UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

APRIL 2020

UNCTAD/ALDC/MISC/2020/2

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Developing productive capacities to industrialize and diversify African economies and achieve the SDGs

Abstract

African policymakers, academics, and development institutions have acknowledged that fostering sustained economic development in Africa and achieving the SDGs require developing productive capacities, transforming domestic production structures towards manufacturing, and diversifying exports. Yet, there is very limited understanding of the linkages among these crucial processes of economic development. This paper seeks to identify some mechanisms through which the development of productive capacities could be linked to structural transformation and exports diversification and how these processes can contribute to the goal of poverty alleviation in Africa. It also examines the role of infrastructure and innovation in developing productive capacities and offers policy recommendations on how productive capacities could be built to support Africa's industrialization agenda and enhance prospects for achieving the SDGs.

Key words: Productive capacities, Industrialization, Diversification, SDGs

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Contents

Acknowledgements

This paper is one of the research activities of UNCTAD aimed at strengthening linkages between trade and poverty reduction in Africa and LDCs. It formed the basis for a presentation on productive capacities in Africa made by the author at the Economic Policy Research Network (EPRN) Conference held on 25 February 2020 in Kigali, Rwanda. The author thanks participants at the EPRN conference for useful discussions and comments.

Introduction

In January 2015, African Heads of State and Government took a bold step to build the foundation for sustained growth by adopting the African Agenda 2063 as the long-term framework that will guide the continents development in the next five decades. This was followed in December 2016 by the design of a domestication strategy aimed at ensuring that elements of the Agenda are incorporated into national plans, programmes and budgets. Efforts have also been made by the African Union to reconcile the African Agenda 2063 with global development initiatives such as Agenda 2030 and the Sustainable Development Goals (SDGs). A common feature of these recent national, continental and global development initiatives is the recognition of the fact that Africa's development challenges are largely structural in nature and need to be addressed to achieve better development outcomes than in the past. In this context, there is an emerging consensus that African countries and the least developed countries (LDCs) must develop productive capacities, transform the structure of their economies towards industrial activities, and diversify exports to lay a solid foundation for robust growth, employment creation, poverty alleviation and the achievement of the SDGs (Signé 2018). The international community has acknowledged the crucial role of structural transformation in the development process by specifically dedicating goal 9 of the SDGs to promoting industrialization and related issues such as infrastructure and innovation.[1]

The development of productive capacities is needed to enhance the ability and capacity of African countries to create employment and fully exploit opportunities created in the multilateral trading system. Export diversification is important to reduce vulnerabilities to global shocks. And structural transformation is necessary to ensure resources are used in areas where they are most productive and lay a robust foundation for sustained economic growth and employment creation. UNIDO (2016) provides several reasons why achieving industrial development is a necessity in Africa and LDCs: first, it is crucial for meeting goal 9 of the SDGs; second, it has high potential for job creation and can therefore contribute to poverty alleviation;[2] third, no country has been able to achieve sustained economic growth without effectively transforming the structure of the economy, mostly into production of manufactured goods; and fourth, it promotes inclusive development by providing decent jobs and government revenue for social investments.[3]

Despite the importance of productive capacities, export diversification and structural transformation to the achievement of Africa's broad development goals and the SDGs, the three concepts are often discussed in isolation and policies are often designed without a clear understanding of the linkages among them. This lacuna stems from the fact that there is no unified and comprehensive treatment of these issues or development processes in the extant economic literature. Against this background, this paper seeks to provide an understanding of the mechanisms through which the development of productive capacities can be linked to export diversification and structural transformation and how these processes of economic development can

[1] Goal 9 of the SDGs is entitled "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation." It has eight industry-related targets and its inclusion in the SDGs is an acknowledgement of the crucial role of industrialization in the economic development process (see United Nations 2015). Goal 9 also recognizes the importance of innovation and infrastructure development as essential drivers and enablers of industrialization.

[2] Cadot et al (2016) provide evidence indicating that the elasticity of poverty with respect to industrial value-added is negative and higher than the elasticity with respect to the agricultural and services sectors. In other words, industry is a stronger driver of poverty reduction than agriculture and services. The strong links between industrialization on the one hand and poverty and employment on the other suggests that achieving goal 9 of the SDGs will enhance the prospect of achieving other SDGs, especially goal 1 on poverty eradication, goal 8 on economic growth and decent work, and goal 10 on reducing inequality.

[3] For a discussion of the industrialization challenge facing African countries and the role of commodities in the industrialization process see Morris and Fessehaie (2014).

contribute to the goal of poverty alleviation in Africa. It also examines the role of infrastructure and innovation in developing productive capacities and offers policy recommendations on how productive capacities could be developed to support Africa's diversification and industrialization objectives and enhance prospects for achieving the SDGs.

