

# Made in Africa

## Manufacturing and the fourth industrial revolution

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This report investigates Africa's manufacturing future. It discusses and then models the potential impact of the fourth industrial revolution, with a time horizon to 2040. Africa has a large and fast-growing population. Because of this, the continent will only be able to grow fast enough to improve livelihoods by moving labour much more rapidly into more productive sectors, in particular manufacturing.

## Key findings

- ▶ The situation in Africa is improving, but the gap in income levels between Africa and the rest of the world will continue to increase along a Current Path forecast.
- ▶ Palliative measures such as the UN Sustainable Development Goals ameliorate the worst effects of underdevelopment but do not constitute a feasible, long-term solution to the development prospects for an African population that will have increased to 2.1 billion people by 2040.
- ▶ Rather than transforming into higher rates of productivity, Africa's structural transformation from low-productivity informal agriculture to low-productivity urban-based retail services has been 'growth reducing'. Instead of industrialising, Africa is deindustrialising.
- ▶ Agriculture is more effective at reducing poverty than other sectors, but manufacturing is unique in its potential to transform productivity and induce rapid economic growth.
- ▶ New globalisation, the future of global value chains and digital production are poised to disrupt the nature of manufacturing globally.
- ▶ The fourth industrial revolution offers Africa opportunities to accelerate economic transformation into higher rates of productivity and growth.
- ▶ This is a future where some goods will be produced and consumed in regional rather than global markets, possibly in a more distributed manner, presenting Africa with opportunities for industrialisation as well as regional trade.

## Recommendations

- ▶ Capitalising on the opportunities presented by the fourth industrial revolution will require a concerted effort from African governments that will have to lead the charge.
- ▶ Leaders in key growth-locomotive countries need to implement concrete measures such as the establishment and support of special economic zones and clear national and regional industrial policies.
- ▶ Developmentally focused leaders need to put the right incentives in place, such as export orientation, support to embryonic manufacturing, and policies to move labour and capital into more productive enterprises.
- ▶ Rapid growth in manufacturing, agro-industry and tradable services requires access to larger markets, hence the imperative of progress with regard to Africa's regional economic integration.
- ▶ Nationally, industrialisation efforts require well-administered, supportive public policies and effective administrative systems.
- ▶ Efforts to combat corruption associated with facilitating export procedures, such as removing trade friction costs due to poor logistics, require specific and ongoing attention.
- ▶ The private sector needs effective government support, such as tax incentives and institutional reforms, to lower transaction costs in customs and business regulation to offset the costs for first movers.

## Introduction

This report is part of a series of ‘big picture’ publications on the future of Africa by the African Futures and Innovation programme at the Institute for Security Studies (ISS). In addition to a number of detailed long-term forecasts on Ethiopia, Kenya, Mozambique, Namibia, Nigeria and South Africa, previous publications have presented forecasts on fragility, violence/instability, democracy, urbanisation, development aid and the potential for Africa to achieve key Sustainable Development Goals (SDGs) in poverty, health and infrastructure.<sup>1</sup>

To varying degrees, these reports have all used the International Futures (IFs) forecasting system, hosted at the Frederick S. Pardee Center for International Futures, University of Denver, for associated forecasts and scenarios.<sup>2</sup> A subsequent section provides more information on IFs.

The purpose of this report is to investigate Africa’s manufacturing future, and the opportunities and potential impact the fourth industrial revolution presents, with a time horizon to 2040. A subsequent report will expand on the analysis presented here, discussing Africa’s demographic dividend and the future of work.

Africa is a hugely diverse continent. It is impossible in a report of this length to do justice to that diversity among its 55 constituent states. Rather than relying on geographical regions, the report generally uses the World Bank 2017/18 classification of African countries by low-, lower-middle- and upper-middle-income groupings. Where appropriate, the report makes a distinction between Africa and the rest of the world within these groupings.

This report argues that an important reason for the widening gap between income levels in Africa and rest of the world is the continent’s growth in low-productivity sectors, both in terms of the size of the labour force employed, particularly in subsistence agriculture and low-end services, and the contribution that these sectors make to gross domestic product (GDP). Structural change has started, but much more is required. It is clear that only by moving labour much more rapidly into more productive sectors, in particular manufacturing, will Africa be able to grow rapidly enough to improve livelihoods given its large and fast-growing population.

The role of the manufacturing sector changes as income levels increase and the way that manufacturing contributes shifts as economies mature. Generally, manufacturing’s share of GDP peaks between 20% and 35%, after which consumption and job creation shift towards services.<sup>3</sup>

In advanced economies the contribution of manufacturing has shifted to promoting innovation, productivity and trade. In the developing world, manufacturing remains critically important as a pathway from subsistence agriculture to rising incomes and living standards.

In advanced economies the contribution of manufacturing has shifted to promoting innovation, productivity and trade

Manufacturing is set to change even more rapidly as part of the fourth industrial revolution, which may offer Africa opportunities to accelerate economic transformation into higher rates of productivity and growth. However, capitalising on these opportunities will require a concerted effort from governments that will have to lead the charge. In essence, Africa needs to speed up the pace of modernisation.

The first three sections provide an overview of Africa’s recent economic trajectory and its current economic structure. A next section comments on Africa’s inability to industrialise, before examining the extent to which new globalisation and the fourth industrial revolution are fuelling changes in the global distribution of manufacturing, largely because labour costs represent a smaller share of total costs as the digitalisation of production proceeds apace. Opportunities for growth in manufacturing still exist, but require appropriate government policy and capacity, neither of which is a given. Two final sections use IFs to illustrate the potential impact of industrialisation in Africa before concluding.

## Africa’s economic trajectory

When comparing average income levels in Africa with those in the rest of the world, the picture is one of growing divergence (Figure 1). Instead of catching up, Africa is falling further behind. Although the situation has improved, particularly since 1995, income levels in Africa are improving more slowly than elsewhere.

Extreme poverty, the most widespread and pernicious characteristic of underdevelopment, is pervasive and tenacious.

Countries grow wealthy and prosperous through the structural transformation of their economies – by moving capital, labour and technology from lower- to higher-productivity sectors. Manufacturing is the most productive sector, the Asian experience shows. Growth-inducing structural transformation from low-productivity subsistence agriculture to high-productivity manufacturing led to rapid income growth, unprecedented levels of poverty alleviation and improved livelihoods. In addition to growth in manufacturing, rapid transformation of its agricultural sector assisted Asia in alleviating poverty.

The experience of sub-Saharan Africa has not followed this trajectory. Rather, a shift has occurred from low-productivity agriculture to slightly more productive employment in services, generally consisting of wholesale and retail trade in the informal sector.<sup>4</sup>

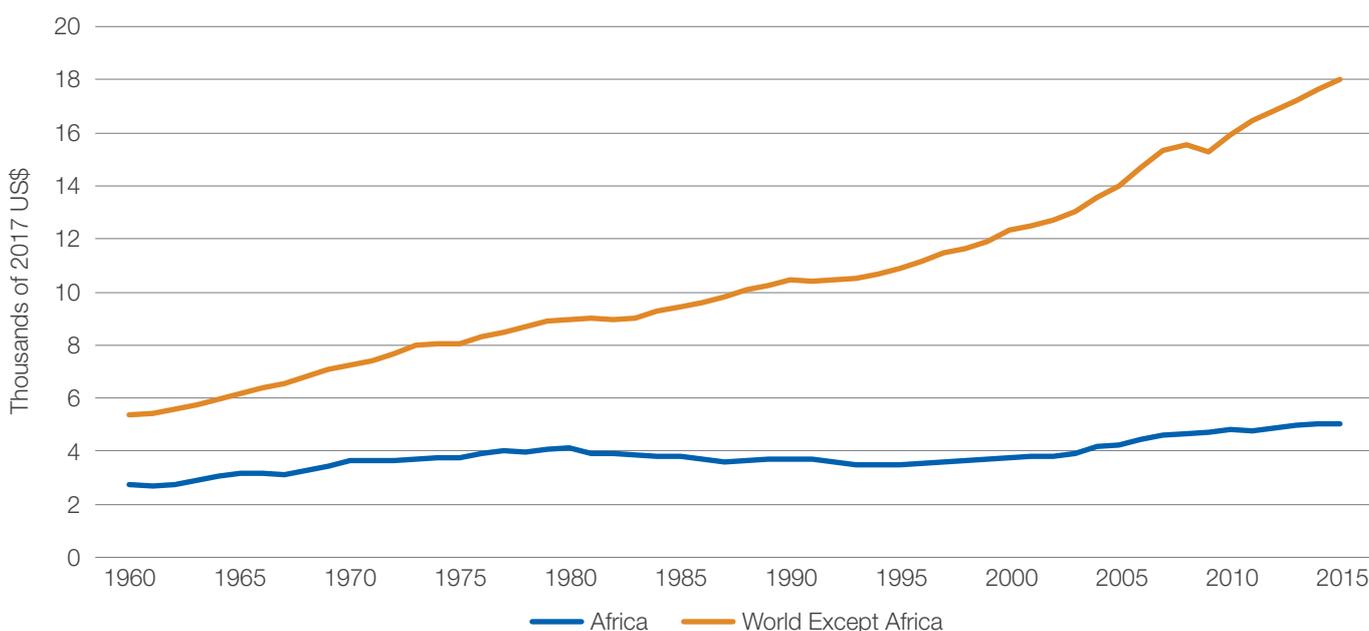
Beyond the various schools of economic theory, such as are represented by the writings of Adam Smith, Friedrich List, John Maynard Keynes, and Walt Rostow, more recent authors as diverse as Arthur Lewis, Erik Reinert, Ha-Joon Chang, Calestous Juma and recently Dani Rodrik have written extensively on the importance

of early industrialisation – and the important role of governments/ruling elites in charting this course.<sup>6</sup> A 2016 report prepared by the United Nations University World Institute for Development Economics Research (UNU-WIDER) explains the importance of industrialisation as follows:

Between 1950 and 2006, about half of the catch-up by developing countries to advanced economy levels of output per worker was explained by rising productivity within industry combined with structural transformation out of agriculture. Industry is the pre-eminent destination sector at early stages of development because it is a high productivity sector capable of absorbing large numbers of moderately skilled workers.<sup>7</sup>

A significant body of research has confirmed that growth in agriculture is more effective in reducing poverty than growth in other sectors.<sup>8</sup> But since manufacturing in Africa is six times more productive than agriculture, growth in manufacturing propels more rapid general economic productivity improvements. Low-end services such as retail and trade were, by 2010, only two times more productive than agriculture, with the result that growth in services in Africa has contributed to no or slow growth in aggregate per capita income.<sup>9</sup> According to Newman et al:

**Figure 1: Average income levels: Africa versus Rest of the World (1960–2015)**



Source: International Futures (IFs) v. 7.33, data from World Development Indicators. Note that all US\$ are in constant 2017 values.<sup>5</sup>

services have been absorbing workers faster than output in the sector has been increasing. The relative productivity of African market services fell from 3.0 times the economy-wide average in 1990 to 1.8 in 2010, suggesting that the marginal productivity of new services workers is low and possibly negative.<sup>10</sup>

Rather than improving productivity, Africa's structural transformation from low-productivity agriculture to low-productivity urban-based retail services has therefore been 'growth reducing'. This is because the share of workers employed in high-productivity sectors such as manufacturing is declining, offsetting positive 'within sector' productivity growth. The result is that the aggregate growth of output per worker is declining.<sup>11</sup>

Although the modern manufacturing sector includes a large service component, some of which is outsourced, and although services are in themselves becoming increasingly tradable, a vibrant manufacturing sector remains unique in the extent to which it boosts productivity throughout the economy, due to its forward and backward linkages that fuel the development of other sectors.<sup>12</sup> 'Manufacturing contributes disproportionately to exports, innovation and growth', according to Manyika et al (2012) in a wide-ranging report for the McKinsey Global Institute.<sup>13</sup>

Organizations as diverse as the World Bank, the African Union and the African Development Bank have long argued that it is particularly important to unlock the agricultural potential of Africa given widespread poverty, high levels of food insecurity, hunger and malnourishment. But beyond a basic, subsistence level of development, industrialisation determines agricultural efficiency and expansion, and even the development of high-value services. The knowledge spillover from manufacturing eventually makes it profitable to invest in more productive agricultural machinery and systems. Growth in manufacturing thereby increases wages and productivity in the agricultural sector.

