1. The role of manufacturing versus services in economic development

Jostein Hauge and Ha-Joon Chang

INTRODUCTION

Throughout the history of capitalism, practically all countries that have transformed their economies from low to high income have done so through a process of industrialisation. In the field of development economics, the theories recognising the strong relationship between industrialisation and economic development (or the lack of industrialisation and no economic development) that we consider most seminal today started emerging in the 1950s and 1960s, and most importantly include contributions by Hollis Chenery, Alexander Gerschenkron, Albert Hirschman, Nicholas Kaldor, Simon Kuznets, Arthur Lewis, Gunnar Myrdal, Ragnar Nurkse and Raul Prebisch.¹

However, not long after the publication of ‘pro-industrialisation’ theories by these scholars, the traditional view of the manufacturing sector as the engine of economic growth and development came to be challenged. It arguably started with Daniel Bell’s 1976 book, *The Coming of Post-Industrial Society*. In the book, Bell argued that the wealth of future societies would rely less on the production of goods and more on the provision of services and the spread of a ‘knowledge class’ (Bell, 1976).² It seems as though Bell’s prediction turned out to be correct. The services sector has come to dominate the economic structure of many economies in the latter half of the twentieth century and even more so in the twenty-first century,

¹ See Chenery (1960), Gerschenkron (1962), Hirschman (1958), Kaldor (1966), Kuznets (1966), Lewis (1954), Myrdal (1957), Nurkse (1961) and Prebisch (1950).

² However, Bell was not the first to argue that the services sector would come to play a more prominent role in the economy. Chenery (1960), Clark (1940), Fisher (1935) and Kuznets (1966) all theorised that the services sector as a share of total economic output would rise at the expense of the industrial sector, following a period of industrialisation. But they were not proponents of the post-industrial society discourse, as Bell was.

in terms of both output and employment. This trend is especially apparent in high-income countries, where the manufacturing sector is shrinking as share of gross domestic product (GDP) at the expense of a growing services sector.

A number of arguments have since emerged, claiming that in this ‘post-industrial age’, economies that want to grow and raise their productivity need to put more effort into developing their services sector (e.g., Baer and Samuelson, 1981; Bhagwati, 1984, 2010; Ghani, 2010; Ghani and O’Connel, 2014; Haskel and Westlake, 2017; Romer, 2012). In an interview with *Manufacturing and Technology News*, Michael Porter, one of the most well-known advocates of this post-industrial society discourse, has argued that services are where the high value is today:

We used to think of services as flipping hamburgers, now we have to think of services as rocket science. Services are where the high value is today, not in manufacturing. Manufacturing stuff per se is relatively low value. That is why it is being done in China or Thailand. (McCormack, 2006, p. 1)

While the post-industrial society discourse is debated most fiercely in the context of high-income countries, it is also discussed in the context of developing countries. Like high-income countries, many developing countries are seeing the share of the manufacturing sector in their economies declining (see Figure 1.1³) – a development Palma (2005) has called ‘premature de-industrialisation’.

Understanding the driving forces behind premature de-industrialisation, and more generally the industrialisation struggle that today’s developing countries are facing, is beyond the scope of this chapter to tackle in detail.⁴

³ China is excluded from East and Southeast Asia because its inclusion would significantly affect the aggregate figures for that region. Like other world regions, manufacturing value-added as a share of GDP in China has decreased, from 39.9% in 1980 to 29.4% in 2016 (WDI, 2018). However, in China’s case, we should be careful in interpreting this as de-industrialisation. First, the country’s GDP has grown more than 30-fold since 1980 (at constant prices), meaning that manufacturing value-added would have to grow at an unimaginably high rate in order not to decrease its share of GDP. Second, China’s current figure for manufacturing value-added as share of GDP (29.4%) is a high figure by any standard.

⁴ Premature de-industrialisation is partly caused by decreasing relative prices of manufactured goods, especially those exported by developing countries. We will discuss this trend in greater detail in the section ‘Argument 3: the smile on the smile curve has grown’. Additionally, the development literature highlights the 1980s policy shift towards neoliberalism – and thus the rejection of industrial policy – as a major cause of premature de-industrialisation. For example, UNCTAD (2016a) states, ‘Unilateral trade opening, financial deregulation, regressive income redistribution and the retreat of the developmental state led to premature deindustrialisation in several countries, notably in Latin America’.

Sources: Calculations based on WDI database and UNCTAD statistics database.

Figure 1.1 Manufacturing value-added as percentage of GDP in world regions, 1980–2016

However, it is important to note that this phenomenon is partly driving the belief of the post-industrial society in developing countries. For example, in its recent *World Economic Outlook*, the International Monetary Fund states that ‘a shift in employment from manufacturing to services need not hinder economy-wide productivity growth and the prospects for developing economies to gain ground toward advanced-economy income levels’ (IMF, 2018, p. 129).

In this chapter, we will summarise and analyse the arguments on both sides of the debate on development strategies of developing countries: those that are pro-services and those that are pro-manufacturing. The chapter first presents the pro-services arguments. It then presents the pro-manufacturing arguments in a way that critically engages with the narrative and the evidence of the pro-services arguments.

We acknowledge that there are reasons for developing countries to take the post-industrial society discourse seriously. Some services are characterised by higher tradability and more productivity growth potential than before, and it seems that developing countries will have a hard time breaking the ‘middle-income trap’ without specialising in at least some high-value services. But we conclude that, unless you are a small and unusual economy that can specialise in one or two

activities,⁵ you will not achieve sustained economic development without developing an internationally competitive manufacturing sector.

THE POST-INDUSTRIAL SOCIETY DISCOURSE: PRO-SERVICES ARGUMENTS

Argument 1: Services Contribute More to Productivity Growth and Technological Development than They Used To

Developments in information and communication technology (ICT) and massive increases in the size of firms mean that scale economies are more easily achieved in a range of services (Hallward-Driemeier and Nayyar, 2018), and that it is more profitable to procure some services from specialist providers rather than produce them within a manufacturing firm (the latter largely having been the case in the past) (Nayyar, 2013).

Most importantly, we are seeing increasing incidences of scale economies in services that use digital technology and/or are highly digitalised. In some digitalised services, the marginal cost of providing an additional unit of service has actually come close to zero. Think about data centres and search engines, whose characteristics are not too different from how economists are taught to think about manufacturing operations: fixed assets are costly (for example, server farms, cooling systems, secure sites, and so on) but costs rapidly decrease with scale. These features are also true for media streaming services. For example, Netflix and Spotify can deliver their services around the globe in a flash. By the end of 2017, Netflix had 118 million paying subscribers, while Spotify had 65 million. Only seven years before that, both services had barely any subscribers (Statista, 2018).