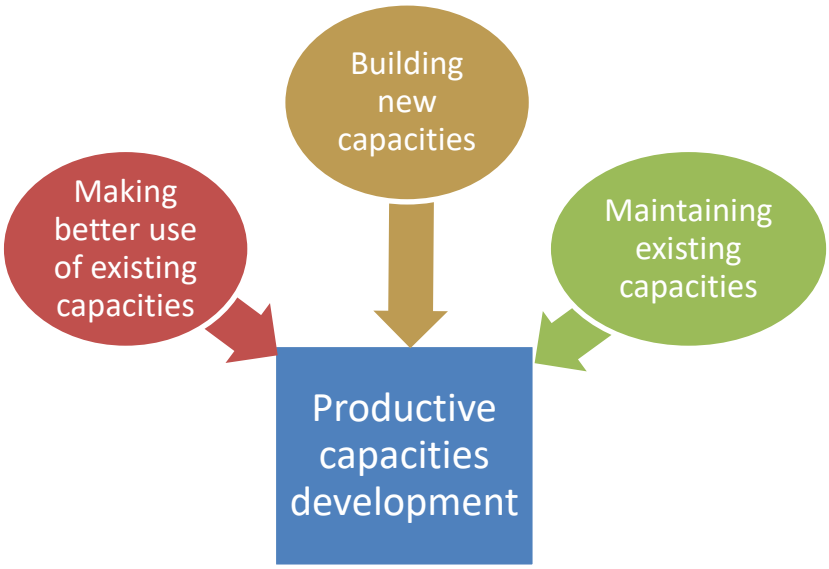
The rest of the paper is organized as follows: Section 1 introduces the concepts of productive capacities, export diversification and structural transformation and explains the linkages between these processes of economic development and how they contribute to the goal of poverty alleviation. Section 2 examines the drivers of productive capacities development with a focus on the role of infrastructure and technology and innovation. Section 3 identifies and discusses policies to develop productive capacities in such a way that supports Africa's Industrialization Agenda. The final section (4) contains concluding remarks.

1. Productive capacities, diversification and transformation: Concepts and linkages

The development of productive capacities is increasingly a hot topic in policy circles and in the literature on the economic development of Africa, least developed countries, and small island developing states. Yet, there is no consensus on how to define it and what it means. Over the past two decades, attempts have been made by several researchers to provide a definition of the concept. For example, UNIDO (2003) defines productive capacities as "the ability to produce goods that meet the quality requirements of present markets and to upgrade in order to tap future markets." UNCTAD (2006) refers to productive capacities as "the productive resources, entrepreneurial capabilities and production linkages which together determine the capacity of a country to produce goods and services and enable it to grow and develop." While each of these definitions has a different focus and scope, they suggest that productive capacities refer to the potential output that can be efficiently and competitively produced in a country given its factors of production, state of technology, and the social and political environment within which production takes place. In this context, productive capacities describe the production possibility frontiers of an economy.

Part of the growing interest in productive capacities development can be ascribed to the fact that it is regarded as a necessary condition for poor and vulnerable developing countries to better integrate into the global trading system, foster sustained growth, and meet the SDGs. Weak productive capacities have made it challenging for poor and vulnerable developing countries to fully exploit opportunities created in the global trading system and reap the benefits of trade. In 1980 Africa accounted for about 11 percent of world population and 6 percent of world trade. In 2017 its share of world population rose to about 17 percent while its share of global trade fell to 2.3 percent. The very low and declining share of African countries in global trade is due largely to the fact that they lack productive capacities, particularly in manufacturing activities. In this regard the development of productive capacities should be on the priority list of African policymakers to enhance their ability to fully exploit the potential of international trade for development and enhance prospects for meeting the SDGs. There are three aspects to the development of productive capacities: building new capacities; making better use of existing capacities; and maintaining existing capacities (Figure 1).

Figure 1. Core dimensions or aspects of developing productive capacities



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In the discourse on Africa's economic development, as well as in policy circles, the emphasis has always been on how to build new productive capacities. But building new capacities will make a significant contribution to the long-term goal of developing productive capacities only if it is combined with efforts to better utilize and maintain existing capacities. In the manufacturing sector, many plants in Africa operate well below installed capacity even though African governments are trying to build new capacities in support of their transformation agendas.[4] Clearly, such incoherence in approach to developing productive capacities is not conducive to the realization of the long-term goal of productive transformation and is an important factor in explaining the low productive capacities of African countries (Box 1). In this context, there is the need for a more coherent approach to developing productive capacities in Africa than in the past, with emphasis on building as well as utilizing and maintaining existing capacities.[5]

Unlike the concept of productive capacities, there is clarity and good understanding in the literature of what structural transformation and diversification mean. In general, economists regard structural transformation as the movement of resources from low to high productivity activities both within and across sectors. The share of manufacturing value added (MVA) in gross domestic product (GDP) and MVA per capita are two widely used indicators or proxies for structural transformation in both policy discussions and empirical work. MVA per capita represents the relative value of net manufacturing output to population size while the ratio of MVA to GDP captures the role of manufacturing in the economy (UNIDO 2017). Regarding the third concept, diversification, it generally refers to the production or export of a wide variety of goods and services. And it can be

[4] For instance, the enterprise surveys conducted by the World Bank indicate that in 2017 the average capacity utilization rate in Sierra-Leone was 58 percent and in Ethiopia in 2015 it was 63.3.

