster firms and institutions to address common problems based on their interdependence (Gereffi & Lee, 2016). Cluster firms in developing economies struggle when presented with conflicting demands from global buyers seeking lower production and labour costs, while at the same time complying with higher quality or social expenditures (Lund-Thomsen & Pillay, 2012). Thirdly, active upgrading efforts in industrial clusters increase the demand for high-skilled and better-paid workers as well as investment in advanced training and new skills, for example, product development and design (see Posthuma, 2008).

Lastly, there is a wealth of empirical evidence (Humphrey, 1995; Rabellotti, 1997) showing that small firms in clusters both in developed and developing countries are able to overcome some of the major constraints they usually face: lack of specialised skills, difficult access to technology, inputs, market, telecommunication, credit and external services (Giuliani, et al., 2005). SMEs located in clusters and involved in value chains, may undertake a process of upgrading in order to increase and improve their participation in the global economy, especially as the industrial sector plays a role and affects the upgrading prospects of SMEs.

As an example, Thailand's clustering in its auto industry perfectly illustrates the benefits that come from developing strong horizontal linkages along a vertically aligned supply chain. This was a major reason for the growth, and subsequent relative competitiveness, of Thai auto components, including plastic auto components. The types of firms that benefitted in the Thai case include tier 1, 2 and 3 firms. In most cases, locally-owned Thai firms were created as a result of joint-ventures with OEMs, mostly Japanese, that came with exclusive agreements for

the production, and use, of specific components. These arrangements also proved extremely beneficial for Thailand's auto sector in terms of its rate of technological change and global competitiveness (see section 4 on the role of the state and multinational capital and section 5 for individual discussion on technological competitiveness from the firm-level perspective). Kohpaiboon (2008) notes that foreign auto suppliers brought new technologies and production routines as they gained ownership control which facilitated the strong technological growth of the Thai auto components sector.

Industry 4.0 and the technologies and methods associated with it could make the possible gains from clustering for South Africa's underdeveloped auto component sector more enticing. A fundamental aspect of 4IR is access to, and sharing of, knowledge. Firms view *knowledge* as a source of competitiveness and a prerequisite for successful participation in international trade and investment (Fagerberg & Srholec, 2017). Thus, firms require favourable environments in which to share this knowledge.

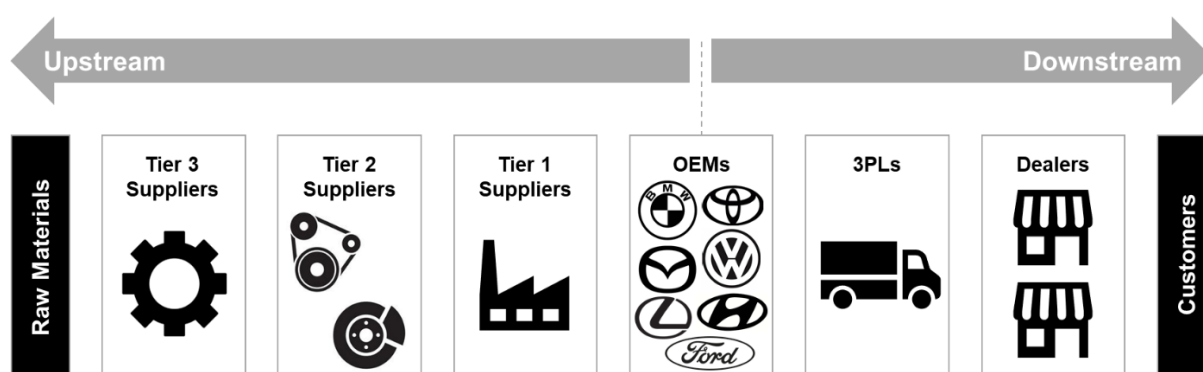
Therefore, clusters or regional hubs of expertise provide this space, which assists in the nurturing of small and medium enterprises (Bell, et al., 2018). Importantly, it must be noted, for there to be successful synergies within a cluster, firms are required to invest a significant amount in order for there to be homogenous levels of technological capabilities among all members. By doing this the cluster can create a space that can easily share resources and foster innovations whilst simultaneously competing and cooperating (Bell, et al., 2018). This will enable firms within the cluster to better enter the export market while also diversifying the industrial base of the economy.

However, this framework warns that the potential for a cluster to create more technologies is strongly linked to the quality and strength of local innovation systems (Bell, et al., 2018). Thus, the success and development of clusters rests on capturing the ability to become leaders in the evolution of knowledge instead of relying solely on internal linkages (Lema, et al., 2018). For successful technological development to take place within a cluster, specifically with regards to Industry 4.0 technologies and the idea of connectedness, firms should create an environment based on mutual trust, compatibility, close corporation, and shared norms (Bell, et al., 2018).

3. The Automotive Supply Chain and Automotive Components

The automotive industry is one of the world's largest manufacturing industries (Black, et al., 2018). The automotive supply chain is characterised by high levels of concentration with few countries and companies leading production and assembly (Lejarraga, et al., 2016). The global production system today is comprised of complex and dynamic interdependencies spanning across various industries and sectors, as well as countries and regions. These interdependencies unfold in a wide range of technological, organisational, and institutional dimensions and involve different actors (Andreoni, 2018, forthcoming).

Figure 1: Stylised Representation of the Auto Global Vale Chain



Source: Authors

In the GVC terminology, the automobile industry is considered a Producer Driven GVC (Wad, 2009), which is governed by large OEMs who control the assembly, research and design, distribution and sales of automotive around the world. The above stylised figure highlights the centrality of the OEMs in the auto supply chain. Various OEMs have governed the auto value chain through controlling core technologies and products. In specific cases, OEMs have set up different types of organisations to govern the upstream and downstream processes (Wad, 2008). Furthermore, Wad (2008) notes that American OEMs followed vertical integration, whereas Japanese OEMs utilised vertical collaboration and European firms typically follow a horizontal collaboration effort.

The significant role played by OEMs, and their capacity to affect investment, often determines the development of local supply chains, and strongly influences the policy space available to state institutions. In this regard, the bargaining dynamics established between state and MNCs companies becomes crucial to understand supply chain development and localisation processes. At policy level, finding a way to voice the needs of local component suppliers also becomes essential for a sustainable development of a local manufacturing base (see Black et al, 2018).

Both Thailand and South Africa, in attempting to develop and grow their automotive sectors into respective production hubs, drafted Masterplans (see section 4.1 for a discussion on these). These were formulated with the intention of incentivising OEMs to set up their operations in each country, with the goals of boosting production output and localisation within the respective domestic supply chains. For the following discussion, we will briefly describe both country's auto supply/value chains and auto components sector, where information was available. Subsequently, we use the development of the plastic auto component sector as to our analysis. Thus, in the following sections, we briefly detail the policy efforts on the part of the South African State to create a sustainable and competitive plastics industry, while comparing the initiatives of the Thai government in its attempts to become a global leader in the manufacture of plastic and automotive components.

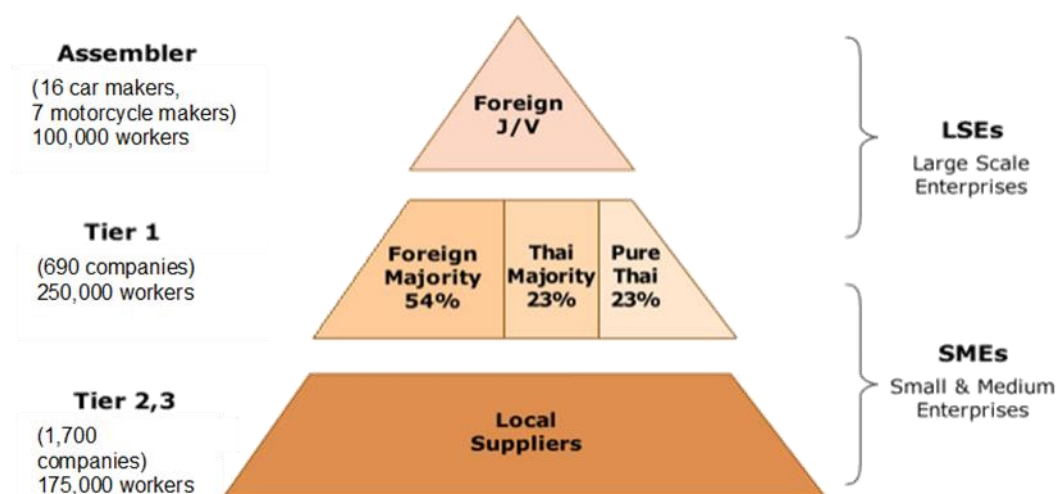
3.1. Thai Auto Value Chain, Auto Components, and Plastic Production

3.1.1. Thai Auto Supply Chain

The Thai automotive supply chain closely resembles that of the global auto supply chain (refer to figure 3 below) in terms of its structure and concentration of producers at the different tiers (figure 2). There are presently around 16 major foreign-owned auto manufacturers operating

in Thailand. These companies form the anchors with which the rest of the Thai auto supply chain has developed. The strong growth and development of the Thai automotive sector is due to the commitment by the state to its Masterplan strategies (see section 4.1 for a discussion on policy).

Figure 2: Automotive Supply Chain in Thailand



Source: TAPMA (2014)

Most of the tier 2 and 3 producers are local suppliers and classified as SMMEs whereas the upper tiers of the supplier chain are foreign-owned or foreign-majority owned companies. The above figure shows that a significant portion (48%) of employment within the auto supply chain resides in the tier 1 producers with the tier 2 and 3 companies accounting for one-third of total employment (as of 2014).

3.1.2. Automotive Components in Thailand

From an automotive parts perspective, the Thailand Auto Parts Manufacturers Association (TAPMA)⁶ notes that there are more than 2000 automotive component manufacturers (typically SMMEs) in Thailand with roughly 700 of these being Tier 1. Many of these SMMEs are joint ventures with either Japanese or European firms. This means that these Thai component manufacturers may have to meet standards specified by the OEMs.⁷ The end-user market is divided into two parts. The first is the OEMs market to whom the auto component manufacturers supply. The second market is the replacement market where firms are subject to less stringent specifications.