Services have also become more closely linked to innovation. A common way to measure an economy's rate of innovation and technological development has been to look at how much research and development (R&D) is being carried out; and there is clear evidence that R&D is focusing more on services. On a global scale, R&D expenditure in services increased from an annual average of 6.7% of total business R&D during 1990–1995 to 17% during 2005–2010⁶ (WTO, 2013).

⁵ For example, a small economy that is rich in natural resources (for example, Brunei, Kuwait, Oman, Qatar), or that specialises in being a financial haven (for example, Monaco, Lichtenstein), or specialises in tourism (for example, Malta).

⁶ However, some of this increase in services' share of R&D is most likely attributable to outsourcing of R&D to specialised laboratories that are now being reclassified from

Companies providing the high-tech digitalised services mentioned above, like Netflix and Spotify, are mostly based in high-income countries. But there is also evidence that services in developing countries are showing productivity-enhancing characteristics. A study conducted by Cruz and Nayyar (2017) on six low- and middle-income countries – Brazil, China, Egypt, India, Nigeria and Russia – found that ICT service activities in these countries are as technology-intensive (as measured by a range of learning-by-doing and innovation metrics) as the manufacture of electronics. ICT services have had a particularly positive impact in India, where the growth of such services is closely associated with the increase in economic growth since the late 1990s (McMillan et al., 2017).

Also in Africa, the increase in economic growth since the late 1990s has been associated with an expansion of services. While Africa has experienced almost no structural change in the traditional sense, from agriculture to manufacturing, it has experienced some structural change from agriculture to services (McMillan et al., 2017). According to UNECA's *Economic Report on Africa* in 2015, Africa's services sector grew at an annual rate of 5.8% in 2000–2012, higher than the world average growth rate of services. The report stresses that growth of services and the growth of the continent's GDP are highly correlated, although it is more careful about claiming a causal link in any direction. The growth has been strongest in ICT services, transport services (mostly airlines) and tourism (UNECA, 2015). Many of these services earn foreign exchange, contributing to easing severe balance of payments constraints in many African countries.

Argument 2: Services Have Become More Tradable

Traditionally, manufacturing has been viewed as a stronger driver of economic development than services because all manufacturing products can in theory be exported. Exports not only ease a country's balance of payments constraints, but they also make economies of scale more easily achieved through specialisation. Most services, on the other hand, cannot be traded. This is because they require proximity between the consumer and producer. Think about eating in a restaurant, getting a haircut, having a medical check-up or getting your house cleaned.

However, technological developments – particularly the decline in the cost of phone calls and use of the Internet – and the reduction of regulatory trade barriers have made more services tradable (Bhagwati, 1984;

manufacturing to services, and better measurement of R&D in services (Hallward-Driemeier and Nayyar, 2018). We will discuss this further in the next section.

Ghani and Kharas, 2010). These, most importantly, include information, communication, banking, insurance and business-related services. The poster child of services-based trade success is the United Kingdom (UK), where trade in services now accounts for 19.4% of GDP – roughly 50% higher than the world average (WDI, 2018) – thanks to growth in trade of mainly financial and business services.

India is another country that has achieved success through exporting services. In fact, it has become the world's largest exporter of 'Telecommunications, computer, and information services', with an export value in this category of \$74 billion in 2014 (Loungani et al., 2017, p. 30). According to Bosworth and Collins (2008), this increase in exports is due not only to more services being 'produced', but also to increasing productivity of India's services. The country's total factor productivity in services grew by 2.4% between 1980 and 2006, twice the level of total factor productivity growth in both industry and agriculture. Hyderabad, the capital of Telangana, is hailed as the prime example of services-led growth in India. Experiencing a 45-fold increase in services exports between 1998 and 2008 (Ghani and Kharas, 2010), it has become India's hub for ICT-related services, thus earning the nickname 'Cyberabad'.

A third example is Rwanda, a country that in the last few years has increased its foreign exchange earnings considerably through the expansion of tourism services, such as gorilla viewing. In fact Rwanda, and many other African countries such as Uganda, Tanzania and Tunisia, report that tourism is the top single earner of foreign exchange for their respective countries (Chang et al., 2016).

Argument 3: The Smile on the Smile Curve has Grown

The smile curve – coined by Stan Shih, Acer's⁷ chief executive officer in the early 1990s – is an illustration of the value-adding potentials at different stages of a value chain. It suggests that services such as R&D, product design (the left side of the smile), branding, advertising and retail (the right side of the smile) constitute a larger share of value-added than the manufacturing and assembly process (the bottom part of the smile). For example, Ali-Yrkko et al. (2011) found that only one-third of the value of a Nokia N95 phone comes from manufacturing: making the parts (33%) – processors, memory chips, integrated circuits, displays and cameras – and assembling the phone (2%). Two-thirds of the value comes from services, such as support services (30%), licences (4%), distribution (4%), retailing

⁷ The Taiwanese electronics company.

Figure 1.2 The growing smile of value chains

(11%) and operating profit (16%). Since the 1970s, the smile on the smile curve has grown (WIPO, 2017), suggesting that manufacturing is becoming less profitable and services are becoming more profitable; at least, those services that are part of a ‘production’ value chain (Figure 1.2).⁸

Kaplinsky (2005) confirms this trend: after sustained growth in the prices of globally traded manufactures until the early 1980s, we have witnessed an aggregate relative decline in these prices, most significantly for those exported by developing countries. Using more recent data, Milberg and Winkler (2013) find a similar result by looking at the price manufactured imports from developing countries into the United States (US). They find that clothing, footwear, textiles, furniture and toys have all experienced a 40% import price decline relative to US consumer prices from 1986 to 2006.

The growth of the smile curve is a result of many factors. First, as value chains have become global, several transnational corporations based in the West that derive profits from ‘intangible’ parts of the value chains have expanded their global reach and power. Since the early 2000s, a

⁸ The smile curve as an illustration of value capture in a value chain has shortcomings, though. First, some manufacturing activities are high value and do therefore not fit into this typology (examples being the manufacture of machine tools, lasers, medical imaging systems and aircraft propulsion systems). Thus, the smile curve is more fitting to describe manufacturing value capture in developing countries rather than advanced economies. Second, it is debatable whether services that depend on engineering know-how, such as R&D and industrial design, should be counted as separate from manufacturing. This point will be discussed further in the ‘Pro-Manufacturing’ section.

handful of firms have accounted for 50% or more of the market share in practically every global industry (Chang et al., 2016). In essence, a small number of actors are appropriating increasing shares of profits over a larger market, accruing these from technological dominance (fortified by strong protection of intellectual property rights), brand name recognition, and privileged access to low-cost capital.