[5] In principle, there are three main approaches that could be adopted to assess and monitor the development of productive capacities in African countries. The first is an input-based approach involving the aggregation of indicators on three core components or determinants of productive capacities development, namely: productive resources, entrepreneurial capabilities, and production linkages in an economy (UNCTAD 2006). The second approach to assessing the development of productive capacities is an outcome-based approach involving determining a country's productive capacities by looking at the mix of products it already produces. In this framework, higher productive capacities are associated with the production of dynamic products and sophisticated goods (Freire 2013). The third approach is through a benchmarking exercise, involving computing the state of productive capacities in a relatively successful developing country and comparing actual capacity in an African country of interest with those of the representative country.

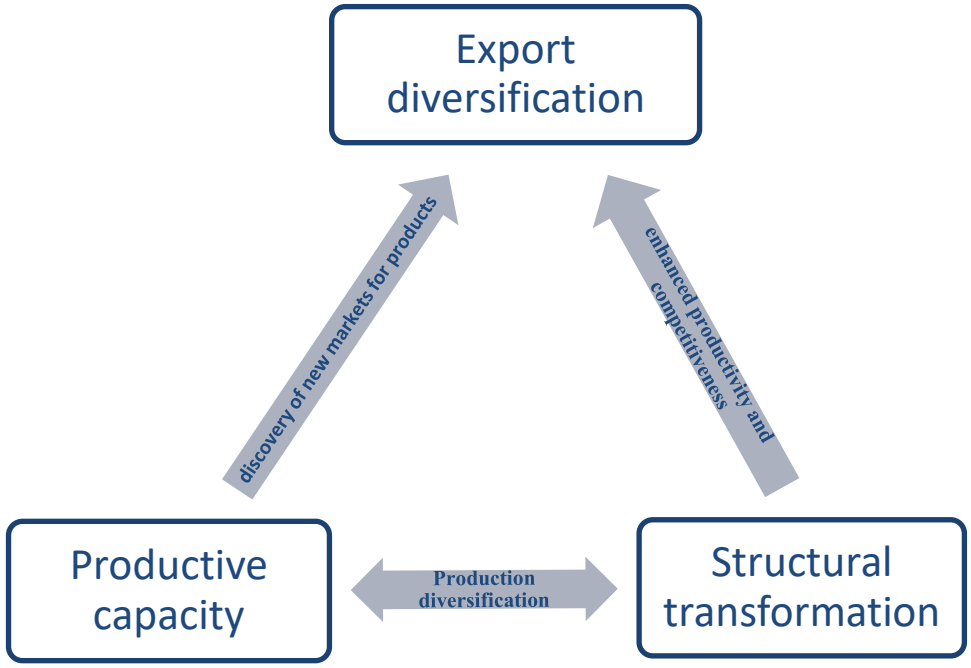
accomplished through introduction of new products to existing markets, increasing the quality of existing products, and finding new markets for existing products. Quantitatively, diversification is measured using concentration indices such as the Herfindahl, Gini and Theil Indices, which for the most part capture inequality between product or export shares (Cadot, Carrère, and Strauss-Kahn, 2011).

Box 1: Assessing Productive Capacities in Africa

Although it is widely believed that developing productive capacities is imperative for Africa, there are no comprehensive quantitative studies measuring the state of productive capacities in the continent. To address this limitation, UNCTAD is developing a framework for measuring productive capacities in developing countries and the findings of this study is expected to be published in 2020. That said, a recent Report by the World Economic Forum on readiness for the future of production can give us an idea of the state of production in some African economies (WEF 2018). The Report quantifies the structure of production in 100 economies in the world and discusses the drivers of production in these economies. Regarding the structure of production, its focus is on the economic complexity and scale of production. The scores for the structure of production ranges from 1 to 10 with the latter indicating a higher or stronger production structure. The findings of the Report suggest that African countries have very limited production base when compared with countries in other continents. Among African countries in the sample, South Africa had the highest score (5.03) and global rank (45), reflecting the fact that it has a stronger production base than other African countries. Egypt, Tunisia, Mauritius and Morocco are the other African countries with relatively strong production base while countries such as Zambia, Tanzania, Uganda and Ethiopia have very low production base. The low scores of African countries are due to the fact that the scale of manufacturing activities in these economies tends to be small and they produce goods that are not sophisticated. They also have relatively poor infrastructure, weak human capital and very low innovation capabilities.

The economic literature recognizes the crucial importance of structural transformation and diversification in the development process. Kuznets (1973) pointed out that as an economy grows there is a movement of resources from agricultural to non-agricultural activities, resulting in a declining share of agriculture and an increasing share of manufacturing and services in output and employment. Herrendorf, Rogerson and Valentinyi (2014) also discussed the role of structural transformation in the growth process using a multi-sector growth model. Regarding diversification, Imbs and Wacziarg (2003) have shown that export concentration and per capita income follow a U-shaped pattern in the development process. That is, as per capita income increases production and employment initially become more diversified but after a threshold level of income is reached, they become concentrated again. Until recently, the two processes of economic development (structural transformation and diversification) where treated independently of each other in economic models. Papageorgiou, Perez-Sebastian and Spatafora (2013) addressed this limitation by developing for the first time a framework that simultaneously incorporates both structural transformation and diversification in the growth process. However, their paper did not consider the issue of productive capacity development. The current paper complements existing work in the literature by identifying and discussing some mechanisms through which productive capacities development could be linked to the concepts of export diversification and structural transformation (figure 2).