Components of the primary sector, such as agriculture, can eventually be part of the 'high-tech' sector (given the potential for technological upgrading within the agricultural sector) when combined with IT or digital technologies. This is thanks to precision farming, automation and genetic engineering.<sup>14</sup> The geographic proximity to industry gives farmers a market with greater purchasing power, eventually allowing greater

specialisation in the division of labour in agriculture and an escape from subsistence farming.

The same holds for the materials sector. To benefit from the potential of beneficiation of raw materials, a country must purposefully develop local industries that have the capacity to add value to that material. Initial industrial development facilitates value addition to raw materials rather than the other way around.

The manufacturing sector stimulates growth in high-end services, such as finance and logistics

Similarly, the manufacturing sector stimulates growth in high-end services, such as finance and logistics, which in turn are crucial for continued improvements in productivity.

### Recent economic trends

Africa experienced a general economic decline during the 1970s and concomitant increases in debt. With the introduction of structural adjustment programs during the mid-1980s, the International Monetary Fund (IMF) and World Bank offered budget and balance of payments support. In return, the international financial institutions required adherence to an agreed set of policy reforms geared towards achieving macroeconomic stability.

Perhaps their most significant impact was the devaluation of official exchange rates to bring Africa's overvalued currencies to reasonable levels.<sup>15</sup> The subsequent development framework now shifted away from the state to reliance on markets for resource allocation and the private sector as the main engine for economic growth – but at the expense of effective oversight or an implementation role for the state.

Among other things, the conditional support the international financial institutions provided put an end to efforts at implementing national industrial policy that countries as diverse as Ethiopia, Ghana, Kenya, Mauritius, Mozambique, Nigeria, Senegal and Tanzania had tried, with very limited success.<sup>16</sup> The impact was to cut off industrialisation as a development option for Africa in favour of trade liberalisation, deregulation, the free market and a small state.

Figure 2 compares manufacturing as a percentage of GDP in Africa's low-middle and upper-middle income countries in the rest of the world. Apart from a growing gap until the end of the 1980s, upper-middle-income countries in Africa and elsewhere have steadily de-industrialised. From 1990 to 2015 the manufacturing value-added to GDP in lower-middle and upper-middle Africa is respectively around 6 and 7 percentage points below the global average for these two country groupings. Across country income-groups, the contribution of manufacturing to GDP in Africa has stagnated or contracted since the mid-1980s.

### The contribution of manufacturing to GDP in Africa has stagnated or contracted since the mid-1980s

On a comparative basis, Africa is significantly under-industrialised. The percentage of GDP consisting of services has steadily increased from around 44% of GDP since the 1980s to an estimated 57%, 48% and 41% average for Africa's upper-middle-, lower-middle- and low-income country groupings respectively.

Figure 3 presents manufacturing as a percentage of GDP, comparing sub-Saharan Africa with East and Southeast Asia, South Asia, and Latin America and

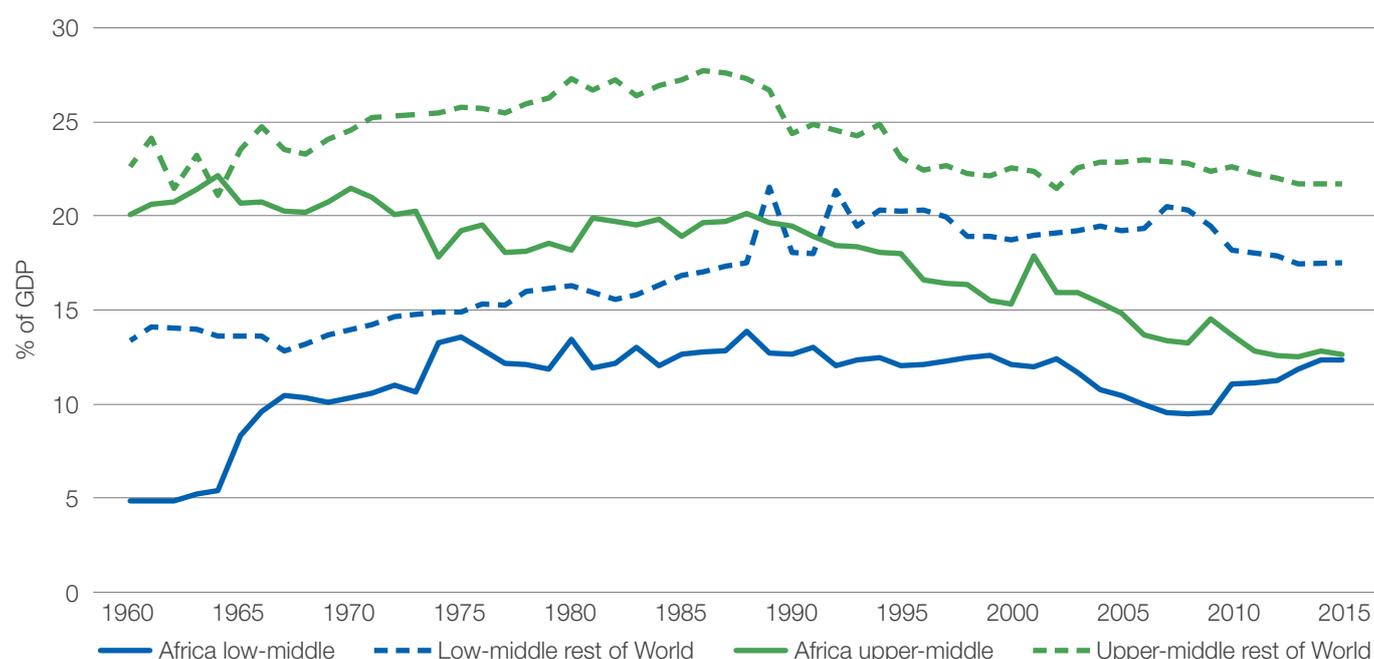
the Caribbean. It reflects the consistently low levels of manufacturing in Africa's post-colonial history. Whereas manufacturing and then high-end services have grown in other regions – in East, Southeast and South Asia, in particular – this has not occurred in Africa.

Generally, the services sector dominates in high-income rather than low-income economies. In high-income economies, this sector accounts for up to two-thirds of value added to GDP; in low-middle- and low-income economies, it accounts for up to half. Among other considerations, low tradability of services means that at lower levels of development predominantly service-based economies have less ability to export. Lower export earnings mean a weaker ability to buy advanced technology from abroad, which in turn leads to slower growth.

Chang (2002) goes as far as to characterise as 'a fantasy' the view that developing countries can largely skip industrialisation and enter the post-industrial phase where services increasingly drive growth: 'the manufacturing sector has an inherently faster productivity growth than the services sector.'<sup>17</sup>

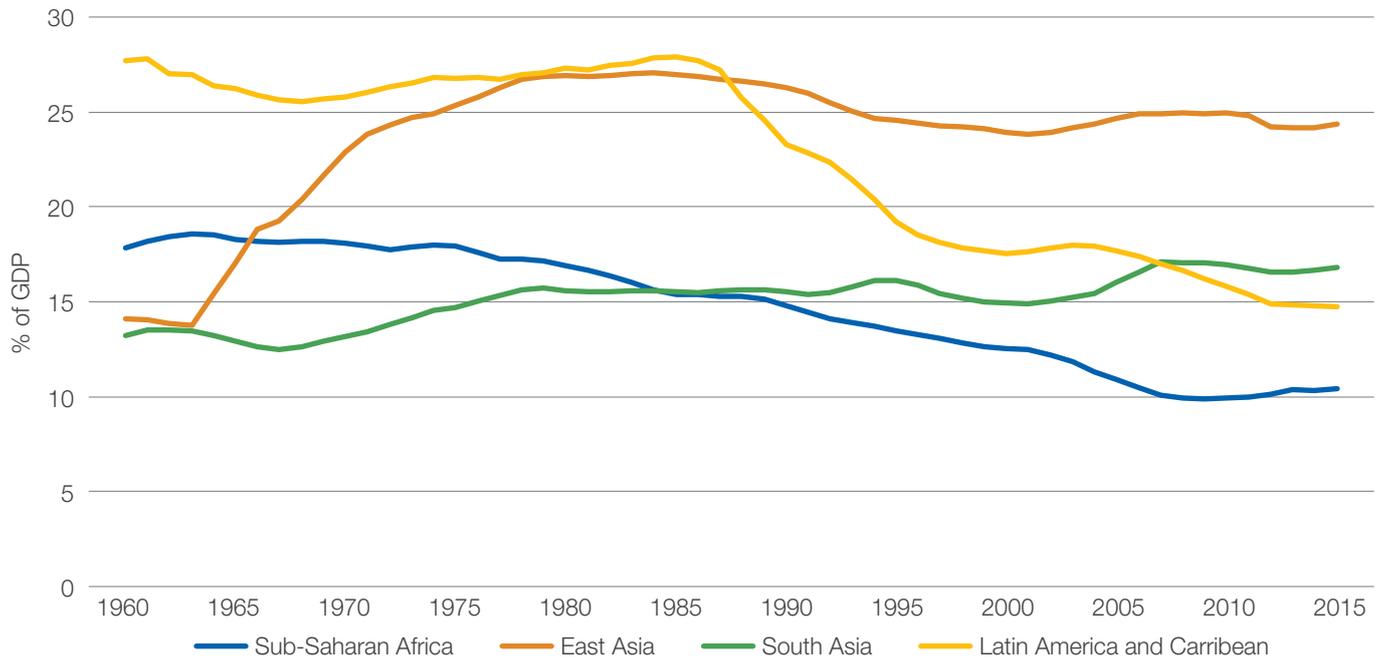
According to Monga (2017), the problem is that at low levels of development, 'most services are low-productivity, subsistence, and even informal activities that may help households escape poverty, but are

**Figure 2: Manufacturing as percentage of GDP: low-, low-middle and upper-middle-income country groups**



Source: IFS v. 7.33, data from IMF World Economic Outlook

**Figure 3: Manufacturing as a percentage of GDP by selected global regions**



Source: Calculation in IFs v. 7.33, five-year moving average

not sustainable sources of growth.<sup>18</sup> At higher levels of development, in sectors such as financial services, computer and software services, transport, and distribution, services have become very dynamic – but high-value services constitute a very small segment of the larger sector in much of Africa.<sup>19</sup>

‘Manufacturing’s role is also changing’, write Manyika et al (2012).

The way it contributes to the economy shifts as nations mature: in today’s advanced economies, manufacturing promotes innovation, productivity, and trade more than growth and employment. In these countries, manufacturing also has begun to consume more services and to rely more heavily on them to operate.<sup>20</sup>

While the manufacturing sector offers particular opportunities for capital accumulation, the relative capital intensity of manufacturing has declined over time. Since 1990, argues Szirmai (2009), capital intensity in manufacturing in advanced economies has been much lower than in the economy as a whole, lower even than in agriculture – although this is also a function of the declining share of manufacturing in the total economy.<sup>21</sup>

Services, such as transport, financial, health and recreation, are growing more rapidly than any other sector in their contribution to global GDP, including in

Africa. In India, often considered an example of service-sector led growth, the contribution of the services sector to GDP overtook that of agriculture in 1975. The contribution of manufacturing to GDP only overtook agriculture three decades later.

The early growth in services and the fact that India only recently entered a favourable demographic window – a period in which there is a large working age population relative to the dependent population – are two important reasons for India’s lower-than expected growth over a number of decades. Since 1991, economic liberalisation has unshackled an economy stifled by over-regulation, corruption and lack of competition.

The law of diminishing returns determines that countries that specialise in supplying raw materials, agricultural products or low-end services yield a progressively smaller return for every unit of capital or labour added compared to the provision of manufactured goods.

Unable to rapidly improve productivity and with a fast-growing and youthful population, per capita average income levels in Africa peaked in 1980 and declined to 1995 as trade shocks and economic crises took their toll, reflected in Figure 1.

From 1995, Africa’s economic growth accelerated and would remain robust for almost two decades

based on higher primary export volumes that were required to feed Asia's manufacturing and construction boom. Nevertheless, lack of policy certainty and high transaction costs attracted little private investment to Africa outside of the resources sector.<sup>22</sup> As Page (2017) notes, 'Structural adjustment had taken place without producing structural change.'<sup>23</sup>

The debate about the role of the state in Africa's development trajectory evolved markedly during this period. The mantra of 'good governance' – defined as 'the manner in which power is exercised in the management of a country's economic and social resources for development'<sup>24</sup> – steadily replaced the need to downsize the state.