The above table highlights the impressive growth in the number, output, and contribution to employment of Thai automotive parts suppliers. It shows how over the past 20 years, the promotion of the Thai automotive industry by the Thai government along with significant investment and policy that has been oriented towards clustering have contributed to the strong growth in its components sector. Similarly, the below figure echoes this sentiment in showing

⁶ From interview at BITECH, Bangkok, 17/10/2018.

⁷ There are currently 18 car makers in Thailand from Japan and European OEMs. These OEMs consist of: Auto Alliance, Ford, General Motors / Chevrolet, Honda, Isuzu, Mitsubishi, Nissan, Suzuki, Toyota, RMA, Mercedes-Benz, MG (SAIC-CP), and Volkswagen.

how many new auto parts suppliers have been created within, and along, the Automotive Manufacturing Corridor⁸ (AMC) in just 10 years.

Table 1: Automotive parts supplier plants in the Thai industrial census

	Ownership	1996	2006	2011
Number of plants	Foreign-owned	59	133	94
	Thai-owned	144	365	378
Average age of plant (years)	Foreign-owned	7	11	16
	Thai-owned	11	13	15
Average output (million baht per plant)	Foreign-owned	453	1 225	941
	Thai-owned	169	213	362
Average employment (workers per plant)	Foreign-owned	210	322	386
	Thai-owned	136	114	143

Source: Warr & Kohpaiboon (2017)

In terms of the strengths of the Thai auto component industry, these can be broken down into a few main categories. First, the Thai automotive component sector benefits from relationships with many large OEMs, which have invested in building the infrastructure and the development of personnel who work in the industry as well as in new technology. Many of the OEMs see Thailand as a strong destination to invest and fund infrastructure development. This is likely due to the strong government support towards growing the automotive sector as well as more favourable labour conditions in terms of lower costs/higher skills compared to South Africa.⁹ Second, Thai component manufacturers have access to a strong regional market with high demand for their products whereas South Africa's regional market is severely underdeveloped. To date the Thai government has signed almost 20 Free Trade Agreements earmarked for the development of the long-term relationship with the region.¹⁰

However, given these strengths there are some glaring weakness. For example, similar to South Africa, the Thai plastics auto component industry suffers from a relative shortage of properly trained workforce to meet the demands of the highly-dynamic technological environment in which the automotive component sector operates (Warr & Kohpaiboon, 2017). Furthermore, the industry faces a major threat from other cheap labour countries such as

⁸ The automotive corridor, and economic corridors in general, refer to an integrated network of infrastructure typically urban landscapes that connect various economic nodes or hubs (Brunner, 2013). Warr and Kohpaiboon (2017, p.3) state that "economic corridors are one of a range of development instruments designed to facilitate infrastructure development, trade, and economic growth. Others include growth triangles, growth areas, coastal corridors, and industrial zones. The essential feature of an economic corridor is that it facilitates economic development along the connection itself, including provision of electricity, telecommunications, and water supply grids."

⁹ From field interviews, Bangkok, Oct. 2018.

¹⁰ Annually, Thailand produces 2 million cars for the local demand and external demand mainly from the region.

Cambodia and Vietnam, which may attract automotive manufacturers in the future, weakening the attractiveness for new investments in the economy by the large OEMs.

3.1.3. Plastics Industry in Thailand

The plastics industry in Thailand is regarded as a global hub of plastics manufacture. Its staggering development has been built on the production of high value-added products. While being important in generating employment, the Thai plastics industry only contributes to around 2.7% in manufacturing value-added. The majority of firms in the plastics products are small-scale employing less than 50 employees. However, the average size of plastics firms is around 89 employees, which is less than the manufacturing average of 103. Yet, the plastics industry is also noted as being among the fastest growing exports industries in Thailand (Kraipornsak, 2014). This growth is attributed to the strong global demand for plastic products, which has encouraged new investments in the industry.

The Thai plastic industry is composed of multinational companies (MNCs) and local firms, receiving more FDI than other manufacturing sectors (Kraipornsak, 2014). Most of the FDI stems from Japan and Taiwan. The tier 1 is mainly composed of by MNCs while Thai firms are mostly in tier 2 and 3. These MNCs have their headquarters in Japan, America, Germany and France. According to the Plastic Institute of Thailand (PITH)¹¹ there are 200 companies that are in the tier 1 category and 600 in tier 2. The volume composition of plastic products in Thailand is similar to that of South Africa with the bulk of the products being used in the packaging industry and the smallest industry being plastic automotive components.

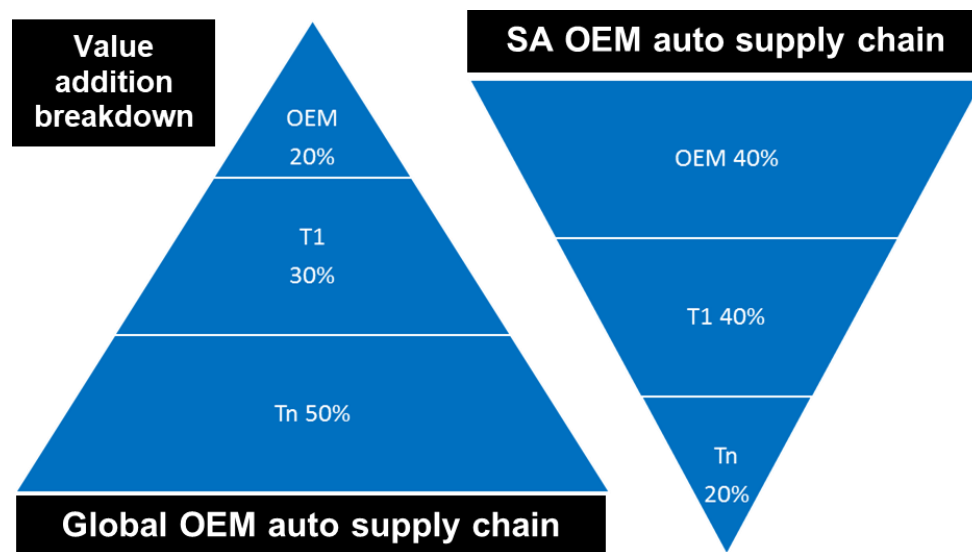
3.2. South African Auto Value Chain, Auto Components, and Plastic Production

3.2.1. South African Auto Supply Chain

The SA auto value chain is highly concentrated around OMS and Tier 1 suppliers (Figure 3), while the local supplier base (Tier 2 and 3) remains significantly underdeveloped relative to leading international competitors (Black, et al., 2018). This inverted nature of the domestic supply chain raises particular concerns, as local content is still very low compared to the targets fixed in the 2035 Masterplan. Such a structure also signals that the incorporation of the SA auto industry into the global auto chain has not translated in significant local development. At the same time, the leading role of OEMs has dominated the entire supply chain, and substantially influence the SA state's policy space (see Masondo, 2018).

¹¹ Interview with the Plastics Institute of Thailand, Bangkok 18/10/2018.

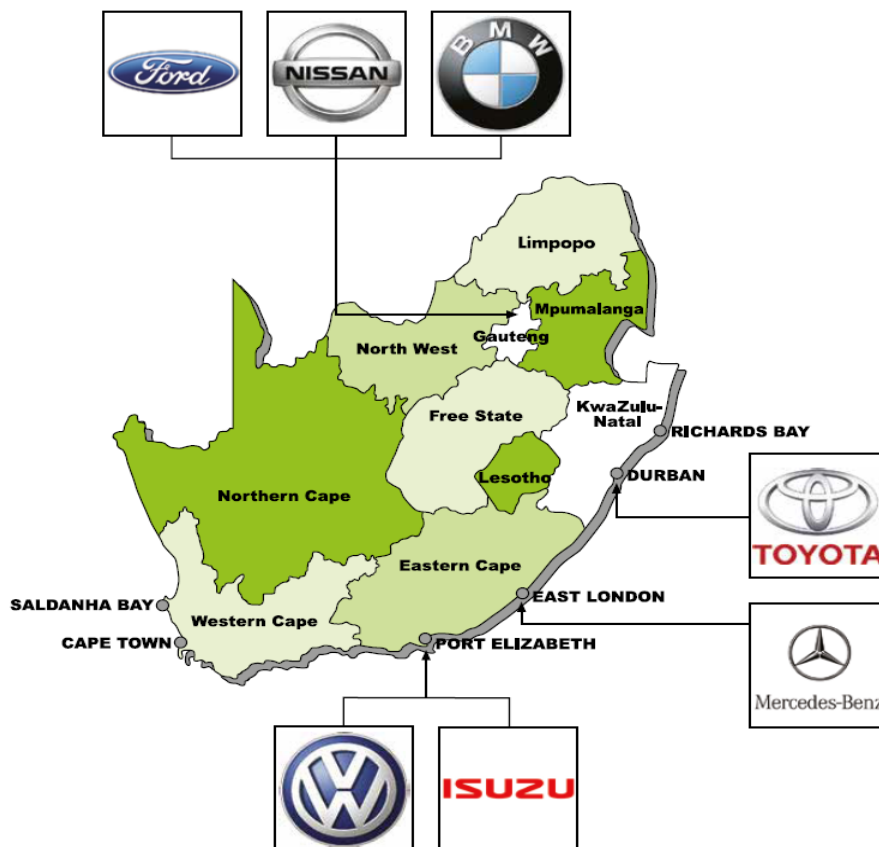
Figure 3: South African Automotive Supply Chain compared to Global Auto Chain (value addition breakdown)



Source: Barnes (2016)

Whereas Thailand's auto supply chain was similar to that of the global supply chain, South Africa's lower level tiers (2 and 3) are less developed. The figure above shows that the global supply chain's value addition is mostly accounted for by the lower level tiers (50%) with the remaining value addition coming from tier 1 with 30% and the OEMs producing 20%. In contrast, the majority of South Africa's value addition comes from the top of the supply chain with OEMs accounting for around 40% and the low-level tiers accounting for 20%. Significantly, the lower tiers of the supply chain accounted for a large portion (one-third) of total auto employment in Thailand. Therefore, it stands to reason that South Africa can potentially significantly boost employment levels in its auto supply chain through the promotion and development of lower tier suppliers.