Figure 2. Mechanisms linking productive capacities to diversification and transformation



Source: Author

To understand the relationships depicted in figure 2, it is important to note that there are at least two ways that a developing country can enhance its productive capacities. The first is to increase capacity to produce existing (traditional) products and the second is to increase the capacity to produce new and more sophisticated products. When productive capacities are developed to increase output of existing products, it results in neither production diversification nor structural transformation of the economy. However, it can contribute to export diversification if it is accompanied by the creation or discovery of new markets for products. In other words, there is the possibility that the development of productive capacities could lead to export diversification even when it does not promote production diversification and structural transformation of the economy. In contrast, when productive capacities are developed to produce new and more sophisticated products, it will result in production diversification and hence structural transformation of the economy. In this context, the development of productive capacities leads to structural transformation when it is accompanied by production diversification.[6] Given the fact that structural transformation involves a movement of resources from low to high productivity activities, it enhances productivity and competitiveness of an economy thereby contributing to export diversification. Therefore, when productive capacities are developed in a manner that results in production diversification it can contribute to both structural transformation and export diversification of an economy. So far, I have examined how productive capacities affect structural transformation and export diversification. But the structural transformation of an economy also has an impact on the development of productive capacities. For instance, it has been argued that the transformation of the production structure of an economy towards manufacturing activities fosters technological innovation, which is a major driver of both the development of productive capacities and export diversification (Osakwe and Moussa 2018). Therefore, in the formulation and implementation phases of development policies there is the need for African policymakers

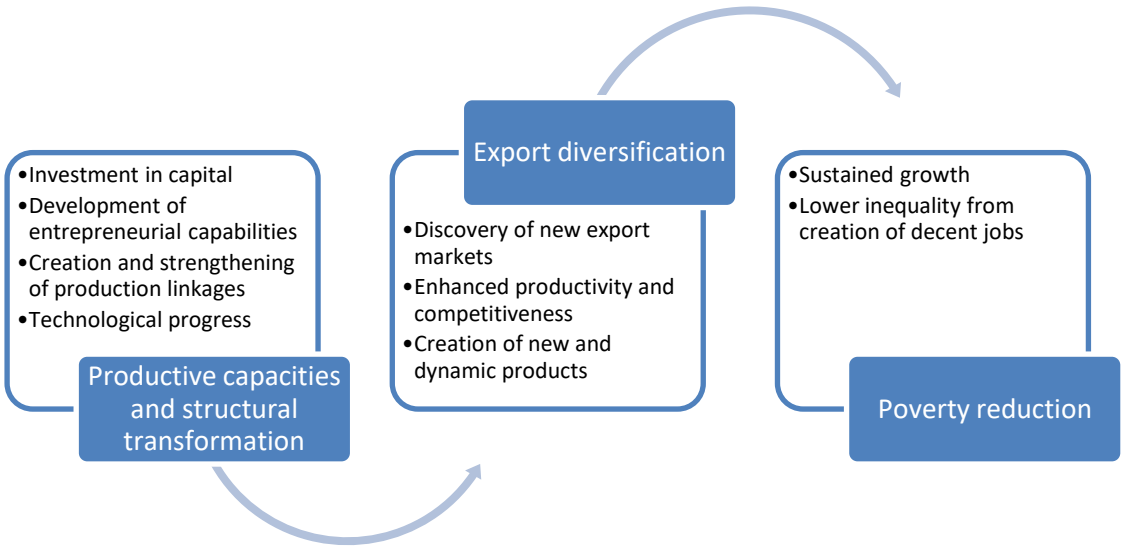
[6] It should be noted that the capabilities of enterprises play a crucial role because they define the feasible set of products that could be produced in an economy and hence determine whether or not the development of productive capacities induces production diversification and structural transformation (Nubler 2014).

to consider the mutually reinforcing relationships between productive capacity development on the one hand and structural transformation and export diversification on the other.

An interesting question to pose at this stage is how productive capacities, export diversification and structural transformation are linked to the national development goal of poverty alleviation? Figure 3 provides an illustrative mechanism linking these processes of development to poverty reduction, which is goal 1 of the SDGs.

It begins with a recognition that developing productive capacities and transforming the structure of an economy require: investments in capital (physical and human); the development of the entrepreneurial capabilities; creating and strengthening production linkages within an economy; and technological innovation. When these factors and processes are accompanied by either the discovery of new export markets for (existing and new) products or enhanced productivity and competitiveness, they foster export diversification. And export diversification contributes to poverty reduction by affecting the two main sources of changes in poverty: growth and inequality. A key channel through which export diversification has a positive impact on growth is an increase in value-addition and productivity. Regarding the impact on inequality, it arises through the positive impact of export diversification on creation of decent jobs which reduces income gaps and hence inequality in the economy.