In particular, branding is becoming a key strategy by which these corporations make profits. We are seeing this most prominently in industries where production technology is now standardised, such as apparel, footwear, consumer electronics and, to some extent, automobiles. The profits of the manufacturing and assembly stages of these global value chains – activities that are often outsourced to companies in developing countries – are being squeezed by the sheer power that these transnational companies have. In the words of Ford Chairman William Clay Ford Jr, ‘It’s easy to build a car. It’s harder to build a brand’ (Davis, 2009, p.200). Some brand power is associated with considerable technological design content (such as Apple), but the maintenance of brand loyalty is usually the main source of rent generation (think about the marketing and advertising efforts by Nike).

Second, the profits of the manufacturing and assembly stages of global value chains are shrinking because of increased competition among developing countries. With greater participation of China and other Southeast Asian countries in the global economy, the developing-country share of low-tech manufacturing exports has almost tripled since 1980, and the global pool of unskilled labour has doubled since 1990 (Hauge, 2018). Alongside untapped capacity in the Asian production system, the number of people looking for unskilled work in the manufacturing sector in Africa is also rapidly increasing. All of the above means that developing countries have to find a way to develop capabilities in the services segments of global value chains. If not, they will end up capturing decreasing value at the bottom of the smile curve.

Argument 4: New Technological Developments Will Make Manufacturing Jobs in Developing Countries Redundant

With the advent of the so-called fourth industrial revolution – technological breakthroughs associated with things such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles, and three-dimensional (3D) printing – there is a growing fear that manufacturing will become less reliant on labour. International development organisations are therefore suggesting that developing countries should start looking for alternative ways to absorb surplus labour (e.g., UNCTAD, 2016b; World Bank, 2016).

A study by Manyika et al. (2017) shows that, with currently demonstrable technologies, 60% of all occupations in the world contain at least 30% technically automatable activities. These technically automatable activities represent 1.2 billion jobs. In a breakdown of economic sectors by activity type, the study reveals that manufacturing is in the top three among automatable activities, where 60% of jobs can potentially be automated.

Developing countries typically specialise in manufacturing that is highly labour-intensive, raising the 'automation alarm' to even higher levels in the developing-country context. The World Bank's 2016 World Development Report estimates that two-thirds of all jobs in developing countries are susceptible to automation (World Bank, 2016). In particular, assembly manufacturing stands at risk of automation. For example, sewing machine operators are currently 100% automatable (Manyika et. al., 2017). China stands out as the developing country most rapidly automating production. The stock of industrial robots in China increased from 25 000 in 1995 to 206 000 in 2015. By 2018, this number was expected to reach 400 000, which will give China the highest stock of industrial robots in the world (Hallward-Driemeier and Nayyar, 2018).

Africa is another region where people are worrying about the potential negative impact of automation. The impact of automation in Africa is understudied, but if we assume that labour-intensive manufacturing will become drastically less labour-intensive, this will have dire consequences for industrialisation in most African countries. Most importantly because Africa's population is growing at an alarming rate: by 2030, the continent is expected to have 1.6 billion people. With the current youth bulge in Africa, an estimated 800 million of these are expected to be eligible for work in 2030, compared to 460 million in 2010 (Fengler and Rowden, 2013).

MANUFACTURING MATTERS: PRO-MANUFACTURING ARGUMENTS

Counter-Argument 1: Economic Growth and Development has Very Rarely Happened Without Industrialisation

The arguments supporting the manufacturing sector as the main driver of economic development are rooted in the clear observation that, throughout the history of capitalism (in both the near and the distant past), practically all countries that have transformed their economies from low- to high-income have done so through a process of industrialisation.

Source: Bairoch (1982).

Figure 1.3 Distribution of global manufacturing output (%)

Between 1750 and 1950, the West's gradual establishment as the world economic hegemon – starting with the industrial revolution in Britain in the late eighteenth century – was also a process of establishing itself as the world's manufacturing hegemon (Figure 1.3). In 1750, Europe, North America and Japan constituted only 27% of manufacturing production in the world.⁹ But by 1900, those regions made up 90% of world manufacturing production (Bairoch, 1982). Unsurprisingly, economic growth rates between the West and 'the rest' started diverging as well. Between 1820 and 1950, per capita GDP in the West grew at an average annual rate of 1.08% per year, compared to only 0.29% per year in the rest of the world.¹⁰ By the early twentieth century, the world was clearly divided into two groups of economies: one was rich and industrialised, the other was poor and dependent on agriculture and natural resources. Industrialisation came to be seen as the main driver of economic development.

After World War II, the world's manufacturing landscape started to change. As developing countries were given more autonomy in steering policies towards their own development objectives, they implemented policies to promote industrialisation. As a result, a significant share of the world's manufacturing production has relocated to these countries,

⁹ In the seventeenth and first half of the eighteenth century, global manufacturing was dominated by China (porcelain and silks) and India (cotton textiles) (Nayyar, 2013).

¹⁰ The West includes Western Europe, Western Offshoots, Eastern Europe, the former USSR and Japan. The rest of the world includes Asia, Africa and Latin America. Calculations are made from the Maddison Online Database with 1996 Geary-Khamis dollars.

particularly to East Asia. The star performers include Hong Kong, Singapore, South Korea and Taiwan, whose pace of industrialisation and economic growth between roughly 1960 and 1990 was unprecedented in history, and still is. Since then, they have been followed by countries including China, Indonesia, Malaysia, Thailand and Vietnam.

According to a study of ‘growth miracles’ by the World Bank in 2008, only 13 countries in the world have been able to sustain an annual growth rate of 7% or higher since 1950. Only two countries, both with small populations and highly idiosyncratic economic structures – Botswana and Oman¹¹ – are among the group of 13 that have not grown on the basis of industrialisation (World Bank, 2008). A similar study has been carried out by Ocampo et al. (2009). They constructed a sample of 57 developing and transition economies grouped into 12 regions, and looked at the relationship between the production structure of the economy and economic growth between 1970 and 2007. They found that GDP growth rates were positively correlated with an increase in industry’s share of GDP in all regions that went through sustained periods of growth.

The relationship between growth of the manufacturing sector and sustained economic growth has in fact been documented as robust by many more scholars (e.g., McMillan and Rodrik, 2011; Nayyar, 2013; Rodrik, 2007; Szirmai, 2009; Szirmai and Verspagen, 2011). Thus, it is not surprising that no country, except a few states exceptionally rich in oil (for example, Brunei, Kuwait, Qatar) or very small financial havens (for example, Monaco, Lichtenstein), has achieved high and sustainable standards of living without developing its manufacturing sector.¹² This is why the terms ‘industrialised country’ and ‘developed country’ are often used interchangeably.