Figure 4: Location of large, foreign OEMs production plants in South Africa



Source: *Automotive Export Manual (2018)*

In terms of the presence of foreign OEMs within the South African auto sector, figure 3 shows that OEMs account for 40% of the value addition. In stark contrast to the high number of foreign OEMs operating in the Thai auto sector, the number of OEMs operating in South Africa total half that of Thailand. Thailand's auto Masterplans have laid the groundwork for the successful attraction of many OEMs. South Africa has not been able to achieve the same rate of success through its various automotive policies (see section 4.1.3).

3.2.2. Automotive Components in South Africa

The South African automotive components sector is vastly underdeveloped compared to the Thai auto components sector. Among the 125 firms, which form part of the National Association of Automotive Component and Allied Manufacturers (NAACAM)¹², approximately 110 supply OEMs (Tier 1) for assembly and aftermarket requirements. The other firms are Tier 2 and 3 suppliers. As per the latest figures, around 70% of Tier 1 manufacturers in South Africa form part of NAACAM. with their employment in 2017 estimated at around 51 000 (approximately 64% of the total employment by the automotive component sector.)

The success of the local industry is heavily dependent on the strategies of OEMs, which are often large multinational corporations with operations in multiple countries around the world. Currently large (mostly foreign) OEMs choose to source their products externally rather than

¹² Data on the exact number of automotive component manufacturing firms in South Africa is not precise unless they belong to an association such as NAACAM.

employing the services of local manufacturers,¹³ However, in line with the government's focus on increased localisation, the last four years reflect an overall growth in local value addition in parts supplied to local OEMs (NAACAM, 2018). furthermore, in 2017, local value add in automotive components grew at and compound annual rate of 12.5%. Yet, these figures are likely the outcome of exchange rate fluctuations rather than an increased commitment on the part of OEMs to source their components locally (NAACAM, 2018).

Table 2: Major component export categories (R'Millions), 1995-2017

	1995	2005	2015	2016	2017
Catalytic converters	389	9935	20326	21892	18702
Engine parts	102	1000	3941	3901	3773
Tyres	213	1183	2193	2527	2516
Automotive tooling	153	332	1459	2110	2447
Engines	9	781	1448	1378	1525
Radiators and parts	66	220	1190	982	975
Transmission shafts/cranks	55	553	1060	861	839
Stitched leather seat parts	1019	2693	993	768	525
Other	1077	5073	17031	18622	18973
Total	3 083	21 770	49 641	53 041	50 275

Source: AIEC (various years)

Despite the challenges highlighted above, exports of automotive components have risen sharply, rising from R3 billion in 1995 to R50.3 billion in 2017.¹⁴ This growth was the result of large export subsidies, which formed part of the Motor Industry Development Programme (which ended in 2012) and the Automotive Production Development Programme. With local content levels in the South African automotive sector as a whole around 38%, it is clear that local firms may continue to struggle to compete and grow in such a hotly-competed market like automotive components.

Still, the relatively small scale of the South African auto industry, and by extension the underdeveloped components sector, can be put down to a few problems. First, the small market for automotive products in South Africa, as well as in the region, limits the scope and scale of production. Second, many of the firms in the sector, which do not form part of multinational corporations face severe financial constraints in their ability to scale up and upgrade their current operations. This limits the ability of these firms to expand their productive capacity in order to compete on volume and unit price with larger TNC subsidiaries. Thirdly, many large (often foreign-owned) OEMs choose to send higher volume products overseas. This is due to foreign component manufacturers (specifically Thailand) have the capacity to meet a significantly higher level of demand than South African firms.

¹³ The phenomenon of global sourcing has not been countered but actually fostered through the rebate mechanism included in previous auto policies: OEMs managed to gain import allowance by increasing export.

¹⁴ Yet, the nature of this increase in automotive component exports raises concerns. This is because any sizable growth has only come from exports of catalytic convertors. Thus, the perceived growth of automotive component exports and hence the domestic sector can be considered as a false positive as there has not been any meaningful diversification and growth in exports of other components since 1995.

Fourthly, the costs of labour, particularly skilled labour such as artisans, technicians and managers, also contributes to lower competitiveness of many local firms. These high-skill cost premiums are indicative of the current poor state of education and skills shortages in SA (Barnes, 2009). The lack of price competitiveness, combined with low production capacity, present in the South African auto component manufacturing sector means that a large share of auto components is imported, while local content levels are declining. Fifthly, power outages also put a major strain on component manufacturers, which leads to many lost days of operation. Thus, South African firms may be viewed as unreliable. Fifthly, the relatively old age of many of the machines in operation in South Africa means that the local component manufacturers are not as efficient as their international counterparts who can afford to employ newer and more efficient technologies.

3.2.3. Plastics Industry in South Africa

Plastics manufacturing in South Africa contributes around 1.9% to GDP and 16.6% to the manufacturing sector (DTI, 2019). The South African plastics industry is well developed on many levels of the plastics value chain. It includes the production of polymer chemicals through to the manufacture of different plastic products (Roberts, 2001). Furthermore, the plastics sector caters to local and export demand with its products mainly being produced for the building, construction, and automotive industries (DTI, 2019). Additionally, plastic products are also utilised in a number of other industries such as the textile, electrical, and agricultural industries.

The plastics industry in South Africa employs over 60 000 workers with around 1800 companies operating in the sector (Plastics SA, 2014). Many of the firms involved in the conversion of plastics are considered small- to medium-sized enterprises where the average number of employees are 130 (DTI, 2019). The upstream polymer chemical firms form part of industrial groupings which are closely aligned with domestic conglomerates (Roberts, 2001). On the downstream, the firms involved in the manufacture of plastic products, like other light manufacturing firms, is underdeveloped compared to Thailand.

The South African plastics industry's development is constrained by a variety of factors. These include the pricing of raw materials, lack of advanced manufacturing methods and processes, the lack of a research and development focus by downstream firms, and lastly, is the high transportation costs associated with South Africa's geographical position. However, in terms of the automotive sector, plastic auto component firms account for only approximately 4%¹⁵ of the total component firms in South Africa. Therefore, we see the plastics industry as having strong potential to significantly improve its integration and contribution to the auto sector.

4. Explaining Thailand's Competitiveness: Key Enablers of Success

The above section detailed the strengths of the Thai automotive and plastics sectors while outlining the relatively underdeveloped and poor state of the respective South African industries by comparison. It therefore is of interest for this paper to understand why Thailand has been successful in creating and promoting its automotive and plastics sectors, and why South Africa is lagging behind. The following sections will compare and contrast five factors that we feel have been instrumental in explaining Thailand's success.

¹⁵ Interview with PlasticSA, 1/10/2018.

4.1. Policy Frameworks

4.1.1. Thailand Masterplan

Thailand's government has been instrumental in enabling the industry to become a leading production centre through its well-advised support, which began in the early 1988s (Ariffin & Sahid, 2017). Policy initiatives such as the country's masterplan significantly contributed to the continued growth witnessed by the industry. Over time, the Thai Government has offered substantial support to the domestic industry, and through the Board of Investment (BOI), it has provided a range of fiscal and non-tax incentives for investors. Tax-based benefits have included exemption or reduction of import duties on machinery and raw materials, and corporate income tax exemptions and reductions. Non-tax incentives include permission to bring in foreign experts, own land, and take or remit foreign currency abroad. Foreign businesses are also entitled to 100% ownership (ASCCI, 2016).

The Thai automotive sector has also received tax incentives by the state and one such case is the corporate income tax exemptions for direct investment into specific, aligned technologies. At the OEM level, this takes the form of advantaging investments in particular vehicle platforms and that conform to specific requirements.¹⁶ These supporting schemes come with certain conditions attached. For instance, in the case of the Eco Car, OEM investments are required to meet two criteria in order to qualify: first, a minimum demonstrated volume output of 100,000 units, and secondly, the processing of certain engine parts must be undertaken locally (ASCCI, 2016).

The first criterion encourages OEMs to position their plants to supply both domestic and export markets in order to achieve the minimum volume threshold. Volume requirements also encourage OEMs to prioritise investment in a narrow scope of vehicle platforms, thereby giving the industry globally competitive economies of scale at an assembly level and potentially through the value chain. The second criterion serves to develop local value chains by making the OEM incentive contingent upon certain processes being undertaken locally (such as engine assembly and the processing of important drivetrain parts) and offering preferential incentives to invest in prioritised supplier process technologies. Investments by OEMs and suppliers in vehicle segments and technologies falling outside of those prioritised typically receive support through a secondary set of benefits also available to other investments. These include the duty-free importation of machinery and raw materials to be used in the production of vehicles for export (ASCCI, 2016).

The main goal for the Thai Automotive Industry Masterplan is for Thailand to become a regional hub for automotive exports (Ariffin & Sahid, 2017). In the past few years, Thailand's automotive policy appears to have been working as automotive production in Thailand has grown to around 2 million units annually. However, this has come at expense of, similar to South Africa, most the Thai auto industry being controlled foreign-owned producers who exert their influence on the domestic supply chain and control core technologies, the rate of technology adoption, production processes and research and design (Ariffin & Sahid, 2017). Yet, given this, the domestic component industry is far more advanced and developed and this behaviour of MNCs has translated into more technology transfers than South Africa's with a far-greater number of tier 2 and 3 companies supplying to the OEMs (see figure 2 above). This is also true to Thailand's production of plastic automotive components.

¹⁶ Automotive Supply Chain Competitiveness Initiative 2016 report.