Within the lexicon of donors, the IMF and World Bank, the focus on good governance was a way to respond to the inefficiencies, corruption and predation that had become a defining characteristic of many of Africa's governments. In time, the debate would eventually shift to the need to attract and enable foreign direct investment from the private sector as the best means to facilitate growth.

### Africa's economic structure

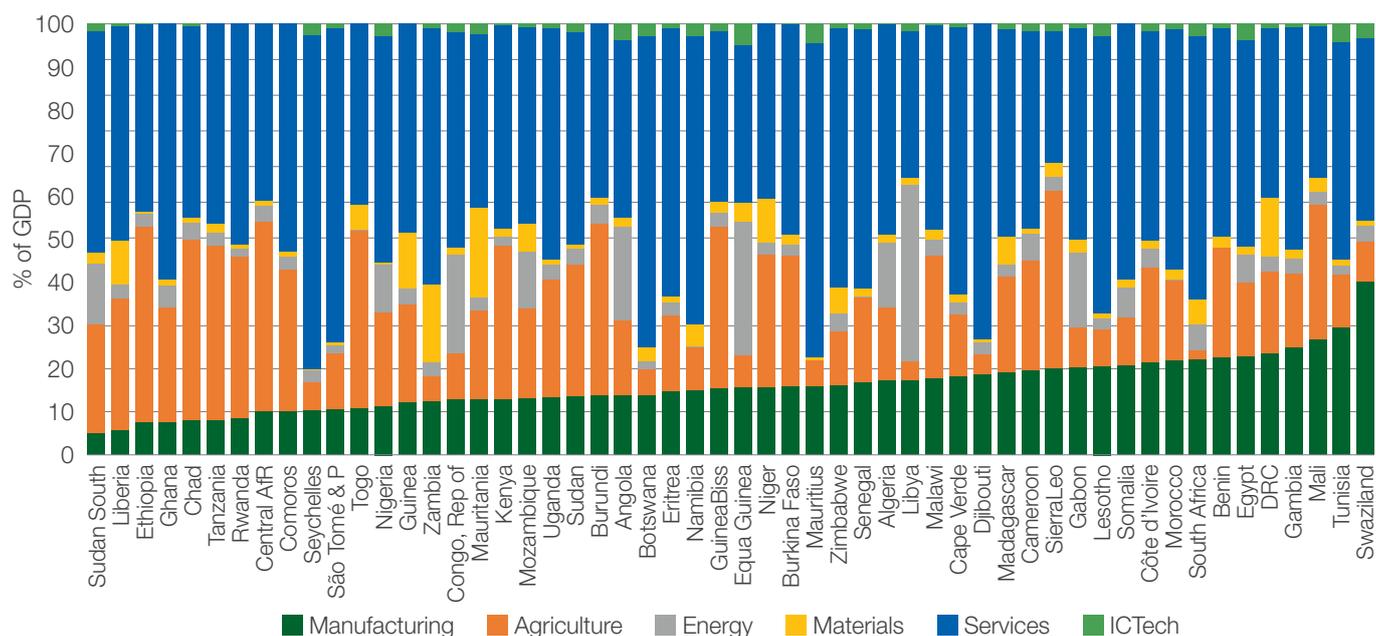
Figure 4 presents the composition of individual African economies in 2015, with countries sorted according to the contribution of the manufacturing sector to GDP.

The economics module in the IFs forecasting system conceptualises supply, demand and trade in each of six economic sectors: agriculture, energy, materials, manufacturing, services and in ICT.

The size of the manufacturing sector ranges from 5% in South Sudan to 29% in Tunisia (the second largest) and 40% in Swaziland, the last due to the location of clothing manufacturers to benefit from access to the US market under the African Growth and Opportunity Act. On average, the contribution of manufacturing to African economies has followed a steady decline since independence; and has never achieved the average manufacturing peak share of 20–35%, at which point manufacturing employment and output both decline as wages rise, consumers have more money to spend on services and that sector's growth accelerates.<sup>25</sup>

Ethiopia has the largest contribution from agriculture to GDP at 45% and South Africa the smallest at slightly more than 2%. Yet South Africa, which has an efficient commercial farming sector, is one of the few African countries that is largely self-sufficient in foodstuffs, whereas Ethiopia is a net food importer and import dependency is set to expand significantly. Energy makes the smallest contribution to GDP in Benin and

**Figure 4: Sectoral composition of African economies by value added to GDP, arranged by relative size of manufacturing sector (2015)**



Source: IFs v. 7.33, data from IMF World Economic Outlook

the largest in Libya, at close on 41% due to role of oil in the economy. Other large energy producers are Angola, Republic of Congo and Equatorial Guinea.

The economy of Africa's only high-income economy, the island state of the Seychelles, has the smallest contribution from the materials sector. The two countries with the largest contribution from materials are Mauritania (mostly iron ore) and Zambia (copper). The African country with the smallest services sector is Sierra Leone, at 31%. The services sector constitutes more than 70% of GDP in Botswana, São Tomé and Príncipe, Mauritius, Djibouti and the Seychelles. ICT is smallest in Niger.

In no African country does ICT contribute more than 5% of GDP. In Nigeria, Africa's largest economy, IFs calculates that agriculture accounts for 21% of added value to GDP, energy for 11% (despite its huge petroleum sector), manufacturing for 11%, services for 52% and ICT for 3%.

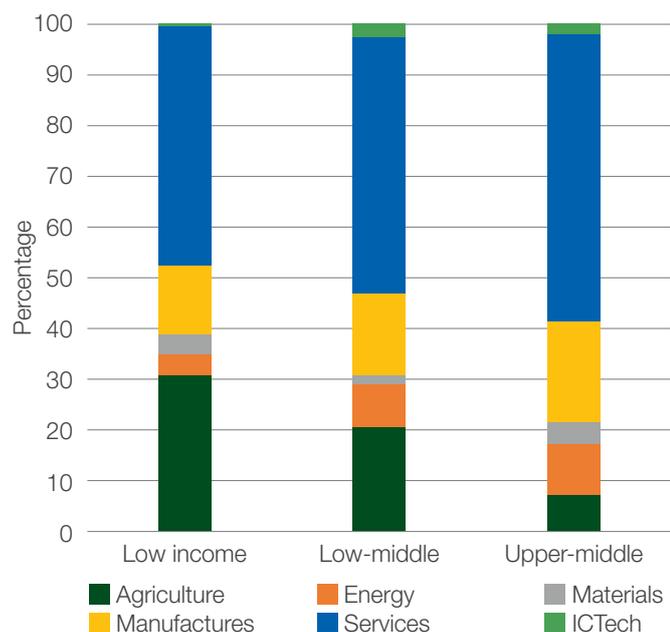
Figure 5 presents the sectoral composition of African economies compared to those in the rest of the world by World Bank income groupings. An agricultural sector characterised by low productivity dominates African economies, on average accounting for 30% and 20% of the value-added of Africa's 27 low- and 18 lower-middle-income countries' GDP. Manufacturing accounts for 14% and 16% in each grouping.

What is readily evident from Figure 5 is that Africa's share of manufacturing as a portion of GDP is two, nine and ten percentage points lower than that for low-, lower-middle- and upper-middle-income country groups in the rest of the world. Figure 5 also illustrates the extent to which Africa's upper-middle-income economies trail behind those in the rest of the world in the contribution that ICT makes to GDP (by an average of two percentage points).

Over the last two decades, ICT has overtaken agriculture as the third-largest contributor to GDP by value globally and it has become particularly important in high-income economies. Whereas the ICT sector is responsible for only 1% of the value-add to GDP in low-income countries (and agriculture 30%), it contributes almost 8% to GDP in high-income countries (whereas agriculture only contributes 2% of added value in high-income countries). Despite its relatively small contribution to added value, in many instances ICT is a growth multiplier, particularly at higher-income levels because it facilitates knowledge exchanges, including the effective functioning of regional and multinational value chains that include goods and services.

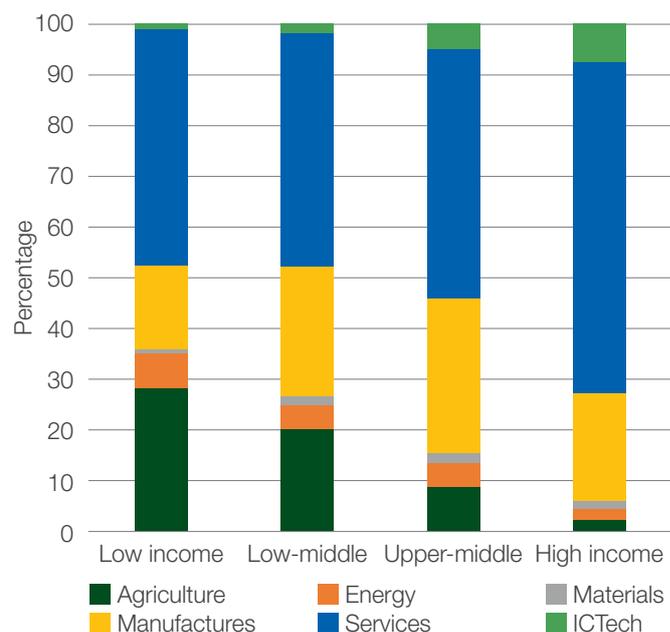
With a small (and declining) industrial sector, the African continent is struggling to achieve higher productivity in other sectors such as agriculture, which is larger (as

**Figure 5a: Sectoral composition of economies in Africa (2015)<sup>26</sup>**



Source: IFs v. 7.33, data from IMF World Economic Outlook

**Figure 5b: Sectoral composition of rest of the world economies by income group (2015)<sup>27</sup>**



Source: IFs v. 7.33, data from IMF World Economic Outlook

proportion of GDP) when compared to that in the rest of the world.<sup>28</sup>

Contrast this with the situation in emerging Asia, which embarked on a targeted and conscious effort to expand the contribution that manufacturing made to its economies, largely through the establishment of regional value chains that morphed into global value chains (GVCs). Over time, GVCs became longer and more complex as firms sought locations that provided the most benefit from low labour and transport costs, as well as good access to raw materials and markets.

Different parts of the production process were eventually located in different locations. Design occurred in California, high-technology manufacturing in Singapore, Taiwan and Hong Kong, and assembly in China, Vietnam, Thailand or Indonesia, as part of the vertical disaggregation of manufacturing, characterised by offshoring, outsourcing and the availability of knowledge and capital that resulted in rapid productivity growth.

The ICT revolution that began in the 1990s lowered the cost of coordinating complex processes over large distances, in a way that is comparable to how the steam engine and eventually the combustion engine lowered the cost of transportation. Knowledge and ideas flowed seamlessly across international borders and trade agreements became deeper to facilitate the flow of information and development of integrated manufacturing value chains.

The ICT revolution that began in the 1990s lowered the cost of coordinating complex processes over large distances

Beyond the structural transformation between sectors, such as the shift from agriculture to manufacturing and services, productivity transformation within each sector determines income growth. In the manufacturing sector, Asian economies upgraded technology by jumping from one product to another with increasing knowledge content.

This is the analogy of the flying geese model – the division of labour in East Asia that Japan and others pursued so effectively during the 1960s.<sup>29</sup> In this model, Asian countries caught up with the West in the

production of manufactured goods by steadily moving up the value chain to more productive (and higher-value) activities.

GVCs require technical testing, legal advice, ICT support and other business services to facilitate international goods sourcing. Modern services such as logistics support, transport and communication services play an important role in coordinating value chain activities. In the process, services become a major source of value creation for multinational companies, allowing for the differentiation of products and increasing the value of manufactured items.

Service inputs therefore make up an increasing amount of manufacturing activity. In some manufacturing industries, more than half of all employees work in service roles such as research and development and office support roles. In the last two decades pure services GVCs have emerged; for instance, in tourism and business services including accounting, tax and investment advice.<sup>30</sup>

The explosive growth of GVCs during the early 2000s eventually spanned a number of companies, industries and countries. The world entered a decade of hyperglobalisation because of 'better communication technologies, falling trade barriers, the expansion of MNEs [multinational enterprises], more efficient services and the growing capabilities of emerging economies.'<sup>31</sup> GVCs became the backbone of the global economy, facilitating enormous flows of goods, services, capital, people and technology across borders. They transformed emerging economies such as Taiwan, Singapore and South Korea into manufacturing powerhouses.<sup>32</sup>

In time, the factory economies of the G7 countries (with some exceptions, such as Germany and Japan) deindustrialised, while manufacturing grew in Asia. China and others experienced dramatic levels of industrialisation and thus rapid income growth even as production processes became increasingly complex.