If we look in greater detail at the countries that have experienced de-industrialisation, or premature de-industrialisation, we see a clear trend of decelerating economic growth, as the manufacturing sector shrank and the service sector expanded. For example, Organisation for Economic Co-operation and Development (OECD) countries have on aggregate experienced a growth slowdown since the 1980s (WDI, 2018). In the United States, it is no coincidence that the 2016 presidential campaign saw the emergence of two candidates, at opposite ends of the political spectrum (Bernie Sanders and Donald Trump), campaigning for a manufacturing renaissance. In Latin America – the region that most notably experienced

¹¹ Botswana has amassed its wealth from precious stones (diamonds), while Oman has done so through oil.

¹² Neither Botswana nor Oman are mentioned, as their current level of GDP per capita arguably does not qualify for having achieved ‘high and sustainable standards of living’.

premature de-industrialisation – the decline in manufacturing as share of GDP also caused a growth slowdown (Palma, 2005, 2014). In Africa, premature de-industrialisation caused a decline in economic growth.¹³

In summary, economic development has never happened without industrialisation, apart from in a few countries with highly idiosyncratic structures. Moreover, countries and regions that have de-industrialised or prematurely de-industrialised have experienced a slowdown in economic growth or, at worst, declining economic growth.

Counter-Argument 2: Manufacturing Still Remains the Driver of Productivity Growth and Technological Development

As highlighted earlier in this chapter, it is important to acknowledge that some services have increased their potential for productivity growth and technological development. But the manufacturing sector still remains the driver of productivity growth and technological development. Part of the reason for this can be found in Nicholas Kaldor's three growth laws, which are perhaps the most classic endorsements of manufacturing as the engine of economic growth.

The three laws postulate the following. First, the growth of GDP is positively correlated with the growth of the manufacturing sector, in part explained by the absorption of surplus labour from agriculture to industry. Second, the productivity of the manufacturing sector is positively correlated with output growth of the manufacturing sector (also known as Verdoorn's law). This is attributed to the increasing returns to scale of the manufacturing sector, both static and dynamic. The former refers to output level or sector size, while the latter signifies the effect of learning-by-doing, which is a function of both cumulative past output and/or cumulative production experience over time. Third, the productivity of non-manufacturing is positively correlated with the growth of the manufacturing sector, because of technological spillovers effects from the manufacturing sector to other sectors (Kaldor, 1966).

The superior productivity potential mentioned in Kaldor's second law is an important point (building especially on the work on increasing returns by Young, 1928). Economies of scale are more easily achieved

¹³ When neoliberal reforms were imposed in Africa in the 1980s, state support for industrialisation was dismantled and the manufacturing sector went into decline. GDP per capita in Africa also declined, at an annual average rate of 1.6% between 1981 and 1994 (WDI, 2018). Economic growth in Africa has picked up since the mid-1990s, but the growth is highly volatile and tends to swing in tandem with price fluctuations of primary commodities (Pilling, 2016; Taylor, 2015). The share of manufacturing in economic output in Africa is currently the lowest of all regions of developing countries in the world, at around 11% (WDI, 2018).

in the manufacturing sector, as manufacturing activities lend themselves more easily to mechanisation and chemical processing than do other types of economic activities. The ease of spatially concentrating manufacturing production is also an important factor behind the greater productivity potential. Agriculture is more constrained in terms of space, soil and climate. And some services activities are, by their very nature, impervious to productivity increases. Chang (2014, Chapter 7) provides the example of producing music: if a string quartet trots through a 27-minute piece in nine minutes, we will not say that its productivity has trebled.

It is also important to emphasise the third law, as many people tend to forget that productivity growth in other sectors of the economy are often a result of innovations in the manufacturing sector. Think about how the world's most productive agricultural economies are heavy users of chemicals, fertilisers, pesticides and agricultural machinery, and how the world's most productive service economies rely on top-tier computer technology, transport equipment and, in some instances, mechanised warehouses.

These also take form through organisational innovations that originate from the manufacturing sector. For example, many fast food restaurants use assembly techniques in their kitchens, and some even deliver food on a conveyor belt ('YO! Sushi' being the famous example). As another example, large retail chains often apply modern inventory management techniques that were developed in the manufacturing sector (Chang et al., 2013).

The importance of the manufacturing sector for a country's overall innovation infrastructure cannot be highlighted enough. Even in advanced countries, where manufacturing production is supposed to have been on the decline since the early 1990s, the bulk of innovation happens in the manufacturing sector. In the US, firms associated mainly with industrial production still employ 64% of all scientists and engineers, and the manufacturing sector accounts for 70% of industrial R&D (Bonvillian, 2012).

In short, our discussion in this section shows that many services 'import' technology from the manufacturing sector. In the next subsection, we will see not only that many services are productive because of imported technology from the manufacturing sector, but also that their existence is dependent on a manufacturing core.

Counter-Argument 3: The Existence of Services is Largely Dependent on a Manufacturing Core, More Than the Other Way Around

In the previous section, we mentioned how the productivity of manufacturing spills over to services. Additionally, many services are dependent on manufacturing firms as customers, and would not exist without a

manufacturing core. Hirschman (1958) made an important contribution to understanding the spillovers from the manufacturing sector to other sectors of the economy. He argued that all sectors are linked to one another through backward and forward linkages, but that the manufacturing sector is characterised by stronger backward and forward linkages than other sectors of the economy, thus acting as the main engine of economic development.

Daniel J. Meckstroth's recent paper, 'The Manufacturing Value Chain is Much Bigger Than You Think!' (Meckstroth, 2017), illustrates Hirschman's point in a useful way. He provides the example of a manufacturing plant, and shows how it stimulates many domestic service activities in the upstream supply chain and the downstream sales chain. The upstream supply chain includes corporate and contract R&D services, outsourced professional services for manufacturers and distributors, transport of inputs used in production, and utilities provision for the manufacturing plant and its distribution facilities (for example, electricity, water and gas). The downstream sales chain includes transport of the manufactured goods to port or market, wholesale and warehousing operations, retail operations, and aftermarket maintenance and repair services of the final product. Based on this framework for understanding how manufacturing stimulates other economic activities, Meckstroth calculates a domestic manufacturing value-added 'multiplier' in the United States of 3.6. This means that for every dollar of domestic manufacturing value-added in the United States destined for manufactured goods for final demand, another \$3.60 of value-added is generated elsewhere in the domestic economy.