4.1.2. Thai Plastic Policy

The Thai government recognised the importance of light industries and through its targeted policies have developed many of them into large, export-oriented industries (Kraipornsak, 2014). Plastic products now represent one of the fastest growing exports for Thailand. During the previous decade, plastic product exports grew at 26% year-on-year versus other manufactured exports, which only saw 19% growth. While one of the most competitive segments remains that of rubber components due to the local availability of the raw material, Thailand is increasingly specialising in high-tech, light composites, which will soon replace heavy metals in industrial machinery and auto components.¹⁷

In the Thai plastics sector, investment in 4.0 technologies are strongly being linked to sustainability objectives and to *eco-innovation*, i.e. to the production of more environment-friendly materials and to the use of technological upgrading for waste reduction. In this sense, UNIDO is closely partnering with the Plastics Institute of Thailand and with the Thai Government to develop joint programmes.¹⁸ In this regard, 4.0 innovation and environmental sustainability become integrated policy goals: for example, UNIDO has a specific project focused on the creation of a *circular economy* (production linked to recycling) within the Eastern Economic Corridor (EEC). Overall, the Plastics Institute of Thailand¹⁹ stresses how the Thai Government is providing important support (for example in logistics, or in the creation of new platforms dedicated to 4.0 technologies) and seeks to work closely with the private sector. To promote sustainable growth in the plastics industry together with protection of the environment, the Thai BOI classifies projects in the manufacture of eco-friendly plastics as priority activities of special importance to the country. Therefore, these are given maximum investment incentives.

4.1.3. South African Auto Masterplan 2035

South Africa's past policy frameworks aimed at developing a globally competitive auto industry took the form of the Motor Industry Development Programme (MIDP), which ran from 1995 to 2012, and the more recent Automotive Production Development Programme (APDP), which is set to end in 2020. Yet, the further development of South African auto industry is marred by numerous competitive challenges (Barnes & Black, 2017). The main problem facing the domestic industry is the fact that it is a fringe player in global production with its output only contributing to 0.65% to global vehicle output. Also, its level of output (600 000 units in 2016) has not changed much since 2008 (Barnes & Black, 2017). Yet, despite this, the auto industry has remained a key objective for the South African government's broader industrialisation agenda and is one of the few manufacturing sectors to have recorded real growth in the past 10 years.

However, neither of these policies have effectively grown the local auto industry to the levels envisioned. South Africa has remained a lower-tier producer and has not yet reached the heights of becoming a second-tier player in the global auto supply chain (Barnes & Black, 2017). The official reason for this malaise for the auto sector may come down to a deficient

¹⁷ From interview with AMPAS, BITECH, 17/10/2018/. In this regard, all Thai interviewees highlight how environmental standards may represent a challenge for the plastic industry, but also an opportunity, whereby the growing demand for fuel efficient vehicles will require lighter and lighter cars, i.e. light plastics to replace heavy metal components.

¹⁸ From an interview with Ms Sooksiri Chamsuk, UNIDO Thailand Sub Regional Office, Bangkok, 22/10/2018.

¹⁹ From an interview with the Plastics Institute of Thailand, Bangkok 18/10/2018.

demand domestically, as well as regionally, of assembled automobiles and the low levels of localisation, with as much as 60% of the components used in production in South African plants being imported. Whereas, in actual fact, the rebate mechanism allowed the OEMs to continue their importing behaviour, which completely offset any perceived benefits that the early protectionist stance had (Black, et al., 2018).

Thus, South Africa's Masterplan 2035 seeks to drastically alter the landscape of the local industry. Its formulation was derived mainly from that of Thailand's own Masterplan, with additional research conducted on other developing economies such as Turkey, Malaysia, Morocco (Barnes & Black, 2017). South Africa's Masterplan 2035 sets out 6 main targets that it seeks to achieve over the 15-year period. These are: firstly, to increase South African vehicle production to be 1% of global output. Secondly, to boost local content levels of domestically assembled vehicles to 60% (up from around 38% currently). Third, it seeks to double the current level of employment in the auto sector. Fourthly, it aims to improve the competitiveness of the auto industry to be more in line with international benchmarks. Fifthly, the Masterplan seeks transform the auto industry making it more inclusive. Lastly is the target of deepening value addition within local supply chains.

4.1.4. South African Plastics Policy

The latest iteration of South Africa's Industrial Policy Action Plan (IPAP 2018/19-2020/21) has identified the importance of the plastic sector to the manufacturing capacity of the economy as a whole. One of the interventions envisaged by the latest IPAP is to promote the integration of plastic components into the automotive sector. Overall, this emanates from the realisation that there is high growth potential for the plastics industry as the automotive industry shifts to lowering the weight of vehicles to maximise fuel efficiency.

Amongst the latest IPAP's desired outcomes is the increase in local manufacturing of plastic components for the automotive sector, which may aid in facilitating import replacement and further encourage exports. This is in line with the key priorities identified by the 2035 Auto Masterplan, which includes a special focus on the need for the SA auto industry to deepen the supply chain and to enhance local manufacturing capabilities (Black, Barnes, Monaco, 2018). In this regard, localisation opportunities offered by specific plastic auto components are under discussion and are being considered by different stakeholders operating in the industry. For example, the Auto Industry Development Centre (AIDC), the Auto Supply Chain Competitiveness Initiative (ASCCI) and the Durban Auto Cluster (DAC) are involved in this direction. The Durban Auto Cluster recently conducted an in-depth study on the possibility to localise polymers employed in the production of auto components.²⁰

4.2. Clustering

The formation of the Thai auto sector began in the 1960s, under strong trade barriers, which significantly helped the formation of enterprises. This along with the signing of the Plaza Accord of 1985 went a long way to helping Thailand become known as the "Detroit of the East" (Warr and Kohpaiboon, 2017). The Thai automotive industry has become structured in such a way that most of the large, foreign-owned vehicle assemblers are individually linked to a number of independent SMMEs, both foreign- and domestically-owned. Yet, the domestic Thai

²⁰ From an interview with Ms Julia Wedgwood, ASCCI, 12/10/2018.

component manufacturers tend to be more labour-intensive and smaller than their foreign counterparts (Warr and Kohpaiboon, 2017, p.16).

However, Kuroiwa (2017) argues that, in industries that exhibit significant agglomeration economies like the automotive industry, participation in GVCs is not sufficient to sustain economic growth and that industrial deepening is achieved through the formation of a robust supplier base. Rather, it is suggested that industrial deepening is a necessary precursor towards domestic suppliers participating in GVCs.

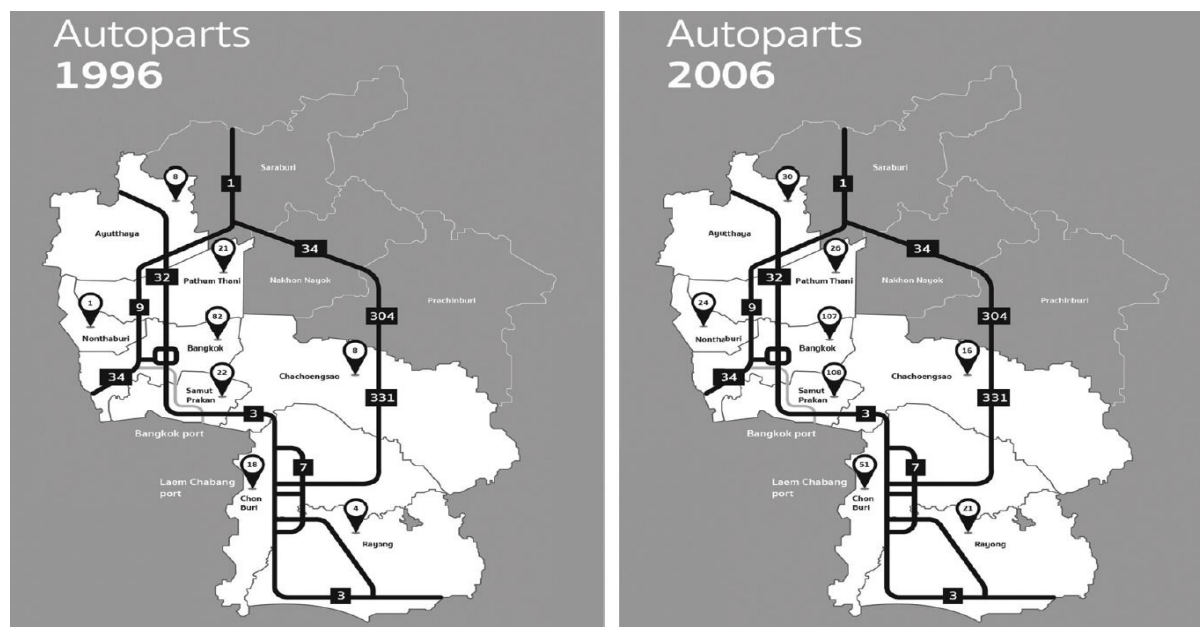
Thus, while GVCs have played a massive role in shaping the Thai automotive industry (and by extension its component manufacturing sectors), it does little in the way of explaining the rapid growth in the adoption of technologies and the changing and upgrading of existing capabilities that have been experienced in many small and medium enterprises in the manufacture of automotive components. Hence, the development of industrial clusters is considered crucial for the development of industries, such as the automotive industry, where the components are heavy and bulky, and just-in-time manufacturing is necessary to improve competitiveness (Kuroiwa, et al., 2017). It also becomes necessary to understand the role of clustering and special economic zones have played in the development and technological upgrading in the Thai automotive industry.

The locating of firms in clusters along with organisations which support innovation can promote the 'interactive learning' process, which in turn provides an opportunity for local firms to upgrade their capabilities (Asheim and Coenen, 2005; Malmberg and Maskell, 2006; Chaminade and Vang, 2008a). The Thai State's cluster programme was designed to attract increasingly larger amount of FDI and facilitate technological upgrading within the automotive industry by positioning large OEMs within a close geographical proximity to small- and medium-sized component manufacturers. Automobile and auto parts producers were encouraged to locate their operations in Bangkok and the surrounding central area (Techakanont & Charoenporn, 2011).