Thus, manufacturing shifted from the G7 group of industrialised countries to China (the largest gainer) and other developing countries such as South Korea, India, Indonesia, Thailand, Turkey and Poland. While the G7 accounted for over 60% of global manufacturing (measured as a proportion of global GDP) in the early 1970s, that share has declined to less than 40% today.<sup>33</sup>

In contrast to the Asian development trajectory, by 2004 average income levels in Africa had only regained the losses since 1980 and improved by an additional 21% in the period to 2015, at which point growth weakened in the wake of commodity price declines. Yet throughout this period, the gap in average income levels, infrastructure and education between Africa and the rest of the world increased.<sup>34</sup>

However, the picture has started to change as employment in sub-Saharan economies has begun to shift towards marginally higher-productivity activities in the services sector (household enterprises, transport, business and trade services) and not towards industry.<sup>35</sup> The lack of an associated demographic transition, which would result in a lower number of dependents relative to workers, means that on current forecasts by Fox, Thomas and Haines (2017), 'Sub-Saharan Africa will not be able to transform through manufacturing as East Asia did over the past two decades.'<sup>36</sup> Thus:

the African growth experience over the last 35 years can, in general, be characterised as...growth in capital-intensive resource- and energy-based industries – which in turn have not generated a sufficient number of jobs. Africa's manufacturing sector has stagnated in output and employment terms. The latter happened in an environment of an unproductive agriculture sector and an employment intensive, urban-based informal retail sector.<sup>37</sup>

Since 2008 trade in goods has grown more slowly than world GDP. GVCs also appear to be shortening as production moves closer to end consumers – part of improving speed to market. Non-labour costs – including the costs of managing complex GVCs – have increased in importance compared to the situation two to three decades earlier.

The sum impact is a trend where the growth and trade within regional trading blocs (as opposed to between these blocs) becomes even more important than they have been historically.<sup>38</sup> Writing for the Organisation for Economic Co-operation and Development (OECD), De Backer and Flaig (2017) explain that rising trade costs and protectionism since the 2007-08 crisis has made international production more expensive.

The increased complexity evident in GVCs may also mean that these arrangements have reached some type of ceiling, despite advances in ICT. The organisation

of production in long and complex GVCs has limited the flexibility and agility of companies to respond to changes in consumer preferences. Localised production, closer to the end-market, has become more attractive in advanced and emerging economies alike.<sup>39</sup> The move towards greater customisation supports this trend: 'Digital technologies...will increasingly allow for customised products manufactured at the cost of a standardised product (some even go as far as "manufacturing on-demand").'<sup>40</sup>

### The contribution of manufacturing to GDP in Africa has stagnated or contracted since the mid-1980s

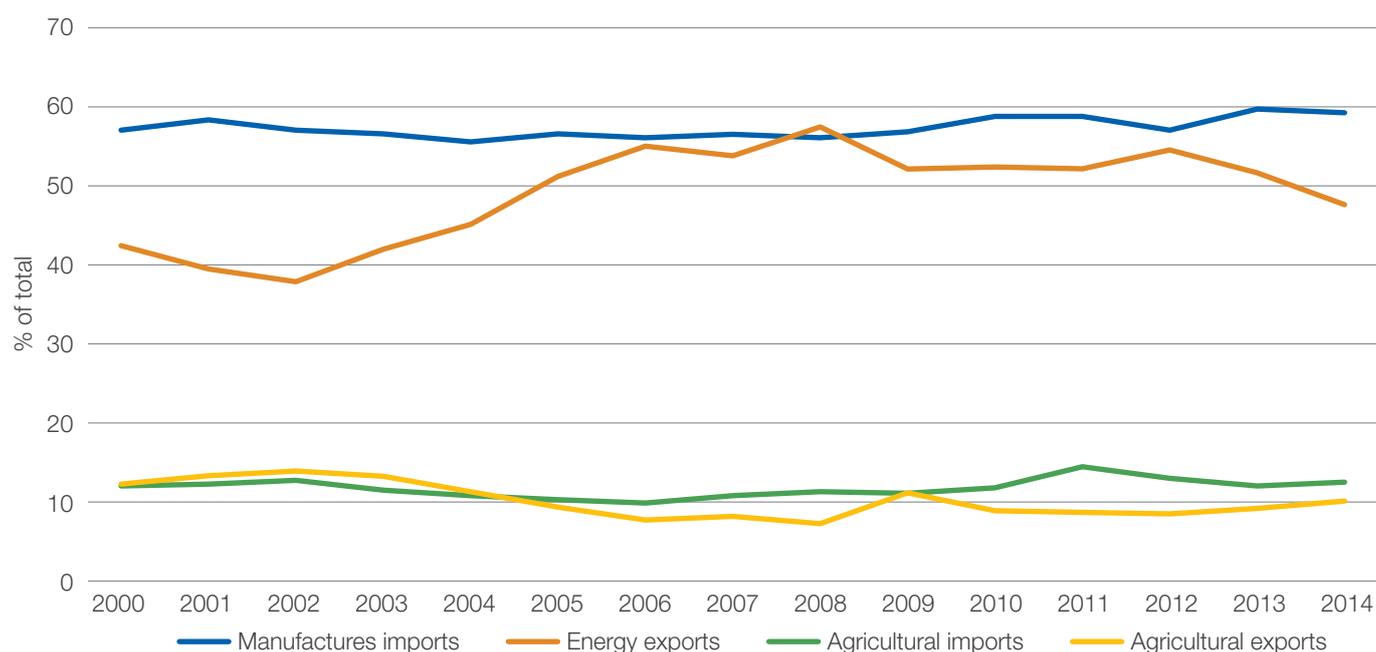
The challenge and opportunity that Africa faces in growing manufacturing on the continent is evident when looking at the composition of import and exports (see Figure 6). Manufactured goods consistently make up close to 60% of Africa's imports by value, while the dominant export segment is energy exports (mostly oil from countries such as Nigeria, Algeria and Angola, and coal from South Africa).

Agriculture constitutes around 12% of imports by value and around 9–10% of exports. Despite the continent's huge agricultural potential, dependence on food imports is growing, with nine African countries depending on imports for more than 40% of demand rather than domestic production (Algeria at 40%; Botswana, Cape Verde, Djibouti, the Gambia, Lesotho, Mauritania, the Seychelles and Somalia at 90%).

The entry point for industrialisation traditionally involved labour-intensive segments of regional manufacturing value chains, meaning that labour costs needed to be competitive. Given that Africa suffers from various other industrialisation disadvantages, such as poor physical infrastructure,<sup>41</sup> high disease burden and poor rule of law, as well as low regulatory and policy quality, lack of policy certainty and the like, the general view is that African labour costs need to be cheap enough to compensate for these other deficits.<sup>42</sup>

A study on Africa's manufacturing labour costs by Gelb et al (2017)<sup>43</sup> concluded that poor African countries have higher labour costs than their average income levels would suggest. The study compared 12 African countries

**Figure 6: Most important import and export sectors: Africa's combined trade with the rest of the world**



Source: IFs v. 7.33

to 17 non-African countries; only Ethiopia compared favourably, labour costs in other African countries being higher than those of their non-African peers. South Africa stands out as a middle-income country with particularly high labour costs and a very capital-intensive industrial sector.

Among low- and lower-middle-income countries, manufacturing labour costs in Kenya, Tanzania and Senegal – three relatively stable coastal countries with strong business sectors – are higher than in Bangladesh, a country with a comparable World Economic Forum (WEF) competitiveness rating and income levels.

According to this logic, Africa is competing with others in poverty wages, although one of the effects of the fourth industrial revolution is the declining importance of labour costs in the location of industry, as reflected in earlier sections in this report.

### Africa's inability to industrialise

In a multi-year study of industrial development that compared eight African countries with Cambodia and Vietnam, Newman et al (2016)<sup>44</sup> offer a number of reasons that, taken collectively, explain Africa's lack of industry.

The first reason is the widely held belief that the initial conditions for industrial development did not exist

in Africa, including basic infrastructure and human capital, financial depth and barriers to entry. It suffices to point out here that these initial conditions did not exist in Japan, the so-called Asian Tigers (Hong Kong, Singapore, South Korea and Taiwan) or China at the time of their modern industrialisation. Governments have to create the right incentives to overcome barriers and create favourable conditions. That, in turn, requires a governing elite committed to economic growth and sufficient government capacity to formulate and implement policy.<sup>45</sup>

Second, few African countries (Tunisia and Mauritius are rare exceptions), set out and implemented a concerted package of public investments, appropriate policy and institutional reforms to increase the share of industrial exports in GDP. In the majority of African countries, little or no consistent effort to boost non-traditional exports, which mostly consist of commodities, was evident.

Third, contrary to successes achieved elsewhere, African governments paid little or no attention to special economic zones (SEZs) where export-oriented industrial agglomerations could benefit from the advantages of proximity to high-quality institutions leading to information and knowledge spillovers, and provision of better social services and infrastructure in a limited physical area.<sup>46</sup> Instead, firms are dispersed in larger

urban areas, such as the capital city, with limited involvement in the same value chain, limiting the scope for localisation economies.<sup>47</sup>

A fourth consideration is that although African governments created institutions that advocated for foreign direct investment (FDI), this was done without real commitment and implementation support, which explains why these efforts achieved very little.<sup>48</sup>

Fifth, a large number of African countries such as Ghana, Kenya, Mozambique, Nigeria, Senegal and Tanzania have embarked on investment reforms in an effort to improve the physical, institutional and regulatory environments in which firms operate. However, active efforts to improve the competitiveness of domestic industries or practical measures to reduce trade friction costs that result from poor trade logistics have not accompanied these reforms.<sup>49</sup>

African governments did not invest in high-quality infrastructure in SEZs, nor did they promote these zones

In low-income countries, domestic industry generally benefits from positive productivity spillovers from foreign-owned firms, particularly if part of the same value chains; but since governments did not pursue such efforts, African firms did not benefit.<sup>50</sup>

Finally, African governments did not invest in high-quality infrastructure in SEZs, nor did they promote these zones and bring in professional management. African SEZs are generally not connected to domestic value chains, since governments' practice (if not policy) was to treat them as stand-alone enclaves.<sup>51</sup>

Without a concerted 'export push' towards higher-value items, combined with determined efforts to protect domestic industry, African countries did not grow the more productive sectors of their economies. Eventually, the reforms associated with structural adjustment policies in the 1980s that were required to deal with Africa's unsustainably high debt levels contributed to 20 years of low growth and low investment.

Bad luck has also played a role in Africa's inability to industrialise. When African economies again spluttered into life at the end of the twentieth century, they not only had to compete with the industrial North but

now also with a number of countries in East Asia, including China.

Global developments may, however, now work to Africa's advantage. These include the impact of the digitisation of production and the trend towards locating manufacturing closer to markets – the impact of what Baldwin (2016)<sup>52</sup> has termed 'new globalisation'.

### The impact of new globalisation

Baldwin argues that knowledge flows consisting of data, information searches, communications, transactions and video dominate new globalisation rather than physical goods and finance crossing borders.<sup>53</sup> Cross-border flows in data, for example, were 45 times bigger in 2016 than there were a decade before.<sup>54</sup> Global flows of knowledge contribute to economic growth and there appears to be potential for lagging countries to catch up in this dimension through investment in ICT. In theory, individuals can directly participate in globalisation, using digital platforms to learn, find jobs, showcase their talent and build networks. In practice, this opportunity is limited to those connected to the internet and with the orientation, knowledge and interest to pursue them.

That caveat aside, ICT-led globalisation and associated knowledge flows are undermining the previous competitive advantage the industrialised countries held as well as the outlook for GVCs, since an increased number of jobs in the developed world are now in direct competition with jobs in emerging economies. The cross-border flow of data and knowledge has broken the monopoly that rich-nation workers had on the use of advanced industrial-manufacturing intellectual property, thereby empowering emerging countries. Baldwin summarises it as follows:

firms could now combine high-tech ideas with low-wage workers in developing nations. While this change was profitable for the offshoring firms and spurred spectacular growth in some developing nations, it also disrupted the livelihoods of rich-nation workers. In some communities, this disruption led to economic fragility and uncertainty, spurring anti-elite, anti-government, and anti-globalization sentiment in Europe and the United States.<sup>55</sup>

In contrast to the disruptive impact of globalisation in rich countries, it has had a cohesive impact in emerging markets, where the middle class has flourished and millions of people have been lifted out of poverty.