Figure 3. Linking productive capacities, diversification and transformation to poverty



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2. Infrastructure, innovation and the development of productive capacities

This section discusses the factors that affect the development of productive capacities, with a more detailed examination of the roles of infrastructure and innovation since they are the focus of goal 9 of the SDGs and are critical to industrial development (Box 2).[7] In general, there are several factors that determine the extent of development of productive capacities in an economy. A stable political and macroeconomic policy environment is conducive to building and utilizing productive capacities and should be regarded as a necessary, although not sufficient, condition for developing productive capacities in Africa. Political and macroeconomic instability increase the degree of uncertainty facing investors thereby creating a disincentive to invest in productive transformation. While many African countries have made progress, over the past two decades, in maintaining political and macroeconomic stability, it remains a major challenge in several countries and needs to be addressed. Human capital is also an important driver of the development of productive capacities in a country. The size and quality of the workforce determine the kinds of productive activities that can be initiated and sustained in a country. They also affect a country's productivity and innovative capacity which in turn affect firm competitiveness. The degree of entrepreneurship is another important factor in the development of productive capacities. Unfortunately, there are several deficits in Africa's enterprise structure that make it challenging for domestic enterprises to thrive: these include the small and informal nature of African enterprises which make it difficult for them to exploit economies of scale; weak inter-firm linkages; low firm growth; and the low innovative capacity of domestic firms (UNCTAD 2013). One consequence of these deficits in Africa's enterprise structure is that most domestic firms cannot compete in export markets and this has had a deleterious effect on the development of productive capacities and industrialization.

Box 2: Industrial Development in Ethiopia: Role of Infrastructure and Innovation
Ethiopia is one of the African countries that have taken bold steps in the past two decades to build productive capacities by making industrial development one of the key pillars of its development strategies. It is a least developed country and differs from many African countries in the sense that it is an agriculturally dependent country but not rich in mineral resources. In 2010 the government shifted from a development strategy based on improving agricultural productivity to a growth and transformation plan with an emphasis on manufacturing development. This shift in development strategy has led to some positive results. For instance, the average growth of real manufacturing value added (MVA) increased from 9.8 percent in 2005-2010 to 13.6 percent in the period 2010-2015. Despite the progress that has been made in the past decade, the level of manufacturing development is still very low relative to other African countries and manufacturing still plays a very limited role in the economy, as evidenced by the fact that over the past decade the share of manufacturing value added in GDP has hovered around 5 percent. Weak infrastructure and innovation have contributed to the poor performance of Ethiopia in terms of industrial development. The Africa Infrastructure Development Index produced by the African Development Bank indicates that in the period 2003-2018, Ethiopia, was one of the countries with very low levels of infrastructure in Africa. It is also one of the African countries with very low levels of innovation. UNCTAD (2015) stresses the need to boost innovation capacities and to enhance coordination between innovation and industrial policies in Ethiopia. There is also the need to strengthen infrastructure development to accelerate industrialization.

Another factor that affects the development of productive capacities is the level of domestic demand (Signé 2018). In many African countries the size of the domestic market is low because of low income levels. Given

[7] Discussions on productive capacity tend to focus on how to develop capacities in the industrial sector. However, productive capacity can also be developed in agriculture through, for example, physical and human capital investments that enhance agricultural productivity. Therefore, it is important to note that although productive capacity is often developed through industrial development, it is a much broader concept than industrial development.

this constraint, domestic firms have no incentives to expand productive capacities except they are either competitive to access export markets or there is an increase in domestic income levels to increase the purchasing power of households. The domestic demand constraint is particularly binding in the case of production of manufactured goods where African firms face serious challenges competing in export markets and so must rely on the strength of their domestic markets to survive or stay in business. In this context, boosting domestic income and enhancing export competitiveness of domestic firms must be on the priority list of African governments if they want to develop and enhance productive capacities particularly in the manufacturing sector.

Infrastructure and the development of productive capacities

The state of infrastructure development in a country has an impact on the capacity of a country to produce and export goods. Nubler and Ernst (2013) argue that the availability of good infrastructure services (in areas such as transport, energy, telecommunications, water, etc) results in improved connectivity and a reduction in production and trade costs. These reductions in transaction costs enhance firm competitiveness, foster international trade and investment, and facilitate adoption of improved technologies. In this regard, infrastructure development increases productivity and growth and contributes to industrial development.

It is well-known that many African countries have very low levels of energy, transport, water and telecommunications infrastructure (AfDB 2018). But the infrastructure challenge facing African enterprises is not only about quantity. It is also about the poor quality of infrastructure, the high cost of infrastructure services, and the generally low access to available infrastructure. The poor state of productive infrastructure in Africa, particularly in the energy and transport sectors, has been a major obstacle to the development of productive capacities, industrialization and growth in Africa. Calderon et al (2018) provide evidence indicating that in terms of the quantity, quality and access to infrastructure, Sub-Saharan Africa (SSA) ranks behind other developing country regions. For instance, SSA has less than a third of the electricity-generating capacity of South Asia and less than one-tenth of that of Latin America and the Caribbean. Also, the share of paved roads in total roads in SSA is 16 percent compared to 53 percent in South Asia and 24 percent in Latin America and the Caribbean. Interestingly, empirical evidence suggests that the potential growth benefit from closing Africa's infrastructure gap is large. For instance, if SSA increases both the quantity and quality of infrastructure to match the median of the world, its growth per capita will increase by about 1.7 percentage points per year (Calderon et al, 2018). Within Africa, there is a wide variation in the levels of infrastructure development across countries. The African Development Bank has developed the Africa Infrastructure Development Index (AIDI) to monitor the state of infrastructure development in the continent. The index lies between 0 and 100 with higher values reflecting higher levels of infrastructure development.