Furthermore, Techakanont and Charoenporn (2011) note that FDI was vital for capital formation in Thailand. FDI in industrialised countries tends to be horizontally integrated and aimed at serving the local market. Evidence suggests that inward investment is motivated mainly by the advantages of proximity to the host market in addition to policy barriers to trade or incentives provided by the host government. FDI in developing and industrialising countries is more likely to be vertically integrated and designed to take advantage of differences in factor endowments between countries (Milner, et al., 2004).

Japanese MNCs in Southeast Asia have long played an important role in the agglomeration or industrial clusters (Interakumnerd & Techakanot, 2015) where these MNCs view the 'division of labour' as a means to locate manufacturing activities according to comparative advantage. Figure 5 shows the number of auto parts manufacturers operating within Thailand in 1996 and 2006. In just ten years the Thai auto components sector grew as much as seven times in terms of the number of producers in a specific region. This shows the validity of the Thai government's cluster initiative as strong driver of growth within the auto industry of Thailand.

Figure 5: Location and number of automotive components manufacturers in Thailand, 1996 & 2006



Source: Warr & Kopaiboon (2017)

In order to increasingly attract FDI (and by extension, technological know-how), firms operating in the 10 prioritised sectors mentioned above are also given priority towards the settlement within the new “Eastern Economic Corridor” (EEC), a special economic zone (SEZ), which is being established in the Eastern part of Thailand.²¹ Thailand is well-placed to act as the hub for ASEAN exports where its industrial production has grown rapidly since 1987 when the Thai government committed to its “Thailand 3.0” policy agenda. Because of this, a strong emphasis was placed at developing heavy industries such as petrochemicals, autos, and electronics. The EEC is touted as the “strategic gateway to Asia” and covers over 13 000 km². The EEC further forms part of the Thai government’s commitment to its cluster-based approach to economic development and has even culminated in multiple SEZ being combined into what has been termed “cluster-based SEZs” or “Super-Clusters” (BOI, 2015). This project is to be rolled out over two phases and will incorporate the already established industrial base of the Thai economy.

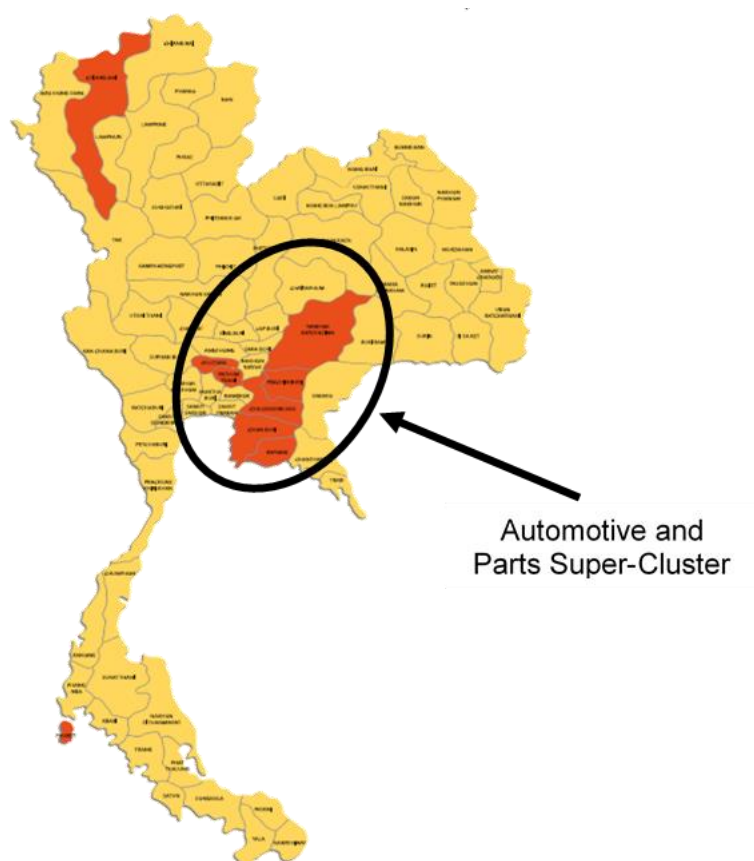
These Super-Clusters²² are designed with a focus on positioning Thailand as a major player in future industry through research and development, high technology industry, and low-labour

²¹ See PRWEB, 2017 “Government of Thailand Announces New 4.0 Investment Attraction Policies”, online at <https://www.prweb.com/releases/2017/02/prweb14092747.htm>.

²² The industries which form the backbone of the Thai Super-Cluster policy are the Automotive and Parts Cluster, Electrical Appliances, Electronics, and Telecommunication Equipment Cluster, Digital-based Cluster, Eco-Friendly Petrochemical and Chemicals Cluster, Food Innovation Cluster, Medical Tourism Cluster, and the Medical Devices and Manufacturing Cluster. There are also plans to further

intensive manufacturing. These will also link key downstream and upstream players across various provinces within the country. For example, the Automotive and Parts Cluster will extend across 7 provinces (see Figure ##). Production within this cluster will focus on the manufacture of motorcycles (with engine sizes greater than 248 CC), automotive engines, important component parts not locally produced or sufficiently produced, and automotive tyres.

Figure 6: Locations of Super-Clusters in Thailand



Source: BOI (2015)

In contrast with the Thai experience, South Africa's experience with clustering has not brought significant economic development since the policy's inception. Rather, there are disparate pockets of success stories but still issues relating to the levels of competitiveness of the firms within these clusters. The question that arises is then how South African firms can learn from the Thai example. The answer may not be that hard to come by. While the Thailand example provides a proof concept in the close clustering of firms can be successful as a means to facilitating technological upgrading, South Africa has a few examples of successful cluster initiatives from which the plastic automotive component sector can learn. One such example is the Durban Auto Cluster (DAC).²³

this initiative through the addition of new industries such as Robotics Automation and Aerospace (<http://thaiembdc.org/wp-content/uploads/2016/01/2016-01-Thai-Government-unveils-new-super-cluster-policy.pdf>).

²³ Other examples of clustering in South Africa with differing levels of success are the Durban Chemicals Cluster (DCC) and the Cape Clothing and Textile Cluster.

The DAC serves as a good starting point for clustering in South Africa and further shows the possibilities through partnerships between government and the private sector. First established in 2002, the DAC comprises 45 companies employing close to 17 000. The establishment of the DAC was seen as a necessary step in bringing together isolated companies in order to collectively expand the Kwa-Zulu Natal automotive industry's share of local and international markets.²⁴ The DAC boasts a figure of 20% of its component manufacturers are localised and, like in Thailand with the role Japanese firms played in growing the sector, Toyota has strong ties to the DAC. Along with other internationally recognised companies such as Bell Equipment, Hino and Man Truck & Bus, Toyota assembles medium and heavy vehicles in the province.²⁵

4.3. The Role of the State and Multinational Capital

The Thai auto industry's impressive growth was helped in part by a large influx of FDI from Japan during the 1980s, which accelerated immediately after the Asian financial crisis in 1998. Since the early 1970s, the presence of foreign MNC auto suppliers in Thailand has grown from around 30 companies between 1971-1985 by adding over 300 foreign suppliers over the following 18 years, until 2005 (Wad, 2009). Thailand was seen by many, including many Western automakers, as an important destination with which to establish an export hub that would export on a regional and global scale. This was given the explicit goals of the Thai government to promote its auto industry through the localisation of production by foreign automakers (Pollio, 2012).

The Thai government was able to achieve this success through a policy mix that included protectionism, regional trade access, concessional investment support, skills development, and, perhaps most importantly, the provision of relatively inexpensive labour and overhead costs (Barnes, et al., 2015). This is similar to the South African experience in many respects. For example, like Thailand, South Africa also made use of high tariffs and local content requirements in its auto industrial policy. Yet, in the Thai case no significant investments were undertaken by the state.

Thus, the Thai auto industry's growth was not simply a direct result of industrial policy on the part of the state. Rather, Japanese suppliers moved into Thailand before the Asian financial crisis changed the political outlook (Lauridsen, 2004). Wad (2009) follows this by arguing that in spite of increased support in a bid to develop more domestic auto component suppliers by the Thai state in the post-financial crisis era, the position of foreign OEMs, particularly Japanese, has strengthened. The OEMs were free to pursue their own agendas with Thai firms consequently paying the price of being relegated to lower tier status, while more foreign MNC suppliers were able to easily enter the Thai market and were granted tier one status (Wad, 2009).

The development of the South African auto industry firstly occurred under the auspices of a high-level protectionist stance (Black, 2001). This led to large OEMs, specifically those of Ford and General motors, to set up plants in the 1920s (Barnes & Kaplinsky, 2000). Post-apartheid, in order to catch up with the delay accumulated due to sanctions, the South African state sought to rapidly liberalise and to attract investments based on a developmental state framework similar to Japan, Taiwan, and South Korea (Masondo, 2018). Yet, since the end of

²⁴ <https://dbnautocluster.org.za/about-dac/>

²⁵ See footnote above.

apartheid, the South African state struggled to reconcile its developmental agenda against opposing forces. On the one hand, there was a pressing need to transform the socio-political-economic structure to address the failure of the apartheid state's neglect of the majority population, while there was a strong desire to catch up with the rest of the world through global integration (Black, et al., 2018). However, this project has been hampered by the post-apartheid's inability to attract and channel investment in private ownership (Masondo, 2018).