The result of these knowledge flows is the denationalisation of the concept of comparative advantage in countries that were part of integrated trade blocs, such as the North American Free Trade Area (NAFTA), the European Union (EU), and East and South-East Asia, where GVCs have been established.<sup>56</sup>

In response to the impact of new globalisation, industrialised countries have embraced policies to protect their knowledge – excessive use of patent protection being an important example – while the emerging factory economies have embraced policies that foster knowledge sharing and creation. It is for this reason that China champions globalisation, while the previous advocate of free trade, the USA (under President Donald Trump), seeks to protect its domestic manufacturing sector from foreign competition; for example, slapping tariffs on imported solar cells and washing machines from South Korea.<sup>57</sup>

As mentioned above, new globalisation is having an impact on GVCs. The international fragmentation of production in search of the lowest cost, which was at the heart of GVCs, appears to have lost momentum,<sup>58</sup> partly because of the impact of the 2007-08 recession, but also due to the shifting economic balance of power.<sup>59</sup> The trend for GVCs to grow in length, complexity and pervasiveness is coming to an end, translating into a global slowdown in trade of goods and services.<sup>60</sup>

Analysts worry that the world has passed ‘peak globalisation’ and that globalisation may even begin to reverse.<sup>61</sup> The most extreme views warn of creeping manufacturing nationalism that hark back to the period that followed the previous great global integration period, which ended calamitously, in the years leading up to the

First World War. Some argue that technological progress and monetary policy may now threaten the current global integration project.

Against this backdrop it is important to acknowledge that a number of African countries have introduced more active approaches to industrialisation, including giving export processing zones (EPZs – broadly, a renaming of SEZs) another try.

Analysts worry that the world has passed ‘peak globalisation’ and that globalisation may even begin to reverse

Africa can also gain from the move to make services, including sales and client services, tradeable. Thus, back office operations including accounting can now spin off and be subcontracted, while front-end customer interaction, such as sales and client services, including data transcription and call centres, can be located anywhere in the world. Most African countries use languages such as English, French, Arabic and Portuguese that are important assets for communication-based services, as well as offering tourism destinations to regions that are rich in culture and wildlife but outside of the traditional destinations.<sup>63</sup>

Mobile (cell) phone usage has increased faster in Africa than anywhere in the world. The widespread adoption of applications such as M-Pesa, a phone based mobile banking app, has created enthusiasm that the mobile revolution can transcend backlogs in other areas. A recent study found that the service has lifted nearly 200 000 people out of poverty since its inception in

**Table 1: Old versus New Globalisation<sup>62</sup>**

Old Globalisation/20th Century	New Globalisation/21st Century
Tangible flows of physical goods	Intangible flows of data and information
Flows mainly between advanced economies	Greater participation by emerging economies
Capital- and labour-intensive flows	More knowledge-intensive flows
Transportation infrastructure is critical for flows	Digital infrastructure becomes equally important
Multinational companies drive flows	Growing role of small enterprises and individuals
Flow mainly of monetised transactions	More exchanges of free content and services
Ideas diffuse slowly across borders	Instant global access to information
Innovation flows from advanced to emerging economies	Innovation flows in both directions

Source: McKinsey Global Institute

2007. Today, more than 95% of households in Kenya have an M-Pesa account, and the service is expanding aggressively into neighbouring countries.<sup>64</sup>

UNICEF's 2017 *State of the World's Children* report summarises the potential of ICT to transform education:

Information and communication technologies (ICTs) are already expanding access to high-quality educational content, including textbooks, video material and remote instruction, and at a much lower cost than in the past. They can potentially increase student motivation by making learning more fun and relatable. And they create opportunities for personalised learning, helping students to learn at their own pace and helping educators with limited resources provide students with better learning opportunities.<sup>65</sup>

However, the report goes on to warn that technology on its own cannot fix education without support from 'strong teachers, motivated learners and sound pedagogy.'<sup>66</sup>

The **first industrial revolution** in the eighteenth and nineteenth centuries was based on the iron and textile industries, and the development of the steam engine.

The **second industrial revolution**, just before the First World War, used electric power for the telephone, light bulb, phonograph and internal combustion engine.

The third or **digital revolution** started during the 1980s and includes the personal computer, internet, and information and communications technology.

The **fourth industrial revolution** builds on the Digital Revolution, representing new ways in which technology becomes embedded within societies and even the human body. It is generally assumed to be about the future impact of technologies such as robotics, additive manufacturing (3D printing), blockchain software technology and big data.

Source: World Economic Forum

On the one hand, it is important to temper expectations about the potential of ICT as a general technology that will enable Africa to leapfrog its many traditional infrastructure deficits. On the other hand, the potential for leapfrogging across various dimensions of health,

education and even infrastructure is expanding year-on-year. Examples include the provision of electricity from renewables as part of off-grid and mini-grid solutions; and self-diagnosis and preventive health care using phone-based technologies. Smartphone apps can already diagnose a variety of diseases, assist in prevention and improve the efficiency of health care. Mobile data devices connect farmers with markets, provide access to accurate weather forecasts and analyse soil nutrients.

However, ICT's most important potential contribution is the potential to help bridge Africa's educational deficit at a time of rapidly changing educational demands to prepare students for a digital future. Here ICT has particularly impressive leapfrogging potential, where pupils in remote areas can access world-class educational materials on handheld digital devices, given sufficient bandwidth at a low enough cost.

ICT's most important potential contribution is the potential to help bridge Africa's educational deficit

In 2010, the World Bank estimated that it would require US\$93 billion a year to close Africa's infrastructure gap, the majority of which would be for the production and distribution of electricity. Actual annual infrastructure investment is only half of that, at US\$45 billion.<sup>67</sup> Previous work by the ISS indicates that deficits in the provision of water and sanitation may actually be even more significant.<sup>68</sup>

Solar, wind and geothermal technologies are particularly well suited to decentralised and distributed energy generation consisting of off-grid and microgrid solutions.<sup>69</sup> According to one estimate, decentralised off-grid solutions could reach 70% of people globally without access to electricity.<sup>70</sup> Off-grid solutions will also 'create greater options for a decentralised access to education, health, and ultimately wealth.'<sup>71</sup> Thus, off-grid systems may be more robust and less affected by unreliable supply and allow Africa to leapfrog some aspects related to its infrastructural deficit

Recent work by the ISS in Kenya hints at the extent to which new technologies may allow for infrastructure leapfrogging in specific areas, such as expanding

electricity access. Whereas data for 2013 from the World Development Indicators around 20% of Kenyans have electricity, public survey data for 2016 from IPSOS puts the figure at 60%. This large discrepancy is largely the result of generators, solar, wind and geothermal that have taken off dramatically in East Africa in recent years.<sup>72</sup>

### Africa’s manufacturing opportunities

Generally, it is becoming increasingly difficult to industrialise. Levels of peak manufacturing employment have declined with each wave of industrialisation from around 30% of employment with the first wave of smokestack industries three centuries ago to levels roughly half that today.<sup>73</sup> This is a trend that will accelerate because of the impact of the fourth industrial revolution on manufacturing and associated reductions in rates of labour absorption.

Manufacturing is hugely diverse. McKinsey identifies five broad manufacturing groups, with different industry characteristics and intensity of factors such as research

and development (R&D), labour, energy, trade and value (see Figure 7).

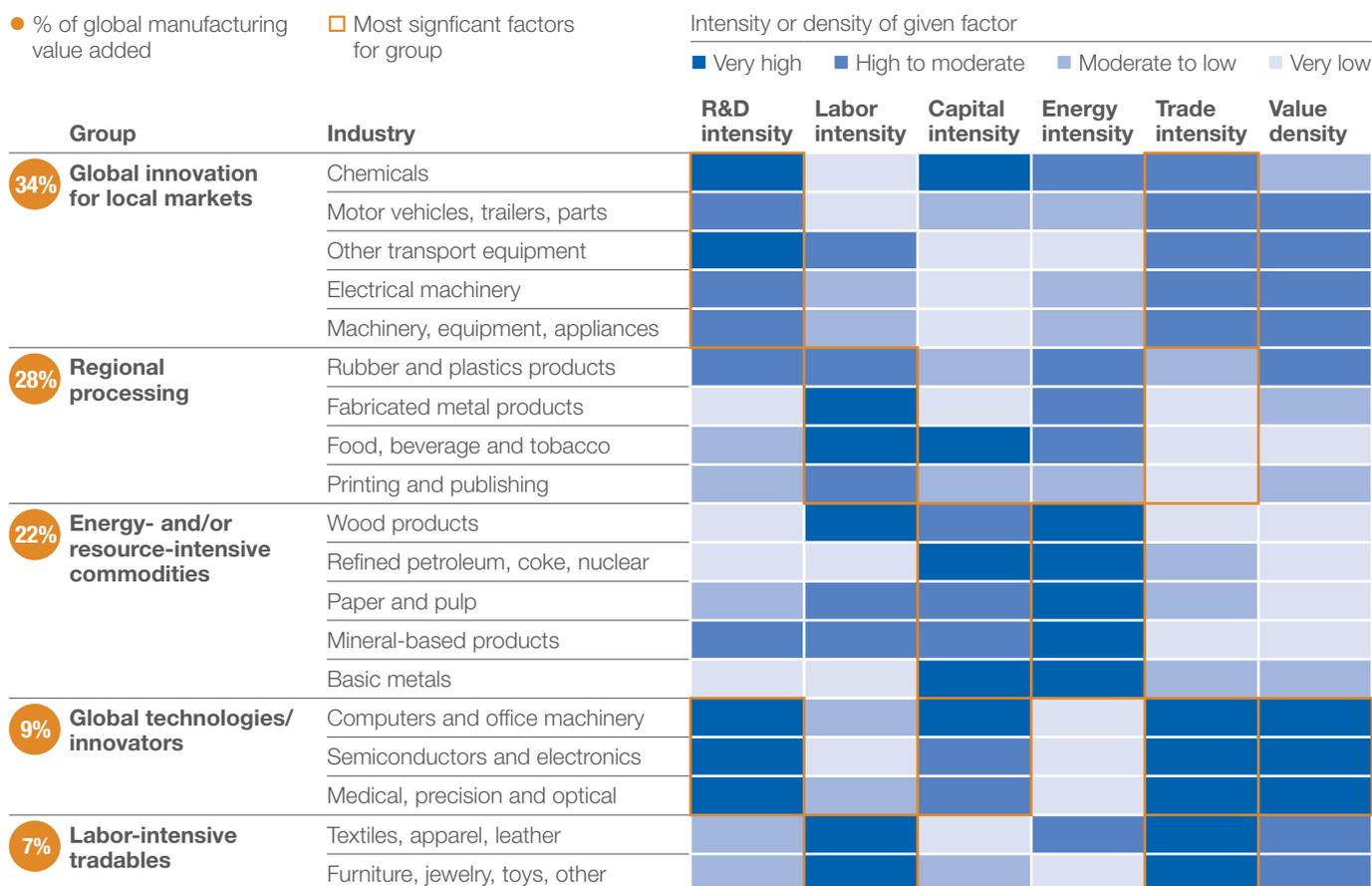
A confluence of technologies is also likely to significantly affect manufacturing globally including a variety of digital technologies, new materials (such as bio- or nano-based materials) and new processes. On a conceptual level, three technologies underpin the digitalisation of production:

the Internet of Things (IoT) – which enables the interconnection of machines, inventories, and goods; big data and embedded software which allow for the analysis of the huge volumes of digital data generated by these objects; and cloud computing providing the ubiquitous availability of computing power.<sup>75</sup>

Sites such as futurism.com report spectacular improvements in artificial intelligence, robotics and autonomous systems almost daily.<sup>76</sup>

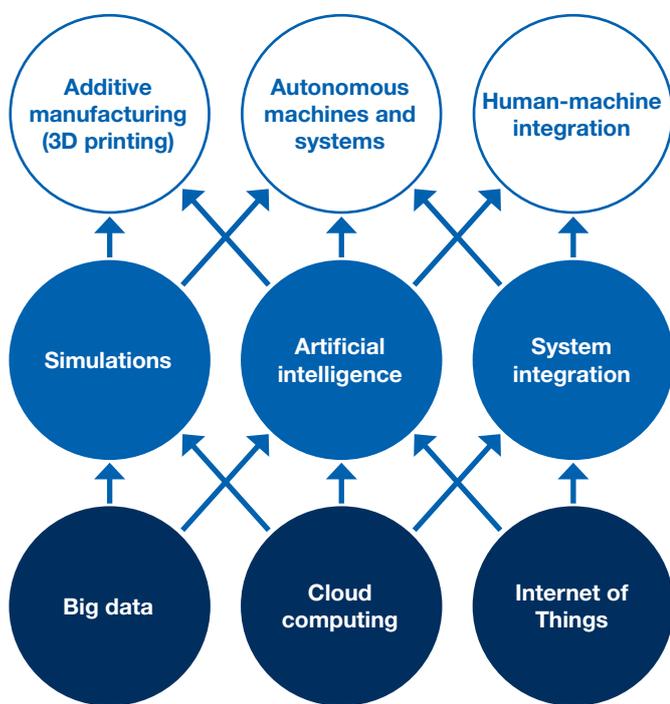
The OECD presented the confluence of these three technologies in the diagram in Figure 8.