However, every economic activity stimulates another economic activity. This means that one could also argue that, just as manufacturing stimulates services, services stimulate manufacturing. But evidence shows that manufacturing has a stronger multiplier effect than services. The seminal study on this was conducted by Park and Chan (1989), who found that the manufacturing sector generates two to three times more output in the rest of the economy than the services sector does. More recent studies also confirm this. Pilat and Wolfl (2005) estimate that 29% of the manufacturing workforce in France contribute indirectly to the production of non-manufacturing output, whereas only 13% of the services workforce contribute indirectly to the production of non-services output. Kuan (2017) shows that in Singapore the manufacturing sector has stronger value-added spillovers to the services sector than vice versa: every 100 new manufacturing jobs are associated with 27 new non-manufacturing jobs. By contrast, every 100 new services jobs are associated with only three additional manufacturing jobs.

Not only do many services depended on a manufacturing core, though: some of them are also by their very nature linked to manufacturing. These most importantly include industrial R&D, innovation, product design and other engineering-related services. Such services depend on manufacturing know-how, and one could make a strong case for having such services counted as manufacturing in the national accounts, which is currently not the case.

Berger (2015) shows that, in some industries, the R&D and manufacturing process are close to inseparable. For example, in solar power the most promising R&D and innovation involves cheaper and more efficient ways of manufacturing photovoltaics. The innovation is in the manufacturing. Similarly, Pisano and Shih (2012) argue that it does not make sense to separate manufacturing from many of the services that are embedded in the manufacturing process. They propose that we should think in terms of the ‘industrial commons’ instead, which they define as: ‘The R&D and manufacturing infrastructure, know-how, process-development skills, and engineering capabilities embedded in firms, universities, and other organizations that provide the foundation for growth and innovation in a wide range of industries’ (Pisano and Shih, 2012, p. 2). Through various industry case studies, they show how the United States has lost much of its innovation infrastructure to competitor countries in East Asia, because the US initially outsourced manufacturing operations to these countries but failed to realise how closely innovation and design services were linked to the manufacturing process. This has implications for how we understand the smile curve we introduced earlier in the chapter. If we classify industrial R&D and product design as manufacturing activities, this suddenly means that manufacturing value-added increases its share of total value in the value chain.

Counter-Argument 4: The Illusion of De-industrialisation

At the very core of the post-industrial society discourse is the observation that the manufacturing sector is contributing less to total economic output in most of the world’s economies. However, a significant part of this decline is an illusion.

First, the declining share of manufacturing in total economic output in many countries is in some part due to reclassification of economic activities rather than an actual change in these countries’ productive structures. For example, in the list of economic activities in the Standard Industrial Classification (SIC) codes made by the Office for National Statistics in the UK, companies are classified according to the activity in which their largest number of employees is engaged. This means that a company that both

makes and delivers a product will be classified into either manufacturing or services, not both, depending on the number of people working in each category. MMEG (2016) uses the example of ABC Computers Ltd, a company that employs 35 people, 20 of whom are employed to make computers and 15 to deliver computers. This company ends up being classified in the manufacturing category even though it employs almost half of its workforce in a non-manufacturing activity. However, if ABC Computers Ltd outsources the delivery of its products to a delivery company in the same country, there is suddenly an increase in services as share of total output in the economy, without this really being the case.

This outsourcing has actually been happening on a large scale in many countries in the last few years: many services that used to be provided in-house in manufacturing firms (for example, delivery, catering, security guards, design, programming, marketing, analytics, and so on) are now supplied by independent services companies (Chang, 2014, Chapter 7). Additionally, some manufacturing companies that have not started outsourcing their service activities have instead applied to be reclassified as services firms, even though they still conduct some manufacturing. This is mainly because the manufacturing share in their total output is falling. A UK government report estimates that up to 10% of the fall in manufacturing employment between 1998 and 2006 in the UK may be due to this reclassification effect (Chang, 2014, Chapter 7).

Why is the manufacturing share in these companies' total output falling relative to services, though? Looking at countries going through the de-industrialisation process in the 1980s and the 1990s, Rowthorn and Ramaswamy (1999) argue that the main explanation for this trend – and, more generally, the trend of a relative decrease in the size of the manufacturing sector – is that productivity in manufacturing grows faster than in services. A more recent study by Tregenna (2009) similarly shows that the trend of de-industrialisation in some countries is happening because the labour-intensity of manufacturing declines more rapidly over time compared to services; that is, manufacturing has higher productivity.

As a result of this greater productivity potential of manufacturing, prices of manufactured goods have declined relative to that of services, resulting in a falling share of manufacturing in total economic output. This is an important observation: de-industrialisation is not caused by the growing irrelevance of manufacturing, as some proponents of the post-industrial society discourse suggest, but rather because manufacturing is characterised by higher productivity growth potential.

We should also note that the relative price decline of manufactured goods is a result of relative price increases of services as well. Because the services sector has lower potential for productivity growth, income growth

in advanced economies, combined with the fact that many services are not tradable, has led to higher wages and prices in the services sector (Baumol, 1967), as well as an increased employment share (Rowthorn and Wells, 1987).

When this relative price effect is taken into account and the shares of different sectors are recalculated in constant prices, as opposed to current prices, the share of manufacturing has in fact not fallen very much in most high-income countries in recent decades. In some of them, such as the US, Switzerland, Finland and Sweden, when calculated in constant prices, it has actually increased (Chang, 2014, Chapter 7).

Counter-Argument 5: Manufactured Goods are Still More Tradable Than Services

In ‘Argument 2’, we highlighted that services have become more tradable, mainly thanks to advances in ICT. This is great news for developing countries that struggle with developing an internationally competitive manufacturing sector; we cited the examples of India and Rwanda, countries that have found ways to increase their foreign exchange holdings through developing tourism services and information services, respectively.

But while this is good news in part, the bad news for countries that try to specialise only in services is that the increased tradability of some services is little more than a drop in the ocean of international trade. World trade in services as a share of total world trade has more or less remained unchanged since we started counting international trade in services: it increased from 20% in 1980 to 22.5% in 2016 (WDI, 2018). Yes, this is an increase, but a very small increase for a 36-year time period during which we are supposed to have witnessed the emergence of the post-industrial society. The remainder of international trade is trade in goods.

Trade in goods dominates international trade because, as we have said, most services require the consumer and producer to be in the same location. And even some producer and business services that can in theory be traded will in many instances locate within the national boundaries of the firms that they serve. For example, in the UK and US, software services, information technology services, R&D services and management consultancy services are often developed and specialised to serve a core manufacturing activity in the country (Pisano and Shih, 2012; OLS, 2017).