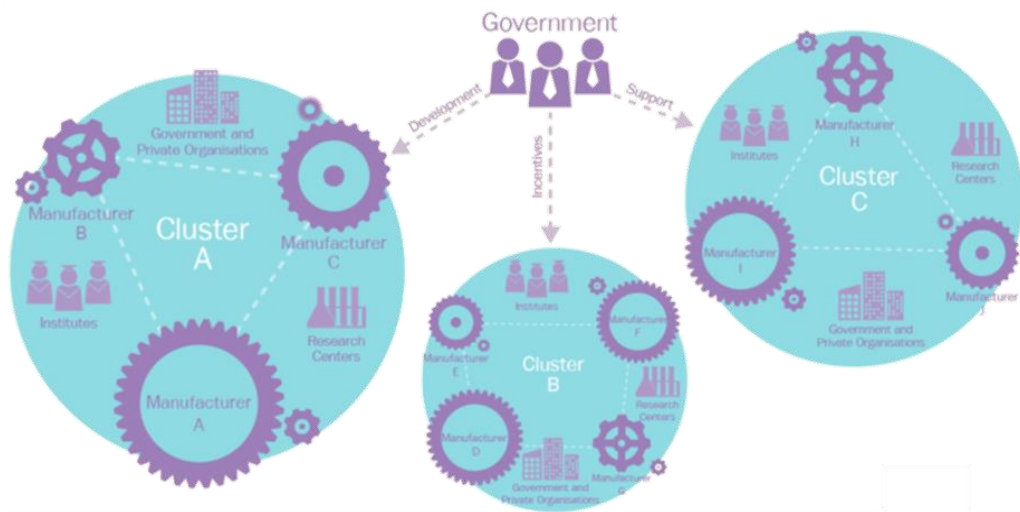
Furthermore, Hamann, et al. (2008) note how the "collaborative governance" that existed between the state and business led to a paradoxical interventionist role of the state in attempts to limit its own powers. Specifically, in the automotive industry, MNCs utilised their power, given the weak powers on the part of the South African state, to defend their investment and productive strategies as well as their hegemonic positions in the domestic supply chain (Black, et al., 2017). Rather, the state's role was crucial in accommodating the needs of the MNCs, to the point where the automotive industry was dependent on the directions taken by global investors (Hamann, et al., 2008).

4.4. Institutional Coordination

The Thai government's commitment to seeing their cluster initiative succeed has been a strong reason for their economic development and growth into an upper-middle income economy in little over 20 years. Importantly, the developmental model that the Thai government followed resulted in its state enterprises accounting for a high percentage of its infrastructure spending during 1996-2001 (Webster & Theeratham, 2004). The evidence of Thai industrial coordination is the successful economic transformation from an import substitution strategy to an export-oriented strategy. This is further seen in the Thai government's execution of its various developmental plans. The success of the Thai economy to executing its development plans started at the upper echelons of the state.

The coordination within the authoritarian Thai state featured a highly centralised mechanism that boasted a top-down dissemination on policy issues. This resulted in a pragmatic use of the FDI it managed to attract. For example, synergistic effects of the Prime Minister's vision, commitment and dedication to the growth of the Thai economy, which in turn, inspired the country's Technocrats, who themselves were motivated and competent, to effectively operate the country's Central Economic Agencies to implement the developmental plans and help realise a prosperous vision of the Thai economy. This strong institutional coordination has assisted with the successful development of its cluster programmes in multiple sectors, including automotive and components. The state focused its attention on development, incentivising, and supporting the companies through a variety of channels.

Figure 7: The Thai government's roles in fostering clusters and SEZs



Source: (BOI, 2015)

For example, the Thai government's Super-Cluster policy highlights its extraordinary level of cooperation and coordination on the part of its various agencies. The aim of the policy is to connect the key players with supporting industries, academic institutions, government agencies, private sector organisations, and local economies. This policy links well with the industrial ecosystems framework as in work of Andreoni (2018), yet the underlying driver is the clustering of firms within a close proximity. Furthermore, the Thai SEZs are designed with the intention of being complementary with SEZs in neighbouring economies. Also, there are plans to build additional infrastructure with the specific aim of supporting the development of clusters in Thailand. These include 3 ports, 5 deep seaports, 7 domestic airports, 6 international airports, 14 industrial estates, 129 higher education institutes, 215 vocational education institutes, along with additional electricity generation of close to 37 000 MW (BOI, 2015).

Whereas Thailand's experience has been one of coordinated effort on the part of its many different actors to achieve a unified vision for the economy, the South African story has been less so. Rather, in South Africa's case, its economic development has been marred by a fragmentation of the state and the agents within it since the demise of the apartheid regime and more recently, since 2008. The vertical fragmentation of the powers within the African National Congress, the ruling party in South Africa since 1994, as a result of competition for extractive rents from local to national levels of government and in state-owned corporations (Bell, et al., 2018, p. iii). As such, the fragmentation of the state and its various departments, gave rise to successful lobbying by large international businesses, which paved the way for excessive rent-seeking. Similarly, this fragmentation has culminated in inconsistencies in economic policy, which has had an adverse impact on the ability of the state to make effective interventions across departments, with the policy instruments of the past being ineffective (Bell, et al., 2018).

The fragmentation of the state has hindered and continues to hinder the successful development, growth, and integration of many of South Africa's hallmark industries, most notably its automotive sector. The nature of the automotive sector in South Africa requires that there be a strong directive from the state, and an ability of the state to effectively negotiate

with large MNCs, to successfully implement policies that are aimed at the development of the auto sector.

4.5. Regional Markets

Thailand's position in the regional economy of Asia was overwhelmingly influenced by the activities of Japanese OEMs and large suppliers (Natsuda & Thoburn, 2013). This strong position within the region was helped in part by a transition from the want to move from the national protectionist stance to one more characterised by a regional protectionism in the form of the ASEAN Free Trade Area (AFTA) (Wad, 2009). However, the smooth transition was halted by the resistance from Malaysia. In 2004, the automobile AFTA was achieved. This was as a result of foreign MNCs in Thailand utilising their power within the local supply chain to lobby for bilateral free trade agreements between Thailand and Japan (Wad, 2009).

The regional market's strength is a huge advantage for Thailand's auto suppliers. AFTA is increasingly defining intra-ASEAN trade with Thailand being able to consolidate its already strong position in the region (Nag, et al., 2007). This has led to boosts in export demand from the Philippines, Indonesia and Malaysia (Nag, et al., 2007). The figure below highlights that Australia is also a major export destination for Thai automobiles. In contrast, South Africa's regional market is significantly underdeveloped and therefore does not provide a similar level of demand for its assembled automobiles and components as in the case of Thailand. As such, South Africa is forced to export to more developed markets such as Europe, with Germany accounting for almost 29% of South African auto exports, and the United States with 19.6%.²⁶ As for African exports, the largest export destination for South Africa automobiles is Namibia, which accounts for just under 3%.²⁷

The weak demand for auto products from neighbouring and regional economies means that South African autos and components being exported are done so at a higher cost than can be sourced from more competitive producers. This lack of close export demand for auto products hampers the growth prospects for local suppliers (see section 5). A strong regional market is a necessary precursor in order for South Africa's auto sector to experience the sizable growth and development that the Thai sector experienced. Nag et al. (2007) state that regional integration can bring about efficiencies in firms' production systems as well as develop the market, which will bring homogeneity.

Thus, the planned African Continental Free Trade Area (AfCFTA) is a step in a positive direction towards boosting trade among African nations. Particularly, as many African economies develop and grow, South Africa should see this as a significant growth area and attempt to fulfil new demand from the growing middle classe across the Africa. South African positioning puts it in a unique position to become the automotive hub of Africa.

²⁶ Data collected from the Atlas of Economic Complexity.

²⁷ See footnote above.

5. Firm Perspectives on Technological and 4IR

In order to better understand the relative competitiveness of Thailand's plastic auto components sector three firm cases are reported for each country. Their selection was based primarily upon their availability and willingness to participate in the study. The Thai firms studied were large domestically-owned tier 1 firms, whereas the South African firms consisted of a multinational tier 1 supplier and two tier 2 suppliers. In addition, the study interviewed industry associations²⁸ in both countries to get their perspectives and perspectives on industry 4.0.

Overall, a comparison can be drawn along four main lines, which are technological competitiveness, awareness of debates surrounding 4IR, institutional capacity and future challenges.

5.1. Technological competitiveness

Technological change is at the soul of increasing competitiveness in any industry since it plays a vital role in changing the structure of the existing industries as well as the creation of new industries (Obradovic, et al., 2015). Technology is a key stimulus that initiates development and growth where it is seen as a means, not an end of changes. Technological change encompasses the development of a better way of doing a known job or the discovery of how to do a previously impossible one (Godin, 2015). At a firm level this entails adoption of the latest machinery and production processes in a bid to increase productivity and efficiency.

The study finds that Thailand firms have over the past two decades made significant strides in technological advancement in both their production and operation management techniques.²⁹ For instance, AMPAS³⁰, which runs seven plants in Thailand is renowned for its technological advancement and modern management techniques, as well as for its commitment to testing environment-friendly technologies. As mentioned above, the increased adoption of technology was channeled by the presence of Japanese OEMs in the country. Partnerships between the OEMs and local firms have improved management and production techniques through continuous human resource development, training and education of the employees in new technologies, connection with external markets, and the attention paid to efficiency in the manufacturing process. In the past decade, the gradual introduction of robotics into many Thai firms' factories has been driven by the dropping prices of robots (and encouraged by progressively higher labour costs).³¹ Similarly, the introduction of R&D, testing and prototyping facilities inside many plants has been crucial in improving and maintaining quality and standards, as well as allowing Thai firms to become leaders in innovation. As a result, Thai firms are significantly more competitive in the auto components export market.

Increased robotics, however, comes with its own associated costs, structural issues, and required skillset for employees. For example, robots need to be *trained* for each product specification and typically are only utilised for one operation.³² In Thailand, the acquisition of

²⁸ PlasticSA, ASCCI, AIDC in SA, PITH, UNIDO Thailand, TAPMA in Thailand. The paper also refers to previous interviews conducted with NAACAM and NAMSA in SA.

²⁹ Interview with Thai Firms and Associations October 2018.