**Figure 7: Manufacturing groups according to McKinsey<sup>74</sup>**



Source: McKinsey Global Institute

**Figure 8: The confluence of key technologies enabling the industrial digital transformation<sup>77</sup>**



Source: De Backer and Flaig

Labour-intensive manufacturing companies will inevitably locate themselves to follow the path of low wages where Africa currently has limited competitive advantage whereas other manufacturing sectors need to weigh factors such as access to low-cost transportation, proximity to the end consumer and critical enablers such as modern infrastructure.

In the past, automation replaced and added muscle to work. The potential now is for machines not only to automate routine tasks, but also to do wholly different tasks, such as developing tacit knowledge. With artificial intelligence, computers are discovering things for themselves (such as more efficient aircraft design) and can do pattern matching better than humans, allowing solutions that would otherwise require inordinate resources such as improved inventory management, or predicting problems with mobile phone networks before they occur, or converting text into sound for the visually impaired. The amount of processing power has increased exponentially and availability of data has expanded – when these are all put together, it translates into very rapid progress.

When considering the widespread impact of these new technologies, however, it is important to bear in mind that ‘what is technically feasible is not always also

economically profitable.<sup>78</sup> The breathless forecasts in respect of the transformational impact of artificial intelligence and the fourth industrial revolution therefore need to be considered with a degree of probity in managing expectations. These developments will also have very different impacts in the developing versus the developed world if largely because what is generally at risk is higher paid routine labour, where robotics present a huge threat.

According to the OECD:

the growing digitalisation of production is most likely the biggest game-changer, reversing the importance and length of GVCs and reorienting global production and trade back towards OECD economies. Reshoring of activities [relocation back home] is expected to become increasingly attractive when these activities can be highly automated; the employment impact of reshoring [within OECD countries] can thus be expected to be rather limited.<sup>79</sup>

Robotics, automation, computerised manufacturing and artificial intelligence all appear to reduce the advantage of low-labour-cost locations. On the other hand, rapid growth in multinationals and consumers now occur within emerging economies. McKinsey estimates that almost half of the world’s largest companies by 2025 will have headquarters in emerging markets and closer to consumer growth.<sup>80</sup>

The sum effect of these trends is likely to restrict the ability of national companies to expand into global markets and constrain the extent to which Western multinationals dominate globally as they have done in the past. Results will be mixed, resulting in greater divergence between regions, but allowing for greater competition.

Africa offers limited but fertile territory in this reorientation of manufacturing, high-end services and GVCs. Although the middle class in Africa is small, it is growing rapidly. The challenge will be to grow African companies – and to attract foreign companies to locate in Africa – and establish regional value chains, rather than allowing the export of unprocessed commodities and minerals.

In January 2018, in his acceptance speech as incoming chair of the African Union, President Paul Kagame of Rwanda pointed to this exact challenge. He acknowledged industrialisation as the historical pathway to prosperity, but asked if an industrialisation growth trajectory is still a viable option for Africa? ‘Technology

has evolved so rapidly in recent years, that Africa's window to follow that strategy is narrowing much more rapidly than previously understood.<sup>81</sup> Not only is the number of people employed per unit of manufacturing output declining, but Asian and other exporters have also successfully penetrated domestic markets in sub-Saharan countries, making it difficult for these countries to build productive manufacturing sectors.<sup>82</sup>

Newham et al (2016) believe that industrialisation in Africa remains possible, although its shape and form will differ from those experienced previously elsewhere. The authors offer three considerations:

First, economic changes are taking place in Asia that create a window of opportunity for late industrializers elsewhere to gain a toehold in global markets. Second, the nature of manufactured exports themselves is changing. A growing share of global trade in industry is made up of stages of vertical value chains – or tasks – rather than finished products. Trade in tasks offers late industrializers an opportunity to enter global markets in areas suited to their factor costs and endowments of skills and capabilities. Third, trade in services and agro-industry is growing faster than trade in manufacturers. These 'industries without smokestacks' broaden the range of products in which Africa can compete, and a number of them are intensive in locations specific factors abundant in Africa.<sup>83</sup>

In a manner similar to the opportunity created by the wage gap between China and the OECD economies around 1980, the growing wage gap between Africa and the rest of the world could eventually offset the productivity advantage of incumbent industrial producers, including in East Asia. However, according to the analysis by Gelb et al (2017),<sup>84</sup> most African countries (with the exception of Ethiopia) are still some way off from that point. However, there is some indication that China has decided to 'offshore' a portion of low-end manufacturing in Africa.

Standards of living are rising in China and pushing up manufacturing costs. At the same time, China and other countries in East Asia are restructuring their economies to meet growing domestic demand, creating space for potential competitors in third-country markets. Africa has to compete with alternative destinations such as Bangladesh, which seems to be emerging as the low-end manufacturing market of choice for future relocation.<sup>85</sup>

While the conditions for African industrialisation as part of GVCs are perhaps now less favourable in relative terms than in the 1960s, the fact that manufactured imports consistently make up close to 60% of Africa's imports by value reflects the large potential for domestic manufacturing and includes basic products ranging from apparel to electronics. The African Union is taking a number of practical steps, such as the launch of the Single African Air Transport Market with the potential to promote trade, cross-border investment and tourism.

The challenges are huge. In a working paper for the African Development Bank, Bhorat et al (2017) describe:

a sub-Saharan African (SSA) productive structure that is disconnected and characterised by products with low levels of complexity...the productive structure in SSA is inherently characterised by lower levels of economic complexity, which informed the notion of limited productive capabilities...the African manufacturing sector is marginal in nature and points to limited employment opportunities.<sup>86</sup>

### **Industrial policy, protection and government support**

Rich countries have all moved through a stage in their development that, when successful, subsequently makes free trade desirable, a stage that China is rapidly entering. This is because the pursuit of open markets and free trade is the result of wealth creation and not the other way around.<sup>87</sup> Global behemoths tilt the playing field to their advantage, while escalating tariffs (on finished goods) that grant established manufacturing industries in richer countries an advantage over startups in lower income countries.

The challenge facing much of Africa is that at middle or low levels of development unfettered free trade serves to maintain the current global divide in labour and capital – although previous sections have indicated that it is becoming more difficult to contain the spread of knowledge.

Industrialisation does not occur by itself. It is the outcome of a set of deliberate policies and requires a determined national effort to nurture and shield infant domestic industry from global headwinds in an interconnected world market dominated by established manufacturing exporters.<sup>88</sup> Membership of the World Trade Organization and other regimes has forced developing countries

to liberalise their markets and Africans have become importers of manufactured goods at a time when the establishment of GVCs has improved efficiencies and reduced prices, making it difficult for new entrants to compete.<sup>89</sup>

The room for manoeuvre is slim. Instead of trading with one another, cheaper imports from Asia, Europe and US eat into Africa's intra-regional trade. Within the East African Community, for example, the most recent data from the Kenya National Bureau of Statistics shows that Pakistan has replaced Uganda as Kenya's top export destination. Instead of growing, intra-regional trade appears to be declining in favour of trade with China, Japan, India and others.<sup>90</sup>

Instead of trading with one another, cheaper imports from Asia, Europe and US eat into Africa's intra-regional trade

And it has clearly become harder to industrialise than previously. Beyond the economic barriers, some of which have been mentioned, the domestic impacts associated with structural reforms are often disruptive. They may even lead to social turbulence, given that industrialisation, as part of broader modernisation processes such as urbanisation, inevitably disrupts established livelihoods.

Many recent successful examples of rapid industrialisation, such as that by the Asian Tigers, China and others, occurred under autocratic regimes where leaders could discount the popular discontent associated with disruptive changes caused. Unlike the experience in Asia, where industrialisation and democratisation generally occurred sequentially, Africa has to balance simultaneous challenges of democratisation and development.

Beyond a developmentally focused leadership, a second requirement in the long journey towards industrialisation is to get the right incentives in place, such as export orientation, support to embryonic manufacturing and policies to move labour and capital into more productive enterprises. This process builds momentum in the expansion of basic infrastructure (such as reliable electrical power and transport infrastructure) and investments in human capital (such as in workers who are better able to perform their jobs), facilitating financial depth, removing barriers to entry and attracting FDI.<sup>91</sup>

Low levels of income and small domestic markets mean that rapid growth of manufacturing, agro-industry and tradable services require access to larger markets, either regionally or internationally, hence the imperative for progress on Africa's regional economic integration. Following the establishment of the Continental Free Trade Area in Africa, progress may now occur. But elsewhere, efforts at regional integration have long been stalled, as is the case in Southern Africa, while the East African Community also seems to have entered a period of uncertainty.

Africa's approach to regional economic integration is characterised as a:

development integration approach that combines market integration with industrial and infrastructure development...to enhance productive capacity and the development of regional value-chains; as well as, through infrastructure development, promote connectivity and reduce the costs of doing business.<sup>92</sup>

Nationally, such efforts require well-administered, supportive public policies and, in the case of the private sector, effective government facilitation – such as through tax incentives and institutional reforms to lower transaction costs in such areas as customs and business regulation – to offset the costs for first movers.<sup>93</sup> Government effectiveness, the ability to administer such complex measures in a timely fashion, and combating corruption associated with export procedures, as well as removing trade friction costs due to poor logistics often present huge challenges in Africa.

Africa is also hugely diverse. Current levels and potential for expansion of manufacturing differ greatly between countries and regions – an examination that is beyond the length limit for this report. At 21% of manufacturing value-added to GDP, North Africa is the most industrialised region on the continent and West and East Africa jointly the least industrialised (both at roughly 12%). Southern Africa, however, has higher levels of government effectiveness and less corruption than North Africa, indicating other advantages. Regulatory quality is also significantly better in Southern Africa than in other regions.<sup>94</sup>

## Getting to lift-off

This section briefly presents seven intervention clusters modelled within IFs to emulate industrialisation in Africa

and its associated impact with a time horizon to 2040. A next section then considers the combined impact of the interventions in a single Made in Africa scenario. The specific interventions and parameter changes are listed in the annex to this report.

Clear industrial policy and determined government leadership and action are critical if Africa is to grow more rapidly. For this reason, a first cluster of interventions improves **government effectiveness and the quality of government regulations**. They reflect the determined efforts by forward-looking African governments to set the agenda for industrial development of Africa.

Clear industrial policy and determined government leadership and action are critical if Africa is to grow more rapidly

A second cluster of interventions on **industrialisation** increases government expenditure in research and development, provides export support to the manufacturing and ICT sectors, and protects against (some) manufacturing and ICT imports.

**ICT** can play important roles in improving efficiencies within and across agriculture, and industrial and services sectors, as briefly mentioned in a previous section. The interventions modelled for this cluster simulate

an aggressive push to improve ICT connectivity. Government spending on ICT increases; fixed and mobile broadband increases; household access to computers and an increase in internet bandwidth per user; while costs of adding fixed and mobile broadband connections reduce.

The interventions in the **education** cluster include reasonable but aggressive improvements in primary, secondary and tertiary completion rates, increases in the ratio of vocational students in secondary school as well as the ratio of science and engineering students at tertiary level. This is because African countries need to rapidly build skills in sciences, ICT, engineering, manufacturing, and mathematics (the drivers of future jobs).<sup>95</sup> Whereas Africa's current education systems are largely oriented towards academic (and not vocational) teaching, manufacturing and the fourth industrial revolution require the skills to build and maintain infrastructure and support economies that increase productivity in the economy.