Countries with very small populations can afford to export only services, such as Lichtenstein, Malta, Monaco and the Seychelles. But once you start moving into the territory of countries with just a few million people, it becomes more difficult. All countries need manufactured goods, and for countries with larger populations it is simply not possible to afford

to import all manufactured goods. This is part of the reason why many developing countries have tight capital controls: foreign exchange reserves are smaller because they have to import most manufactured goods (and because what they export is low value).

India, despite experiencing an export boom in services, still has a trade deficit because its trade surplus in services covered only 51% of its trade deficit in goods in 2017. Only a few years earlier, in 2010, its trade surplus in services covered only 31% of its trade deficit in goods (WDI, 2018). A big part of this improvement in the trade balance is that India has started producing more manufactured goods, both for domestic consumption and for export. The UK, which we also highlighted as a service-based success story, has been consistently struggling with a trade deficit since the early 2000s because its trade surplus in services cannot cover its trade deficit in goods, as in India (ONS, 2018).

Countries that want to be successful in international trade and have a healthy trade balance over time have to develop or retain a strong manufacturing base. With the exception of countries with very tiny populations, relying on exports of services is not enough. In the twenty-first century, 'things' are still what mainly cross borders.

Counter-Argument 6: Technological Developments Will Not Steal Manufacturing Jobs

The fear that our jobs will be made redundant by machines is not new. In fact, it has been around since the Luddites protested in England in 1811–16. The Luddites were a group of textile workers who destroyed machinery as a form of protest because they feared that their skills would go to waste as machines gradually replaced their roles in the textile factories.

Two hundred years later, the textile industry is still highly labour-intensive, and so are a range of other manufacturing industries. In fact, the predicted disruption of the so-called fourth industrial revolution on labour markets is mostly hype at this point: for now, 3D printing and robotics are used in relatively few countries. The existence of a certain technology does not translate into an easily applicable technology or a cost-efficient technology. The studies by Manyika et al. (2017) and the World Bank (2016) cited earlier in this chapter, suggesting that more than half of current occupations worldwide stand at risk of automation, have not gone unchallenged. For example, Arnzt et al. (2016) find that the share of current jobs in OECD countries that stand at risk of automation is only 6–12%. In developing countries, the threat to jobs of automation is found to be even lower, at 2–8% of current jobs (Ahmed and Chen, 2017). The reason for this is that the tasks considered most susceptible to automation

are those that are done mostly by workers in the middle of the global skills distribution – blue-collar workers in high-income countries – and in countries than can cost-efficiently deploy these new technologies (Acemoglu and Autor, 2011). Hallward-Driemeier and Nayyar (2018) show how the manufacture of electronics, pharmaceuticals, electrical machinery and equipment stand at higher risk of automation than the manufacture of textiles and garments, leather products, wood products and basic metals.

Moreover, the assumption that the adoption of new technologies has a net negative effect on employment is not borne out by evidence. A study by Dutz et al. (2018) on the adoption of new technologies by countries in Latin America actually shows the opposite happening: in Argentina, Chile and Columbia, manufacturing firms that invest in ICT technology have experienced a net increase in employment. Second, even if we assume the ‘doomsday’ scenario of 3D printers and robots stealing most of our jobs, we do not know whether the manufacturing sector will experience larger job losses than the services sector or the agricultural sector. While, as cited earlier in the chapter, Manyika et al. (2017) show that manufacturing is among the most automatable economic activities, they also show that transportation and warehousing services are at equal risk of automation, and that food services are more susceptible to automation; in fact, sorting of agricultural products is 100% automatable at this point.

In conclusion, we have to be sceptical of the automation hype, especially in the context of developing countries. Most of the studies we have cited on both sides of the debate talk about the risk and possibility of job losses due to automation. They are not based on historical data. The historical data we do have clearly show that in the context of developing countries, the manufacturing sector has been the strongest driver of employment generation (ILO, 2014).

SUMMARY AND CONCLUSION

In the last few decades, both high-income countries and developing countries have seen manufacturing as a share of their economies shrinking: services now dominate most countries’ economic structures. This shift has fuelled the discourse of the post-industrial society. This discourse contends that today’s economic development strategies need to focus more on developing services, and is rooted in four main arguments: (1) thanks to developments in ICT, services contribute more to productivity growth than they used to, especially digitalised services and services that use digital technology; (2) technological developments and reductions in transport costs have made more services tradable; (3) services account for

a higher share of value-added than manufacturing in today's value chains; and (4) automation puts into question the viability of labour-intensive manufacturing strategies.

In this chapter, we have critically evaluated the validity of the post-industrial society discourse, particularly with reference to developing countries. We acknowledge that there are reasons for developing countries to take the post-industrial society discourse seriously. Indeed, some services are characterised by higher tradability and greater productivity growth potential than they were before, and it seems difficult for developing countries to escape the 'middle-income trap' without specialising in at least some high-value services.

However, for many reasons, sustained economic development necessitates the development of an internationally competitive manufacturing sector. First, apart from a few small economies with highly idiosyncratic features, no countries have been able to transform their economies from low- to high-income without industrialisation. This is because, even as services have increased their potential to contribute to economy-wide productivity growth, manufacturing remains the driver of productivity growth and technological development: economies of scale are more easily achieved in the manufacturing sector because manufacturing activities lend themselves more easily to mechanisation and chemical processing. Even for many non-manufacturing activities, manufacturing is the driver of productivity growth: the world's most productive agricultural economies are heavy users of chemicals, fertilisers, pesticides and agricultural machinery, and the world's most productive service economies rely on top-tier computer technology, transport equipment and mechanised warehouses.

Second, the existence of services within an economy is largely dependent on a manufacturing core in that economy, more than the other way around. Studies investigating the multiplier effect of manufacturing and services have made it abundantly clear that manufacturing has a stronger multiplier effect than services. And some services are by definition linked to manufacturing through engineering know-how, such as manufacturing R&D and industrial design. One could question whether these services should be counted as services, instead of manufacturing, in industry classification codes.

Third, the decline of the manufacturing sector across the world – the development that has prompted the post-industrial society discourse – is partly an illusion. Many services that used to be provided in-house in manufacturing firms have been outsourced to independent firms. This has resulted in an increasing share of services in the economy in the industry classifications systems, without this actually being the case. Moreover,

part of the manufacturing decline can be explained by the fact that manufacturing has faster productivity growth than services (which has resulted in falling relative prices of manufactured products), not because it is 'less important'.

Fourth, while some services have become more tradable, low tradability still characterises most services because they require consumers and producers to be in the same location. This means that countries that rely on their service sector for economic growth will eventually struggle with trade balance constraints.