³⁰ AMPAS Manufactures a wide range of plastic auto components (lamps, rear view mirrors, bumpers, and interior parts), employing large scale plastic moulding processes and vacuum metal icing.

³¹ Interview with AMPAS representative

³² For example, FPI reports that training 20 robots on a new product specification takes over 3 hours.

greater levels of technology, such as advanced robotics has had positive effect on company revenues, productivity and has boosted the demand for higher skilled workers.³³ Overall, while the skill-levels required to operate the implemented technologies have not drastically changed, the software that support the new machines requires a more sophisticated skill set that the previous workforce did not possess. In sum, this implies a recomposition of roles required within the factory, with more software developer, IT maintenance technicians, system integrators and engineers needed, compared to low-skilled assembly line operators.³⁴

Yet, the costs of implementing robotics and other advanced manufacturing systems has declined over the last two decades it has brought about an expansion the scale of manufacturing operations in Thai firms, together with higher efficiency and safety.³⁵ The use of robotics in markets where volumes are required as is the case with in Thai plastic auto enhance competitiveness of the firms. However, in lower volume markets like South African firm the cost of acquiring and implementing robotics into production processes are high making it unfeasible. Therefore, many smaller companies have no choice but to continue operating their plastic moulding machinery with labourers rather than shift to fully automated processes because of the excessive costs of such technologies.

The 4IR entails the combination of multiple systems into one. It emphasizes factories that are fully automated and highly digitalized, what are often referred to as *smart factories*. The Plastic Institute of Thailand cites BKF as one of the most effective attempts to move towards a smart factory and enhance its competitiveness.³⁶ The company is at a relatively advanced stage in the implementation of IoT technologies, in their levels of computerisation and manufacturing control. It is already 10 years since the implementation of their first software aimed at achieving a computer-controlled production process.³⁷ In the past two years BKF has been working on a more sophisticated software, which properly allows for an end-to-end connectivity within their plant. The current software is intended to manage the whole production line, from raw materials control to the output delivery schedule. BKF's technological advancement is reported to have allowed for significant improvements in terms of accuracy, monitoring & flaws detection, problem solving. Waste and production times have accordingly been reduced, and productivity has increased of at least 5-10% since the introduction of the first software. In addition, the employment structure has also undergone critical changes: while tasks executed by operators do not require substantially different skills,³⁸ IT skills have become more and more essentials in the factory, and the number of engineers on the total has notably increased. Currently, engineers represent 20-30% of the employed workforce, and their number could still grow, especially as far as system integrators and software engineers are concerned.

To supervise the process, there are different teams: production planning, production control, logistics engineers etc. Production planning, for example, is in charge of controlling not only that there is no excess/shortage of raw materials in the depository, but also that stock levels are always in line with the targets fixed by Toyota, their main customer. Toyota has promoted

³³ At AMPAS engineers represent 35% of the workforce of 3000.

³⁴ Interview with BFK, 19/10/2018.

³⁵ Since 2013, FPI has introduced 19 robots on to its injection line in order to boost its production volume.

³⁶ Interview with Plastic Institute of Thailand

³⁷ This was initially applied to back-office operations, like purchasing, accounting, inventory control, not apt for shop floor control yet.

³⁸ They mainly press buttons and use barcode scanners.

more stable integration between suppliers and automakers through building strong collaborative ties and engaging supplier networks (Dal Ponte, Charterina, & Basterretxea, 2017).

In contrast, South African manufacturers Diemaster Industries³⁹ and PlastiProfile's⁴⁰ operations still utilise machinery that are relatively older compared to more advanced plastics producing economies. For example, Diemaster's machinery is approximately 18 years old on average, whereas more advanced firms generally replace their machines after 7-10 years.⁴¹ This severely negatively impacts their ability to compete internationally with a lower quality output compared to firms with newer machinery. On the other hand, Plastic Omnium represents an interesting case, in that due to its status as a subsidiary of a TNC, it has access to financial resources that allow it to employ newer and more efficient machinery that rival that of many European and Thai firms.

Another issue that hampers the competitiveness of South African plastic auto component firms is the lack of trade protection in the way of import tariffs on international plastic auto components. This means that they will inevitably lose out to international firms because of their relative lack of technological competitiveness.⁴² Other barriers identified as reasons for the lack of technological competitiveness on the part of South Africa plastic auto component firms is, first and foremost, the high costs involved in procuring these new technologies.⁴³ The quality and price of these machines strongly correlate with the levels of technological skills and capacity of the different international manufacturers. Machines that cost more have broader ranges of options produce better quality outputs and are more accurate which can assist in meeting the strict standards of the OEMs.

5.2. 5.2 Awareness of debates surrounding 4IR

As mentioned earlier on, 4IR entails a convergence of a range of developments in previously disjointed fields, such as artificial intelligence and machine-learning, robotics, nanotechnology, 3-D printing, virtual and augmented reality, and genetics and biotechnology. The 4IR has the potential to enable the deepening of supply chains, which can allow for greater levels of integration into international markets.

In terms of individual firm's experiences, empirical research shows that Thai firms have begun implementing the internet of things (IoT) into their existing production systems. For example, FPI is currently testing the application of new software to individual machines, aiming to eventually integrate them into one system. Through this the firm seeks to extend connectivity to both control and problem-solving operations and gathering data of all machines existing in the plant to one dashboard. However, the application of the IoT to machines that are not fully

³⁹ Diemaster Industries is a tier 2 supplier of plastic automotive components.

⁴⁰ PlastiProfile is a plastic profile extrusion company specialising in the manufacturing of quality plastic products in South Africa.

⁴¹ Interview with GreenTech Plastics Manufacturing.

⁴² In the case of Plastic Omnium, its South African subsidiary was not as competitive as other subsidiaries in Thailand and India. This has resulted in it losing the exclusive right to manufacture and export certain plastic auto components. These subsidiaries, given the relatively more developed auto industry in the respective economies, are able to meet the large production volumes required of the TNC than what the local SA subsidiary is able to produce.

⁴³ The cost of machinery can range between \$180 000 and \$500 000.

integrated can bring with it challenges and inefficiencies. This means that while flaws and malfunctions are able to be easily detected, the production line may not stop all together leading to poor quality output. Yet, this process is not easily achievable. Thus, in order to achieve this linkage, there needs to exist a central dashboard that collects and connects the data from the machines on the integrated production line. From the aforementioned observations, it is evident that the Thai firms interviewed are aware of the technologies of 4IR and they appear to be taking the necessary steps to prepare for the possibly disruptive changes.

In contrast to the Thai case, South Africa firms' perspectives and understanding of 4IR is a lot less developed.⁴⁴ Rather, there is significant attention placed on the possible implications that it has for employment. Unemployment is a key issue and concern in South Africa, hence the firms appear to be adopting a cautious approach in order to find a balance between new technologies and any employment losses. Plastic Omnium's strategic focus includes an introduction of Industry 4.0 in its plant, in order to be more adaptable and flexible to changing market conditions and demands from OEMs. The company regards this will allow for connectivity with OEMs can allow for quick and seamless communication between the suppliers and OEMs. Furthermore, the firms acknowledge that the use of big data can further assist firms to efficiently managing its machinery, which reduces downtime and wastage.

Another important driver of the awareness on 4IR relates has to do with to the role of the respective associations. In Thailand the Plastics Institute has already adopted a focus on 4IR by raising firms' awareness to the benefits these new technologies. Whereas in South Africa PlasticsSA regards 4IR in the industry as not being key priority due to a general concern about unemployment. Instead firms in their individual capacity are choosing to embrace the new technologies to become more competitive, globally. For instance, Diemaster is in the processes of preparing and making their own individual preparations and changes to their production methods to adopting the smart factory. Plastic Omnium indicated already that the MNCs has a 4IR strategy but they foresee for South African firms to reach full automation has a 50-year horizon.

South African plastic automotive firms continue to fall further behind the rest of the world in this sense. The main reason for this slow/lack of technological upgrading on the part of South Africa plastic firms is the high costs involved in procuring new technologies.

5.3. Institutional Support

At a macroeconomic level, institutions are thought of as an essential cause of explaining the differences between the economic growth and development differences across countries (Acemoglu & Robinson, 2008). At the microeconomic level, institutions also play a vital role in nurturing and development firms through the provision of support, and training, both technical and managerial. Institutional support is very often a combination of government, industry associations and other stakeholders, who together form a network, which enables the environment under which this firm growth and development occurs.

An example of strong institutional support in Thailand's case is through its cluster policies mentioned above. Thailand's government has invested in multiple cluster initiatives over the past 20 years. This support included infrastructure development, incentivising, and supporting

⁴⁴ Diemaster and PlastiProfile

firms in their processes of development, upgrading, and integrating into the local supply chain. Thailand's auto masterplan was also hailed for enabling the auto industry to become a leading production centre for automobiles through its strong support. Particularly important in the masterplan's success is the role of the BOI, which offered both fiscal and non-fiscal incentives to investors as well as an exemption of duties on machinery and raw materials.

The industry associations in Thailand namely Thailand Auto Parts Manufacturers Association (TAPMA) and Plastic Institute of Thailand have played, and continue to play, a vital role in the growth of the plastic auto components sector. TAPMA promotes the production of enterprises and supports and assist members in resolving various barriers and negotiating with third parties. These institutions have played a big role in fostering firms move towards a smart factory through investment in information technology.⁴⁵

The Plastic Institute of Thailand is responsible for supporting the long-term development of Thailand's plastics industry. The institute has also recently started engaging firms on the sharing of information on their experiences with their applications of 4IR technologies as well as their adoption of the smart factory model into their enterprises. In addition, the institute provides demonstrations of how an ideal smart factory should look. The institute also brings consultants to promote the competitive benefits of smart factory model. Furthermore, the institute, through training programmes and seminars, has begun to facilitate the new shift to new technologies and production methods by alerting firms to the use of systems integration. The institute recognises that system integration education is essential for the successful transition to industry 4.0 and, therefore, highlights the need to have more people trained as system integration engineers.