Africa's **agricultural potential** can reasonably be expected to unfold over time as a growing manufacturing sector (the implicit outcome of the various interventions modelled here) incentivises demand. Once industrialisation starts to incentivise food production, Africa should go up the agricultural value chain into substantive agro-manufacturing, as one of many spin-offs. Agriculture can provide food and employment to

International Futures (IFs) is a tool for thinking about development over long time horizons. It integrates forecasts across different sub-models, including agriculture, demography, economy, education, energy, environment, governance, health, infrastructure, international politics and technology. These sub-models are dynamically connected, so IFs simulates how changes in one system lead to changes across all other systems. As a result, IFs endogenises a large number of relationships from a wide range of key global systems. The model is an open source tool and available for free at [www.pardee.du.edu](http://www.pardee.du.edu).

IFs leverages over 3 500 historical data series from global data providers such as the World Bank, Food and Agricultural Organization; identifies and measures

trends; and models dynamic relationships to forecast hundreds of variables for 186 countries for every year. Where available, historical data is from 1960 and forecasts extend from 2015 (the current base year) to 2100. It provides forward-looking, policy-relevant material that frames uncertainty about the future of countries (or groups of countries) and across development systems. It thereby allows users to think systematically about potential futures, as well as development goals and targets.

There are three main avenues for analysis in IFs: historical data analysis (cross-sectional and longitudinal), Current Path analysis (where systems seem to be developing), and alternative scenario development (exploring if-then statements about the future). This report uses all three types of analysis.

a rapidly growing population. The interventions in this section increase yields and calorie intake from 2022, thereby reducing hunger and stunting, and generally improve human capital contributions to growth.<sup>96</sup>

Africa trails globally on every dimension of **infrastructure**, with the largest deficits being the lack of a reliable power supply, transport/roads, and provision of clean water and improved sanitation.<sup>97</sup> The drag that poor infrastructure has on physical capital as part of total/multifactor productivity is particularly evident for Africa's low- and lower-middle-income countries and less severe for upper-middle income countries.<sup>98</sup>

The IMF studied infrastructure spending in several countries from 1985 to 2014 and found that an unanticipated 1% increase in public infrastructure boosted GDP by 0.4% the following year, but by 1.5% four years later.<sup>99</sup> The Economic Policy Institute agrees, noting in a 2014 report that 'our analysis confirms with a large and growing body of literature persuasively arguing that infrastructure investments can boost even private sector productivity growth'.<sup>100</sup>

The interventions modelled on infrastructure reduce the capital cost-to-output ratio in energy; accelerate the annual decrease in cost rate of energy production technology; reduce the generation costs for production of electricity; and reduce the costs of improved water connections to households. More energy from gas and other renewables improves electricity access. In addition, access to electricity, safe water and improved sanitation follow, since rural communities can install boreholes and pumps, for example. Electricity transmission losses reduce (because of high-voltage direct current transmission technology).<sup>101</sup> Energy production from gas and other renewables increases.

Support from the **international community** remains important. The intervention moderately increases FDI (that generally flows to middle-income countries).<sup>102</sup>

**Table 2: Comparing scenario GDP growth rates**

Region	Current Path average to 2040	Made in Africa average to 2040
Africa	4.8%	6.5%
Low-income Africa	7.2%	8.9%
Low-middle-income Africa	4.7%	6.4%
Upper-middle-income Africa	3.8%	5.3%

Source: IFs v. 7.33

Finally, the shift to more productive sectors improves **multifactor productivity**.

Before exploring the combined impact of the interventions in the next section, two important caveats are important. First, the exploratory interventions modelled for this report were all done at continental level and not tailored to the improve the use of labour, capital or multifactor productivity at national level. At best, the efforts presented here purport to emulate an Africa that commits to actively pursue greater industrialisation and serves to illustrate potential, rather than map out the specific associated benefits. Second, although the combined interventions advantage all Africans, they are necessarily of greater benefit to those who live in middle-income countries.

The interventions modelled on infrastructure reduce the capital cost-to-output ratio in energy

Previous work from the ISS<sup>103</sup> has underlined the extent to which aid remains important for poor, low-income countries, and pointed to the need for additional measures to achieve substantive poverty alleviation in this large group of countries.

### Made in Africa: the potential impact of industrialisation

This section briefly presents the combined impact of the interventions discussed in the previous section. It is intended to serve as an illustration of the potential impact that industrialisation could have in Africa. The combined scenario is termed Made in Africa and is compared to the Current Path or Base Case scenario in IFs to 2040.

Table 2 presents the average growth rates for countries in Africa, low-income Africa, low-middle-income Africa and upper-middle-income Africa from 2018 to

2040, comparing the Current Path with the Made in Africa scenario.

The IFs Current Path is based on initial conditions of historical variables and calibrated against other forecasts. It assumes no major paradigm shifts, seismic policy changes, or transformative events (very low probability but high impact). The Current Path is therefore a dynamic scenario, representing a continuation of current policy choices and environmental conditions. Although the Current Path generally demonstrates continuity with historical patterns, it generates a range of non-linear, dynamic, and endogenous forecasts rather than simple extrapolations of historical trends.

Such is the impact of compound growth that the difference of 1.7 percentage point growth results in an African economy that is 42% larger in the Made in Africa scenario by 2040 than it would have been under the Current Path (US\$11 513 billion versus US\$8 116 billion in market exchange rates).

The interventions affect the various economic sectors differently. Since the African economy is significantly larger in the Made in Africa scenario, all sectors are larger in

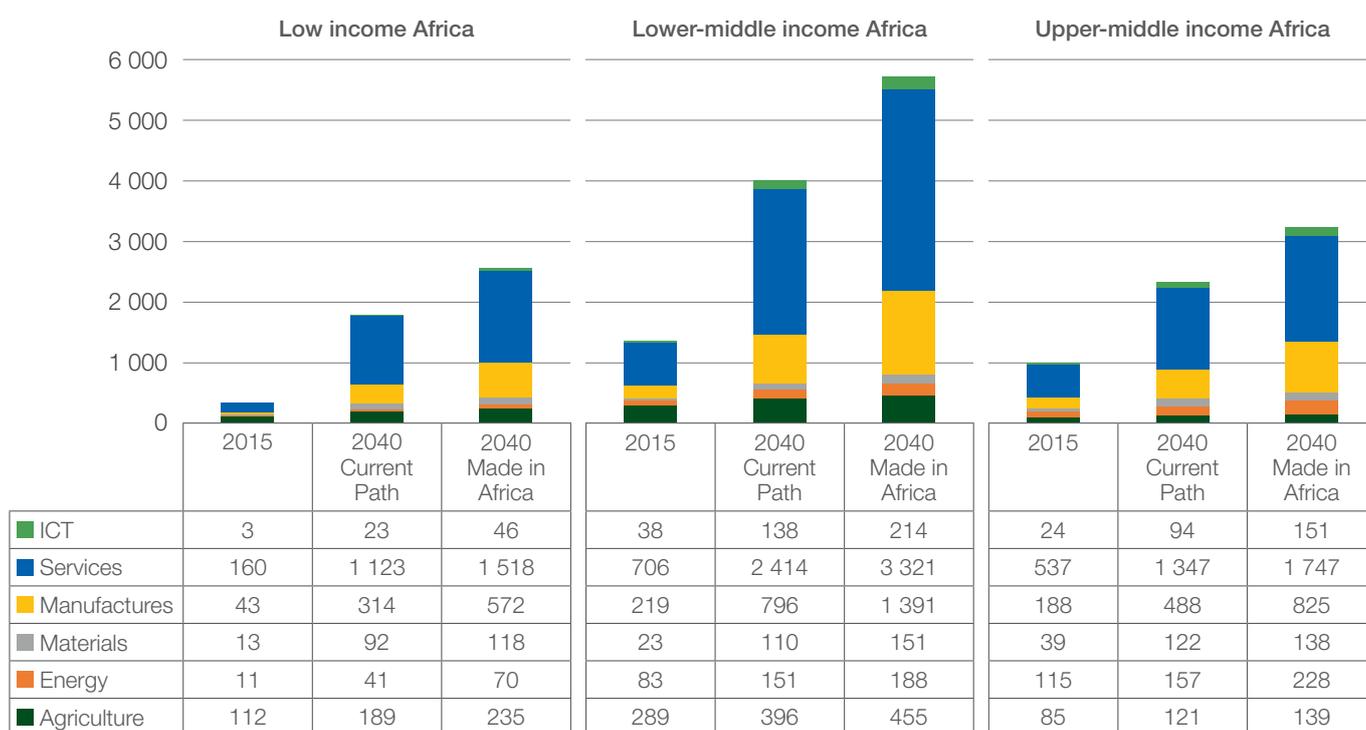
absolute terms. Although services grows rapidly under all scenarios constituting roughly 60% of total value-added by 2040, in the Made in Africa scenario the manufacturing sector expands from its current portion of roughly 17% to 24% by 2040. The materials and energy sectors (as a proportion of GDP) are slightly smaller in Made in Africa than forecast for the 2040 Current Path scenario.

ICT is also proportionally marginally larger in the Made in Africa scenario by 2040. The agricultural sector declines from its current 18% to 7% in the Made in Africa scenario. In the Current Path agriculture would constitute 9% of GDP in 2040.

Figure 9 presents the actual size per sector in US\$ billion, comparing the situation in 2015 with the forecast for the 2040 Current Path and 2040 Made in Africa scenario for each of the three World Bank country income groupings. In the Made in Africa scenario, the combined low-income African economy is forecast to be 44% larger in 2040 than in the Current Path forecast. The numbers for low-middle-income and upper-middle-income groups are 43% and 39% respectively.

Income levels increase dramatically in the Made in Africa scenario. When compared with the Current Path forecast for 2040, Africans in low-income countries will,

**Figure 9: 2015 compared to 2040 for Current Path and Made in Africa**



Source: IFs v. 7.33

on average, have an average annual income level that is US\$1 070 higher in 2040 compared to the Current Path. That is an improvement of 30%. The difference in average income per person by 2040 is US\$2 630 for low-middle-income countries (an improvement of 28% on the Current Path) and US\$5 100 for upper-middle-income countries (30% difference).

Whereas the Current Path forecast is that 30% (or 630 million) of Africa's total population of 2.1 billion people will likely live in absolute poverty by 2040, the Made in Africa forecast is almost ten percentage points lower, a large difference of 200 million people. These results reflect the IFs forecast that the number of Africans living in extreme poverty is expected to increase in the short-to-medium term.