Fifth, the prediction that new automation technologies will steal manufacturing jobs is mostly hype without evidence, especially in the context of developing countries. Blue-collar jobs in high-income countries are at higher risk of being made redundant than manufacturing jobs in developing countries. Additionally, evidence does not suggest that the manufacturing sector will suffer larger job losses than the services sector. If jobs are lost to automation, all sectors of the economy will suffer. But this 'if' is a big 'if': as yet, there is no evidence that automation is stealing jobs in developing countries.

In conclusion, we have to take the post-industrial society discourse with a large dose of scepticism. The idea that services is 'knowledge' work and manufacturing is low-value 'grunge' work is simply not correct: most services, in fact, cannot thrive without a vibrant manufacturing sector. Developing countries should not be tricked into thinking that they can skip the industrialisation phase. Factories are what made the modern world, and they will keep remaking it.

REFERENCES

- Acemoglu, D. and Autor, D. (2011). 'Skills, Tasks, and Technologies: Implications for Employment and Earnings'. In Card, D. and Orley, A. (eds), *Handbook of Labour Economics: Volume 4B*. San Diego, CA: North-Holland.
- Ahmed, S. and Chen, P. (2017). 'Emerging Technologies, Manufacturing, and Development: Some Perspectives for Looking Forward'. Unpublished manuscript, World Bank, Washington, DC.
- Ali-Yrkkö, J., Rouvinen, P., Seppälä, T. and Ylä-Anttila, P. (2011). 'Who Captures Value in Global Supply Chains? Case Nokia N95 Smartphone'. *Journal of Industry, Competition and Trade*, 11(3), pp.263–278.
- Arnzt, M., Gregory, T. and Zierahn, U. (2016). 'The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis'. Social, Employment, and Migration Working Paper No. 189, Organisation for Economic Co-operation and Development (OECD), Paris.
- Baer, W. and Samuelson, L. (1981). 'Toward a Service-Oriented Growth Strategy'. *World Development*, 9(6), pp.499–514.

- Bairoch, P. (1982). 'International Industrialization Levels from 1750 to 1980'. *Journal of European Economic History*, 11(2), pp. 269–333.
- Baumol, W.J. (1967). 'Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis'. *American Economic Review*, 76, pp. 1072–1085.
- Bell, D. (1976). *The Coming of Post-Industrial Society*. New York: Basic Books.
- Berger, S. (2015). *Making America: From Innovation to Market*. Cambridge, MA: MIT Press.
- Bhagwati, J.N. (1984). 'Splintering and Disembodiment of Services and Developing Nations'. *World Economy*, 7(2), pp. 133–144.
- Bhagwati, J.N. (2010). 'The Manufacturing Fallacy'. *Project Syndicate*, August 27.
- Bonvillian, W.B. (2012). 'Reinventing American Manufacturing: The Role of Innovation'. *Innovation*, 7(3), pp. 97–125.
- Bosworth, B. and Collins, S.M. (2008). 'Accounting for Growth – Comparing China and India'. *Journal of Economic Perspectives*, 22(1), pp. 45–66.
- Chang, H-J. (2014). *Economics: The User's Guide*. London: Pelican Books.
- Chang, H-J., Andreoni, A. and Kuan, M.L. (2013). 'International Industrial Policy Experiences and Lessons for the UK'. London: UK Government Office for Science.
- Chang, H-J., Hauge, J. and Irfan, M. (2016). *Transformative Industrial Policy for Africa*. Addis Ababa: UNECA.
- Chenery, H. (1960). 'Patterns of Industrial Growth'. *American Economic Review*, 50, pp. 624–654.
- Clark, C. (1940). *The Conditions of Economic Progress*. London: Macmillan.
- Cruz, M. and Nayyar, G. (2017). 'Manufacturing and Development: What Has Changed?'. Unpublished manuscript, World Bank, Washington, DC.
- Davis, G. (2009). *Managed by the Market: How Finance Reshaped America*. New York: Oxford University Press.
- Dutz, M.A., Almeida, R.K. and Truman, G.P. (2018). *The Jobs of Tomorrow: Technology, Productivity, and Prosperity in Latin America and the Caribbean*. Washington, DC: World Bank.
- Fengler, W. and Rowden, R. (2013). 'How Real is the Rise of Africa'. *The Economist*, 2013 archived debate.
- Fisher, A.G.B. (1935). *The Clash of Progress and Security*. London: Macmillan.
- Gerschenkron, A. (1962). *Economic Backwardness in Historical Perspective*. Cambridge, MA: Harvard University Press.
- Ghani, E. (2010). *The Service Revolution in South Asia*. Oxford: Oxford University Press.
- Ghani, E. and Kharas, H. (2010). 'An Overview'. In Ghani, E. (ed.), *The Service Revolution in South Asia*. Oxford: Oxford University Press.
- Ghani, E. and O'Connell, S.D. (2014). 'Can Service Be a Growth Escalator in Low Income Countries?'. World Bank Policy Research Working Paper No. 6971, World Bank, Washington, DC.
- Hallward-Driemeier, M. and Nayyar, G. (2018). *Trouble in the Making: The Future of Manufacturing-Led Development*. Washington, DC: World Bank.
- Haskel, J. and Westlake, S. (2017). *Capitalism Without Capital: The Rise of the Intangible Economy*. Princeton, NJ: Princeton University Press.
- Hauge, J. (2018). 'African Industrial Policy in an Era of Expanding Global Value Chains: The Case of Ethiopia's Textile and Leather Industries'. Doctoral thesis. <https://doi.org/10.17863/CAM.20781>.
- Hirschman, A. (1958). *The Strategy of Economic Development*. New Haven, CT: Yale University Press.