In South Africa, PlasticsSA⁴⁶ offers a wide range of services which include: leadership skills, business skills, sales and marketing, industrial relations, health and safety for firms in the plastic sector. In terms of the auto sector, the South African government is currently in the final stages of implementing its own Auto Masterplan, which largely draws from the Thai experience. In contrast to the strong presence of institutional assistance and support Thailand, which assisted the growth of the plastics and automotive sectors, the institutional support in South Africa has in the past been lacking. From the interviews, it appears as if there is still little to no direct support on the part of institutions in pushing the ideas of 4IR to domestic firms.

However, NAACAM, one of the main the associations for automotive component manufacturing in South African, does conduct trade shows hosted by the Durban Auto Cluster that aim to bring together various stakeholders in the auto components sector. This is necessary and important step towards the development of new firms and the uptake of technological capacity that will aid South Africa's auto sector in its quest to become competitive, globally. Another point is that it is important to recognize that this process is not solely the role of government or associations. Rather it is the task of all stakeholders along the supply chain to work together in making the adoption and transition to advanced technologies a reality thereby deepening their overall technological capabilities.

⁴⁵ Interview with BKF.

⁴⁶ PlasticsSA is a non-profit umbrella body for all plastics associations in the industry at various stages in the South African plastics value chain.

5.4. Future challenges

Throughout the process of interviewing the firms in Thailand and South Africa the following challenges became apparent as possible constraints on the future growth of the respective industries.

5.4.1. Skills

Although Thailand appears to be better placed in terms of skills than South African firms, the lack of skilled labour, specifically in engineering and technical disciplines, appears as frequent constraint to firm development. Since the demands that the use of more advanced technologies and a dynamic workplace are constantly changing the availability of trained and experienced artisans remains of critical importance to these industries' growth. Specifically, in South Africa, firm competitiveness has been affected by severe shortage of engineers thus impeding the ability of firms to increase their technical capacity. Firms like Plastic Omnium require a significantly higher number and quality of process and mechatronic engineers than what is currently being produced by tertiary education institutions. This has implications for the local supply chain as there are problems with information transfers between component manufacturers and the OEMs.⁴⁷ The skills deficit of labourers in South Africa means that the firms will inevitably struggle to combine advanced technologies with sufficiently trained operators and staff to confront any challenges in the era of industry 4.0.

5.4.2. Competitiveness of Labour

In 2013 Thailand introduced a higher, national minimum wage which has led to increasing labour costs for the Thai industry. To compensate for this firms moved to adopt highly automated technologies. In addition, a threat for the industry lies in the cheap labour in neighbouring countries like Cambodia and Vietnam, which represent an attractive pulling factor for many large companies. However, comparing the labour situations in Thailand and South Africa, it is obvious that in the Thai case, the growth of its auto components sector was helped by its labour wage competitiveness. This made it, and continues to make it, an attractive destination for FDI. On the other hand, South Africa's history of labour unrest and current cost of labour are what appear to be a major stumbling block for domestic firms attempts to fully integrate into the auto GVC. Without a competitive wage offering to foreign-owned OEMs, South Africa's local auto component sector's development will continue to stall.

5.4.3. Fragmented institutional coordination and support

Firms in South Africa pointed to the lack of coherent government policy focused on targeting specific industries as well as a fragmentation of different government departments and institutions. This hinders the ability for firms to make investments under certainty. Furthermore, the constant competition from other developing economies like Thailand, whose state has committed to the pursuing and integrating 4IR technologies and methods in multiple key sectors. This, along with a vision for their auto components sector, has garnered the SMMEs in these countries the environment conducive to growth and technological upgrading. In contrast, only in the past year has South Africa's policy begun to try understand how to tackle

⁴⁷ Plastic Omnium reported a lack of necessary engineering skills in the OEMs which make corrections and changes to products during a production cycle slow as the two sides are not able to easily communicate with each other given the jargon that exists in the industry.

the challenges of industry 4.0.⁴⁸ Most governmental departments are seemingly in competition with each trying to implement their own visions of 4IR and with very little communication between them and major industry players and associations.

5.4.4. Location and regional markets

Geographically, South Africa is currently at a disadvantage due to the high transportation costs involved with shipping finished products to their end destinations in Europe and the USA as two examples. In Plastic Omnium's case, the low output potential of its South African factory (compared to its Indian and Thai factories) makes it difficult to compete on price and therefore hold onto the rights to produce products for major car brands. Thus, it has already lost the manufacturing rights of a major plastic auto component for a popular vehicle model. As mentioned above, the lack of a developed regional market means that South African plastic auto component firms are losing out on a potentially huge market which would dramatically boost the demand for their products and other agglomeration effects. The Thai case is much different with a strong demand from its regional neighbours that helps the incentivisation of foreign OEMs to set up their operations in Thailand given that there is an obvious demand for their products.

5.4.5. Financial constraints

The cost of machines is a major barrier and constraint for firms in the South African plastic automotive component sector. For firms that are not a subsidiary of a large MNC, there is an obvious lack of sufficient financial resources on the part of SMMEs in South Africa to grow. The machinery utilised in the manufacture of plastic auto components can range anywhere from \$180 000 for a base model to upwards of \$500 000.⁴⁹ The price and quality of the various machinery is down to their source location. Chinese machinery, while significantly cheaper than their European counterparts, are not as accurate nor do they offer firms as many options. In an industry with strict quality standards given ever-stricter emission laws, South African firms will not be able to service the international demand if they choose to purchase the lesser machinery. This, therefore, relegates South African component producers to forgoing upgrading of their existing capabilities which further affects the lack of technological competitiveness. This is in comparison to Thai firms who receive significant financial backing from the Thai government which allows them to purchase these top-of-the-line machinery.

⁴⁸ A notable example of this was the Colloquium on the Digital Industrial Policy Framework sponsored by the DTI.

⁴⁹ Interview with GreenTech Plastics Manufacturing.

6. Conclusions: Moving towards 4IR

The debate on how to successfully transition towards a fourth industrial revolution, and on how to build competitive niches that will allow for a full participation into global processes of technological change, is not simple, and still presents significant scope for speculation. However, launching a critical consideration of potential challenges and opportunities brought about by the acquisition of smart technologies is of crucial importance, especially for countries like South Africa that aim at improving technological competitiveness in order not to continue to lag behind.

The present study aims to contribute to such a debate. It focuses on a technologically advanced comparator, Thailand, and on a productive segment where South Africa has indicated potential for technological change and supply chain development – that of plastic auto components. The study is framed as pilot comparative study, and undoubtedly has the potential to be developed further, possibly through a follow-up field research in Thailand. However, it already attempts to identify key lessons for South Africa, and areas for possible intervention. Some of these were already highlighted in the IDTT year 1 study on the automotive supply chain, other emerge more clearly in relation to high-tech productive niches and in comparison with the Thai case.

Overall, the present work intends to provide three main contributions.

Firstly, it seeks to analyse the key factors enabling Thailand's auto supply chain development and technological competitiveness in plastic auto components.⁵⁰ What the study tries to highlight is that, despite South Africa modelling its Auto Masterplan following the example of Thailand's policy frameworks, state policies alone cannot explain Thailand's relative success neither South Africa's relative failure. In this regard, the main factors seeming to explain different trajectories are the combination of vertical plus horizontal integration (participation in GVCs plus clustering effect), the presence of a larger regional market, and a different role played by MNC (especially Japanese) firms in Thailand. From a policy perspective, better coordination and more focused policy objectives (see superclusters and EEC) also appear to have played a substantial role towards Thailand's technological advancement.

Secondly, the paper attempts to highlight, by reporting firms' experiences in this regard, potential benefits and risks associated with the transition (or lack thereof) towards smart technologies. Here, Thai firms, relatively better positioned in terms of technological advancement and overall awareness within the debate on 4IR, explain the benefits of increasing automation and of the adoption of the IoT (connectivity, better management and production control, improved safety etc.) but also costs and related risks (employment re-composition, costs of machine-learning, more difficult access to technology for SMMEs etc.). Overall, while potential benefits are undeniable, it is also clear that they might be unevenly distributed along the chain and requires changing employment assets. For an economy like South Africa, this might mean having to provide particular support to SMMEs and small component suppliers, and to carefully assist employment re-composition with adequate labour re-skilling, in order to avoid employment losses.

⁵⁰ Importantly – plastic auto components represent a segment where auto and plastic sector partly overlap, partly disjoint: policy interventions and supply chain development processes are here treated together even though connections are not always straightforward.

Finally, the paper seeks to use firms' direct accounts to interpret future challenges and accordingly indicate areas where policy intervention might be needed. In this regard, changing needs in terms of labour skills, the cost of accessing technology, and the need to establish either local clusters or regional markets emerge as particularly important. While the clustering effect explains Thailand's successful counter-balance to vertical integration and remains a model that SA may want to expand (in the wake of Durban clusters successful examples), building a regional market appears as a rather fundamental competitive advantage to build in the future.

For the moment, when we come to the role that technological upgrading may play in developing new manufacturing niches, improving the current competitiveness of South African plastic auto components and in facilitating South Africa's integration on global markets, the current policy discussions surrounding Industry 4.0 in SA are still limited, especially compared to the strategies that have been put in place in Thailand. While growing interest is emerging from both policy-making and academic institutions, the South African debate is still in its infancy. In addition, there still seems to be significant detachment between private initiatives and corporate investment on the one hand, and public discussions on the other. The issue of fragmentation between different institutions in charge of formulating policy interventions for the transition to the industry 4.0 also comes up repeatedly. Recently, the IDTT Colloquium on Digital Industrial Policy, supported by the Department of Trade and Industry (DTI) represented a noteworthy attempt to bring together top academics, policy makers, industrialists and external advisors from different countries to debate issues surrounding the 4IR and develop a plan for the SA industry. However, more attempts to get engagement from both private and public sectors will be needed.

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