Since, in the Made in Africa scenario, scarce resources are diverted to the reconfiguration of the productive structure of economies, poverty initially increases more rapidly than in the Current Path forecast, evident in Figure 10. Even in the Made in Africa scenario only Libya, Mauritius, Seychelles, Morocco, Tunisia and Cape Verde will achieve the SDG 2030 target of eliminating extreme poverty, with all other countries missing the target.<sup>104</sup>

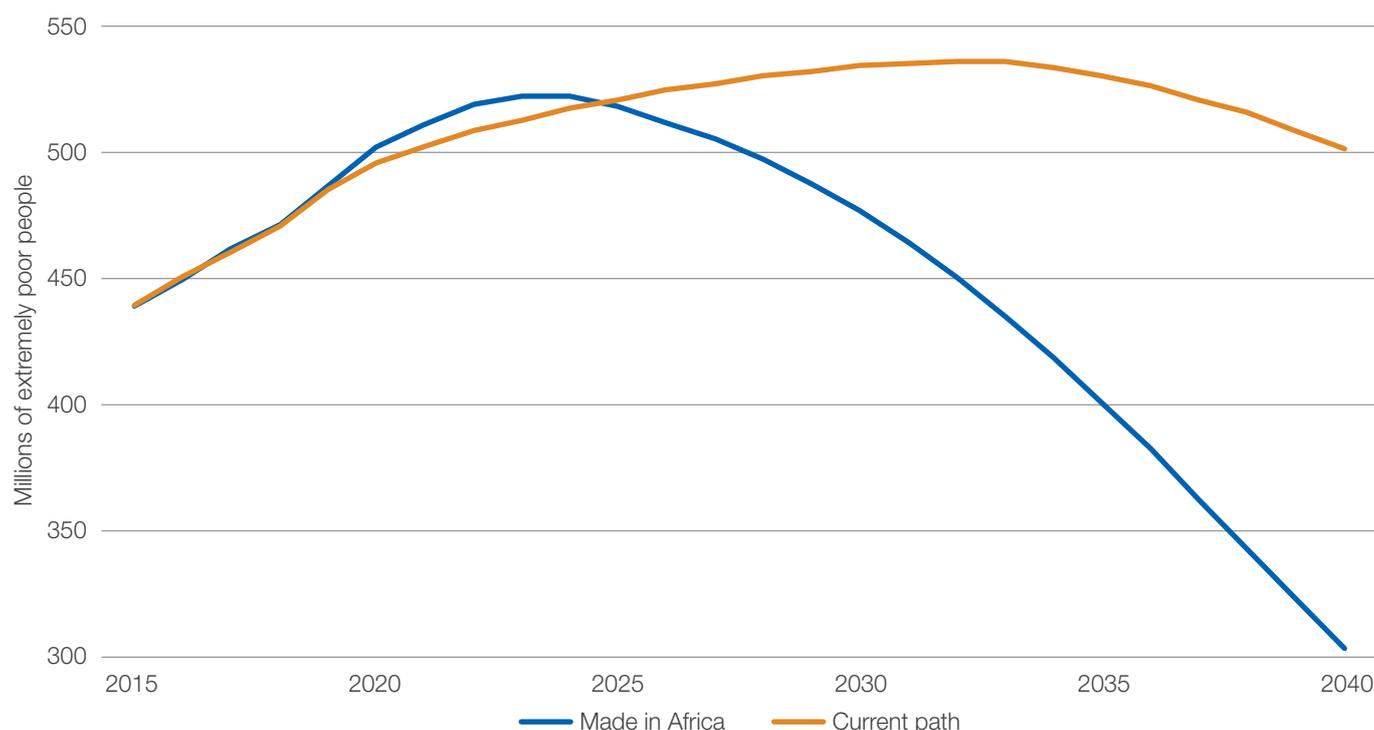
By 2040, the countries with the largest poverty headcount in the Made in Africa positive scenario will be Nigeria (97 million), the Democratic Republic of the Congo (44 million), Madagascar (23 million), Somalia (17 million), Malawi (16 million) and Burundi (11 million). Countries with the largest portion of poor people by 2040 will be Somalia (60%), Burundi (54%), Madagascar (52%), Central African Republic (52%) and Malawi (50%).

These results point to the importance of additional measures to reduce extreme poverty, including continued provision of development assistance to poor countries; and much greater efforts to directly support extremely poor families such as through cash grants.

Improved female education and the provision of clean water and improved sanitation affects population size. As a result, the Made in Africa scenario Africa should have 13 million fewer people (2 067 million versus 2 080 million) by 2040 – a difference that would increase with a focus on the roll-out of contraception and improved basic health care (not included as interventions).

Infant mortality rates decline rapidly in the Made in Africa scenario. Beyond the improvements that can realistically be expected from 2018 to 2040, infant mortality rates for low-income countries decrease by an additional six

**Figure 10: Extreme poverty – Current Path vs Made in Africa**



Source: IFs v. 7.33

deaths per thousand, whereas for lower-middle-income countries they decrease by eight, and for upper-middle income countries by five.

Africa moves decisively towards renewables in the Made in Africa scenario. By 2040, 23% of energy production is from renewables (instead of 14% in the Current Path forecast). The IFs estimate for 2017 is that only 4% of Africa's current energy production is from renewables. Despite the African economy being significantly larger by 2040 in the Made in Africa scenario than in the Current Path forecast, in 2040 Africa would only release an additional 32 million tons of CO<sub>2</sub> above the Current Path forecast.

## Conclusion

Since the 1970s, African economies have experienced a limited – as well as limiting – form of structural transformation from agriculture to low-end services. Manufacturing and industrial development have never taken off<sup>105</sup> and Africa is in fact deindustrialising. Since there is a clear correlation between the degree of industrialisation and per capita income, it is hardly surprising that the poorest countries are invariably the least industrialised.

Manufacturing and industrial development have never taken off and Africa is in fact deindustrialising

Countries in East Asia grew rapidly and over sustained periods of time because of the rapid productivity gains that followed determined efforts to move labour from low- to higher-productivity sectors of the economy, such as from subsistence agriculture to low-end manufacturing and then steadily upwards to increasingly complex manufacturing products. Starting from a low base, where the majority of workers engage either in subsistence farming or informal services, Africa has more to gain from structural transformation than other developing regions, but it has been unable to achieve lift-off.<sup>106</sup>

Given the nature of (new) globalisation, the future of GVCs and digital production, Africa's potential growth in manufacturing would inevitably differ from the smokestack images of yesteryear. Digital production – particularly through the impact of artificial intelligence, automation and robotics – is poised to disrupt the nature

of manufacturing and GVCs globally. Services have also changed. Many are tradable and manufacturing has a large service component, some of which is outsourced today.

Whereas iron and steel production used to be a key requirement for industrialisation, it is unclear how mass production using distributed 3D printing could unfold. Although cost of labour is no longer necessarily the primary determinant in the location of production, labour costs remain a key consideration. Given Africa's relatively high labour costs, other considerations will need to compensate if the continent is to attract and grow manufacturing, including low transport and infrastructure costs, a low regulatory burden and policy certainty.

The future of the fourth industrial revolution is one where some goods will be produced and consumed in regional rather than global markets, possibly in a much more distributed manner, presenting Africa with opportunities for industrialisation as well as regional trade. However, this will only happen if leaders in key growth-locomotive countries embark on a deliberate effort to industrialize such as by establishing and supporting SEZs and clear industrial policy.

If SEZs are to add value to the domestic economy, they need to be locally embedded. This requires a fine balance between providing tax and other benefits in the interests of export promotion, but without undercutting local manufacturing firms outside of SEZs. African states need clear industrial policy frameworks that support local manufacturing, buying local and implementing import substitution where feasible, and within relevant international legal obligations.

African countries must begin by trading among themselves, integrating their isolated markets. Such an approach will eventually make it possible to modernise African agriculture, potentially an important source of food, income and employment opportunities.

This analysis indicates that without much greater emphasis on actively pursuing structural transformation of the economy towards more highly productive sectors, in particular through manufacturing – infusing African economies with technology, in the words of President Kagame – Africa will not be able to add value in its agriculture or higher-end services either.

There is also little evidence to suggest that countries industrialise by adding value to their raw materials without

paying attention to demand among local industries for higher-value products. Initial industrial development thus becomes the driver of demand for beneficiation of raw materials, agricultural productivity and high-end services rather than the other way around.

Even then, the employment intensity of the manufacturing sector is declining when compared to the period when Asia experienced its most rapid manufacturing growth. Given its large infrastructural deficits, lack of education and poor institutions, African industrialisation is likely to follow a different pathway from the traditional entry into low-end mass production. In this journey, ICT could play an important role in improving productivity in various sectors – in particular, education – while other technologies would allow substantive progress in compensating for lags in the provision of clean water, electricity and health care.

On its current development trajectory the gap between Africa and the rest of the world in measures such as income will continue to increase. Change will not occur without huge effort. The transition from low to higher productivity requires ruling elites to set up, nurture,

subsidise and even protect dynamic industries and services, changing the dominant mode of production – in effect, changing society as a whole. These measures require very careful not to say surgical engagement by a competent and modern bureaucracy.

Without moving up the productivity value chain Africa will remain poor. Palliative measures, such as those reflected in the Millennium Development Goals and SDGs, ameliorate the worst effects of underdevelopment without offering feasible, long-term solutions to an African population that, by 2040, will have increased to 2.1 billion people.

The ambitious changes to industrialise Africa modelled in this paper would have a huge impact on the lives of many Africans, but in themselves are insufficient to substantively close the growing gap between average income levels presented in Figure 1. In the absence of an additional effort to accelerate Africa’s demographic transition, most countries will not be able to substantially reduce poverty – an issue to be explored in a subsequent report.

## ANNEX: Interventions in IFs v7.33 for the Made in Africa scenario

Different colours indicate different sectors.

ylm – agricultural yields multiplier	Interpolate from 1 in 2022 to 1.1 in 2040
clpcm – per capita calorie demand multiplier (total)	Interpolate from 1 in 2022 to 1.2 in 2040
edpriintngr – education, primary, net intake rate, annual growth rate, percent	1.74
edprisurgr – education, primary, survival rate, annual growth rate, percent	1
edseclowtrngr – education, lower secondary, general, transition rate, annual growth, percent	1.84
edseclowgradgr – education, lower secondary, general graduation rate, annual growth, percent	0.8
edsecuptrngr – education, upper secondary, general, transition rate, annual growth, percent	1.15
edsecupprgradgr – education, upper secondary, general graduation rate, annual growth, percent	0.3
edterscienshradd – education, tertiary, sci-engg share of grad, additive factor, decimal rate	Interpolate from 0 in 2018 to 1 in 2028, maintain to 2040
edseclowvocadd – education, lower secondary, vocational share, additive factor, decimal rate	Interpolate from 0 in 2018 to 1 in 2028, maintain to 2040
edsecuppvocadd – education, upper secondary, vocational share, additive factor, decimal rate	Interpolate from 0 in 2018 to 1 in 2028, maintain to 2040

edtergradm – education, tertiary, graduation rate, multiplier	Interpolate from 1 in 2018 to 1.1 in 2040
gdsbudgetprotec – government spending by destination, protection factor (education)	0.5
xshift – export shift as a result of promotion of exports (manufactures) ratio	0.05
xshift – export shift as a result of promotion of exports (ICT) ratio	0.05
protecm – protectionism in trade, multiplier on import prices (manufactures)	Interpolate from 1 in 2018 to 1.5 in 2024, maintain to 2040
protecm – protectionism in trade, multiplier on import prices (ICT)	Interpolate from 1 in 2018 to 1.5 in 2024, maintain to 2040
gdstrgtval – spending on R&D	Interpolate from 1 in 2018 to 0.4 in 2028, maintain to 2040
govegqualm – government regulatory quality multiplier	Interpolate from 1 in 2018 to 1.1 in 2030, maintain to 2040
goveffectm – government effectiveness (quality), multiplier	Interpolate from 1 in 2018 to 1.1 in 2030, maintain to 2040
qem – capital cost to output ratio in energy, multiplier	0.8
etechadv – energy production technology, annual decrease in cost rate	Interpolate to 0.02 by 2040
infraelectranslossm – electricity transmission loss multiplier	Interpolate to 0.5 by 2040
infraelecaccsetar – electricity access standard error target	1
infraelecaccseyrtar – years to target electricity access standard error	25
watsafenoconsetar – safe water, no connection, standard error target	-1
sanitnoconsetar – sanitation, no connection, standard error target	-1
watsafenoconseyrtar – years to target safe water, no connection, standard error, years	30
sanitnoconseyrtar – years to target sanitation, no connection, std error, years	30
enpm – energy production multiplier (gas)	Interpolate from 1 in 2018 to 2 in 2038, maintain to 2040
enpm – energy production multiplier (other renewables)	Interpolate from 1 in 2018 to 2 in 2038, maintain to 2040
infraelecengcostm	Interpolate from 1 in 2018 to 0.5 in 2028 maintain to 2040
watsafecostm – water, multiplier on cost of adding an improved connection to a household	0.8
watsafeimpcostm – water connection, other improved, cost multiplier	0.8
xfdistockr – FDI stock, annual growth rate, percent	Interpolate from 3 in 2018 to 8 in 2028, maintain to 2040
ictbroadm – ICT broadband multiplier	Interpolate from 1 in 2018 to 2 in 2028, maintain to 2040
ictbroadmobilm – ICT mobile broadband multiplier	Interpolate from 1 in 2018 to 2 in 2028, maintain to 2040
ictcomputersm – multiplier on computer access to households	Interpolate from 1 in 2018 to 2 in 2028, maintain to 2040
ictintnetbwpum – multiplier on internet bandwidth per user percent	Interpolate from 1 in 2018 to 2 in 2028, maintain to 2040
ictspendm – ICT spending multiplier	1.2
ictbroadcostm – ICT, broadband multiplier on adding a connection	0.8
ictbroadobilcostm – ICT, broadband, multiplier on cost of adding a connection	0.8
Mfpadd – multifactor productivity, multiplier	Interpolate from 0 in 2018 to 0.01 in 2028, maintain to 2040.

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## Notes

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