- ILO (2014). *Global Employment Trends 2014: Risk of a Jobless Recovery?* Geneva: ILO.
- IMF (2018). *World Economic Outlook, April 2018: Cyclical Upswing, Structural Change*. Washington, DC: International Monetary Fund.
- Kaldor, N. (1966). *Causes of Slow Rate of Growth in the United Kingdom*. Cambridge: Cambridge University Press.
- Kaplinsky, R. (2005). *Globalization, Inequality and Poverty: Between a Rock and a Hard Place*. Cambridge: Polity Press.
- Kuan, M.L. (2017). 'Manufacturing and Services in Singapore's Economy: Twin Engines of Growth and Their Asymmetric Dependencies'. Ministry of Trade and Industry, Singapore.
- Kuznets, S. (1966). *Modern Economic Growth: Rate, Structure and Spread*. New Haven, CT: Yale University Press.
- Lewis, W.A. (1954). 'Economic Development with Unlimited Supplies of Labour'. *Manchester School*, 22, pp. 139–191.
- Loungani, P., Saurabh, M., Papageorgiou, C. and Wang, K. (2017). 'World Trade in Services: Evidence from A New Dataset'. IMF Working Paper, WP/17/77.
- Manyika, J., Chui, M., Miremadi, M., Bughin, J., George, K., Willmott, P. and Dewhurst, M. (2017). *A Future that Works: Automation, Employment and Productivity*. San Francisco, CA: McKinsey Global Institute.
- McCormack, R. (2006). 'Council on Competitiveness Says US has Little to Fear but Fear Itself; by Most Measures, US is Way Ahead of Global Competitors'. *Manufacturing and Technology News*, November 30.
- McMillan, M. and Rodrik, D. (2011). 'Globalization, Structural Change and Productivity Growth'. In Bacchetta, M. and Jansen, M. (eds), *Making Globalization Socially Sustainable*. Geneva: WTO and ILO.
- McMillan, M., Rodrik, D. and Sepulveda, C. (2017). 'Structural Change, Fundamentals, and Growth: A Framework and Country Studies'. Policy Research Working Paper 8041, World Bank, Washington, DC.
- Meckstroth, D.J. (2017). 'The Manufacturing Value Chain is Much Bigger than You Think!'. MAPI Foundation, Arlington, VA.
- Milberg, W. and Winkler, D. (2013). *Outsourcing Economics: Global Value Chains in Capitalist Development*. Cambridge: Cambridge University Press.
- MMEG (2016). 'Manufacturing Metrics Review Report'. Report prepared by the Manufacturing Metrics Experts Group for the UK Department for Business, Innovation and Skills.
- Myrdal, G. (1957). *Economic Theory and Underdeveloped Regions*. London: Duckworth.
- Nayyar, D. (2013). *Catch Up: Developing Countries in the World Economy*. Oxford: Oxford University Press.
- Nurkse, R. (1961). *Problems of Capital Formation in Underdeveloped Countries*. New York: Oxford University Press.
- Ocampo, J., Rada, C. and Taylor, L. (2009). *Growth and Policy in Developing Countries: A Structuralist Approach*. New York: Columbia University Press.
- OLS (2017). *Strength and Opportunity 2017: The Landscape of the Medical and Biopharmaceutical Sectors in the UK*. London: Office for Life Sciences.
- ONS (2018). *Statistical Bulletin: UK Trade: April 2018*. UK Office for National Statistics. Newport: Office for National Statistics.
- Palma, J.G. (2005). 'Four Sources of De-industrialisation and a New Concept of the Dutch Disease'. In Ocampo, J.A. (ed.), *Beyond Reforms: Structural Dynamic*

- and *Macroeconomic Vulnerability*. Palo Alto, CA: Stanford University Press; Washington, DC: World Bank.
- Palma, J.G. (2014). 'De-industrialisation, Premature De-industrialisation and the Dutch Disease'. *Revista NECAT*, 3(5). <http://stat.ijie.incubadora.ufsc.br/index.php/necat/article/view/3118/4060>.
- Park, S-H. and Chan, K. (1989). 'A Cross-Country Input-Output Analysis of Intersectoral Relationships between Manufacturing and Services and their Employment Implications'. *World Development*, 17(2), pp. 199–212.
- Pilat, D. and Wolf, A. (2005). 'Measuring the Interaction Between Manufacturing and Services'. OECD Science, Technology and Industry Working Papers 2005/05, OECD, Paris.
- Pilling, D. (2016). 'Africa: Between Hope and Despair'. *Financial Times*, April 24.
- Pisano, G. and Shih, W. (2012). *Producing Prosperity: Why America Needs a Manufacturing Renaissance*. Cambridge, MA: Harvard Business Review Press.
- Prebisch, R. (1950). *The Economic Development of Latin America and its Principal Problems*. New York: United Nations.
- Rodrik, D. (2007). 'Industrial Development: Some Stylized Facts and Policies'. In United Nations (ed.), *Industrial Development for the 21st Century*. New York: United Nations.
- Romer, C.D. (2012). 'Do Manufacturers Need Special Treatment?'. *New York Times*, February 4.
- Rowthorn, R. and Ramaswamy, R. (1999). 'Growth, Trade and Deindustrialization'. *IMF Staff Papers*, 46(1), pp. 18–41.
- Rowthorn, R. and Wells, J.R. (1987). *De-Industrialization and Foreign Trade*. Cambridge: Cambridge University Press.
- Statista (2018). Online statistics portal, <https://www.statista.com/>. Accessed April 2017.
- Szirmai, A. (2009). 'Industrialization as an Engine of Growth in Developing Countries'. UNU-MERIT Working Paper Series 2009-010.
- Szirmai, A. and Verspagen, B. (2011). 'Manufacturing and Economic Growth in Developing Countries, 1950–2005'. UNU-MERIT Working Paper Series 2011-069.
- Taylor, I. (2015). 'Dependency Redux: Why Africa is Not Rising'. *Review of African Political Economy*, 43(147), pp. 8–25.
- Tregenna, F. (2009). 'Characterising Deindustrialisation: An Analysis of Changes in Manufacturing Employment and GDP Internationally'. *Cambridge Journal of Economics*, 33(3), pp. 433–466.
- UNCTAD (2016a). *Trade and Development Report, 2016: Structural Transformation for Inclusive and Sustained Growth*. Geneva: United Nations Conference on Trade and Development.
- UNCTAD (2016b). 'Robots and Industrialization in Developing Countries'. Policy Brief No. 50, United Nations Conference on Trade and Development, Geneva.
- UNECA (2015). *Economic Report on Africa 2015: Industrializing through Trade*. Addis Ababa: United Nations Economic Commission for Africa.
- WDI (2018). World Development Indicators online database. <https://databank.worldbank.org/data/reports.aspx?source=world-development-indicators> (accessed March 2018).
- WIPO (2017). *World Intellectual Property Report 2017: Intangible Capital in Global Value Chains*. Geneva: World Intellectual Property Organization.
- World Bank (2008). *The Growth Report: Strategies for Sustained Growth and*

- Inclusive Development*. Washington, DC: Commission for Growth and Development.
- World Bank (2016). *World Development Report 2016: Digital Dividends*. Washington, DC: World Bank.
- WTO (2013). *World Trade Report 2013: Factors Shaping the Future of World Trade*. Geneva: World Trade Organization.
- Young, A.A. (1928). 'Increasing Returns and Economic Progress'. *Economic Journal*, 38(12), pp.527–542.