The average annual values for the index over the period 2003-2018 shows that Seychelles, Libya, Egypt, South Africa, Mauritius, Tunisia, Algeria and Morocco have relatively better levels of infrastructure development than other countries on the continent. The index also suggests that while the level of infrastructure development in Africa is relatively low, many African countries made significant progress in infrastructure development between 2003 and 2018. For instance, in Cabo Verde the index rose from 24.9 to 48 between 2003 and 2018. In Kenya it rose from 7.9 to 25.6 and in Swaziland it rose from 13.2 to 25.8 over the same period.

A key reason for the poor state of infrastructure development in Africa is the low level of investment in the sector, particularly by the private sector. As shown in Table 1 the private sector accounts for an insignificant percentage of financing for Africa's infrastructure. For instance, in 2017 it accounted for only 2.8 percent of total African infrastructure financing compared to 42 percent by African national governments, 24 percent by members of the Infrastructure Consortium for Africa (ICA), and about 24 percent by China. Some of the reasons why there has been very limited investment, particularly from the private sector, in African infrastructure include: the lack of strong legal, regulatory and institutional frameworks, poor governance, and weaknesses in infrastructure planning, project preparation and implementation. While the lack of funds from the private sector is widely regarded as a constraint on developing African infrastructure, some have argued that a more binding

constraint is the lack of bankable projects (ICA 2018).[8] Collier (2014) argues that one of the reasons it is challenging to attract international private finance to African infrastructure is that projects tend to be small, costly to prepare and hard to value. They also involve high risks because of the possibility of expropriation of assets by African governments. In this regard, there is the need to de-risk African infrastructure projects through, for example, subsidized risk insurance, re-bundling of risks, and use of commitment technologies such as that implicit in the political risk insurance provided by the World Bank under the Multilateral Investment Guarantee Agency (Collier 2014).

Table 1. Sources of African infrastructure financing, 2012-17

	Average 2012-16 Value ($ billion)	2017	
		Value ($ billion)	Share (%)
African national governments	30.1	34.3	42.1
Infrastructure consortium for Africa members	20.2	19.7	24.1
China	11.5	19.4	23.8
Arab coordination group	4.4	3	3.7
Other bilaterals/multilaterals	2.5	2.9	3.5
Private sector	6.2	2.3	2.8
Total	75	81.6	100

Sources: compiled based on data from ICA 2018 and AfDB 2018.

Over the past decade, attempts have been made to estimate Africa's infrastructure financing needs with a view to determining the continents financing gap. For instance, Foster and Briceno-Garmendia (2010) estimated the continent's financing need to be $93 billion per year and the financing gap as $48 billion per year. More recent estimates by the African Development Bank suggests that the continent's financing needs are between $130 - $170 billion per year. Given that the average annual financial commitment to Africa's infrastructure over the period 2012-17 was about $77 billion, it has been estimated that the infrastructure financing gap is between $53 -$93 billion per year.[9] Table 2 presents a breakdown of Africa's infrastructure financial need and gap by sector. It shows that the Water and Sanitation sector has the highest financing gap, which is not surprising in the light of the fact that it accounted for only 14 percent of the financing commitments to Africa's infrastructure in the period 2012-17 while the transport and energy sectors accounted for 42 and 35 percent respectively (figure 4).

[8] AfDB (2018) defines a bankable project as one that provides clear incentives for lenders to consider financing it.

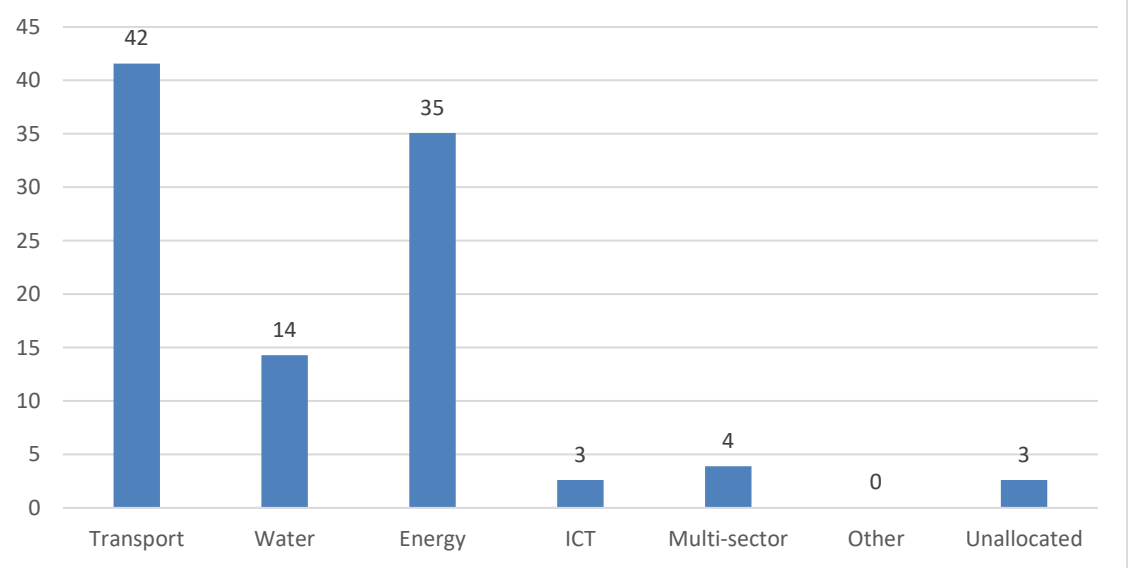
[9] Note that the financing gap in Table 2 is lower than the estimate presented in the African Economic Outlook 2018 because that publication used the average financing commitments for 2012-16 while the number in Table 2 is based on average commitments for 2012-17 which is much higher than those for 2012-16.

Table 2. African infrastructure financing needs and gaps, by sector ($ billion)

	Financing need (low)	Financial need (high)	Average financing commitments (2012-17)	Minimum financing gap	Maximum financial gap
Transport	35	47	32	3	15
Water	56	66	11	45	55
Energy	35	50	27	8	23
ICT	4	7	2	2	5
Multi-sector	-	-	3	-3	-3
Other	-	-	0	0	0
Unallocated	-	-	2	-2	-2
Total	130	170	77	53	93

Source: ICA 2018

Figure 4. Share of average financing commitments (%), by sector (2012-17)



Source: compiled based on data in ICA 2018.

Technology, innovation and the development of productive capacities

Technology and innovation will play a crucial role in developing productive capacities and transforming African economies towards industrial activities. The generation, dissemination and application of science and technical knowledge provides countries access to new techniques of production and contribute to an increase in the competitiveness and productivity of domestic enterprises thereby facilitating the shift of resources from low to high productivity activities (Osakwe and Moussa 2018). African leaders and policymakers have recognized this crucial role of technology and innovation in the development process by launching several initiatives at the national, regional and continental levels.

At the national level, many African countries have integrated Science, Technology and Innovation (STI) policies into their national development plans and strategies. For instance, STI has been explicitly incorporated as an important pillar in Kenya's Vision 2030. In Rwanda the role of STI in supporting the development process was acknowledged in Vision 2020. And in Tanzania STI is regarded as one of the means to achieve its Vision 2025

of transforming the country from low to middle-income status. At the regional level, several regional economic communities such as the Southern African Development Community (SADC), the Economic Community of West African States (ECOWAS) and the East African Community (EAC) have also developed protocols or policy frameworks on STI (ACBF 2017). There are also initiatives by African leaders at the continental level such as Africa's Science and Technology Consolidated Plan of Action for the period 2005-2014 adopted by the African Union in 2005 and the Science, Technology and Innovation Strategy for Africa (STISA) which covers the period 2014-2024 and was adopted at the 23rd African Union Summit in June 2014 (Osakwe and Moussa 2018).

Notwithstanding the high number of STI initiatives adopted by African governments over the past few decades, many African countries still have very low levels of STI relative to countries in other continents and relative to what would be needed to boost productive capacities and foster industrial development. To get an idea of the state of innovation in African countries relative to countries in other continents, we use the global innovation index (GII) prepared by Cornell University, INSEAD, and WIPO (2018). It measures the state of innovation in 126 countries in 2018. The index is a simple average of indices of innovation input and innovation output and ranges from 0 to 100, with higher values indicating higher levels of innovation.[10] In the 2018 index, no African country was on the list of the top 40 ranked countries in the world, which is a reflection of the generally low level of innovation in Africa relative to other continents. Among African countries, South Africa had the highest innovation score with a global rank of 58, followed by Tunisia (66) and Mauritius (75). With a global rank of 125 Togo had the lowest score among the 28 African countries included in the sample (table 3).

One of the interesting findings of the GII 2018 is that although Africa has a low level of innovation, the region has relatively high innovation momentum in the sense that it has more countries on the list of innovation achievers than any other region in the world. More importantly, out of the 20 countries on the list in 2018, seven were African countries (Kenya, Malawi, Mozambique, Rwanda, Madagascar, South Africa and Tunisia). Kenya has been on the list for the past eight years and Malawi, Mozambique and Rwanda have been on it since 2012. Another interesting finding of the GII 2018 is that a country that has higher innovation scores does not necessarily have higher innovation efficiency, which measures the extent to which innovation inputs are effectively translated to innovation outputs. For instance, South Africa has higher innovation scores than Kenya, yet the latter has higher innovation efficiency ratio than the former (table 3). Similarly, Egypt has lower innovation scores than Mauritius, yet it has higher innovation efficiency ratio than Mauritius.

The low level of innovation in Africa relative to other continents and the fact that African countries have not been able to effectively use STI policies in support of building productive capacities and structural transformation of their economies are due in part to low investment in STI capacity development at the national level which has resulted in weak institutional capacities and inadequate capacity to formulate and implement coherent policies (ACBF 2017). But it is also a consequence of the weak systems of innovation in African countries which has not facilitated meaningful and purposeful interaction amongst key economic actors. Firm survival and growth are affected by interdependences and interactions with economic agents such as universities and research institutes, labor exchanges, standard setting bodies, state-owned enterprises, export support agencies, and finance institutions. They are also affected by inter-firm flows of knowledge gained through, for example, joint ventures, sub-contracting and supplier-customer relations (Banji 2006). In most African countries there is very weak interaction between small and large firms and between firms and governments which has created an environment in which the private sector does not play an active role in industrial policymaking. In addition, the poor coordination of knowledge generation and production activities in African countries has led to universities producing graduates without skills required by industry (Banji 2006). In this regard, there is the need for African governments to strengthen efforts to better link research and development (R&D) institutions with the productive sectors of the economy to ensure that their activities respond to the needs of industry.

[10] Innovation input is captured by factors that drive innovative activities in an economy such as: institutions, human capital and research, infrastructure, market sophistication, and the level of business sophistication as reflected in innovation linkages, and capacity to absorb and diffuse knowledge. Innovation output reflects the outcome of innovative activities and is captured by two indicators: knowledge and technology outputs, and creative outputs.

Table 3. African countries in the Global Innovation Index 2018.

Economy	Score	Rank	Innovation efficiency ratio
South Africa	35.1	58	0.55
Tunisia	32.9	66	0.63
Mauritius	31.3	75	0.47
Morocco	31.1	76	0.61
Kenya	31.1	78	0.69
Botswana	28.2	91	0.39
Tanzania, United Republic of	28.1	92	0.72
Namibia	28	93	0.41
Egypt	27.2	95	0.66
Rwanda	26.5	99	0.31
Senegal	26.5	100	0.6
Uganda	25.3	103	0.45
Madagascar	24.8	106	0.69
Ghana	24.5	107	0.51
Algeria	23.9	110	0.42
Cameroon	23.8	111	0.58
Mali	23.3	112	0.59
Zimbabwe	23.1	113	0.6
Malawi	23.1	114	0.52
Mozambique	23.1	115	0.52
Nigeria	22.4	118	0.5
Guinea	20.7	119	0.47
Zambia	20.7	120	0.45
Benin	20.6	121	0.35
Niger	20.6	122	0.36
Côte d'Ivoire	20	123	0.4
Burkina Faso	18.9	124	0.28
Togo	18.9	125	0.36

Note: The innovation efficiency ratio is defined as innovation output divided by innovation input.
Source: compiled based on data from Cornell University, INSEAD, and WIPO (2018).

Institutions are key to the innovative activities of firms and the translation of innovation inputs into output. And they are much more than formal organizations such as universities, firms, finance houses, and state agencies. They provide rules governing interactions among agents and enforce contractual obligations thereby creating a stable and conducive environment for collaboration between firms and for innovation. Banji (2006) argues that the reason traditional STI policies in Africa did not have the expected impact on innovation and industrial development is that they assumed away the role of institutions. Firms innovate through continuous learning and interaction with other economic agents. They also innovate when there are appropriate local institutions to support the process of learning and knowledge acquisition. Yet, traditional technology policies in Africa were developed as if they are divorced from the institutional structures that they are embedded in. Furthermore, technology policies in Africa focused on R&D, import of machinery and equipment and training and apprenticeships (learning by doing) as the main sources of knowledge and skills acquisition by firms. However, firm learning could also arise from learning by using and learning by interacting (Banji 2006). In this context, there is the need for African governments to rethink their approach to the design and implementation of

technology policies to ensure that they incorporate the diverse sources of learning and the pivotal role of institutions in the generation, use and diffusion of innovation.

Another factor that has contributed to the low development impact of STI in Africa is "brain drain" which has led to the loss of experts in science, technology, engineering and mathematics (STEM) with critical skills needed for productive capacity development and transformation (ACBF 2017). A recent study indicates that migrants from sub-Saharan Africa to the Organization for Economic Cooperation and Development (OECD) countries generally have better education than those from other developing regions. Furthermore, it is projected that between 2013 and 2050 the number of migrants from SSA to OECD countries will increase from 7 million to 34 million (IMF 2016). While migration also brings potential benefits to Africa, in the form of remittances, the welfare costs in the form of the loss of highly skilled manpower has dire consequences for innovation, the development of productive capacities and transformation of African economies.

3. Policy recommendations on how to develop productive capacities to support Africa's industrialization agenda

A key message from the previous sections of this paper is that the nature and pattern of productive capacity development matter in an economy. When productive capacities are developed to increase the output of existing (traditional) products rather than the production of new, dynamic or sophisticated products, it will not foster structural transformation of the economy, particularly into manufactured products. In this context, there is the need for African policy makers to adopt the right approach to developing productive capacities to ensure that they achieve their industrialization and transformation agenda. The rest of the paper discusses policies that African policymakers should consider adopting to make the development of productive capacities consistent with the objective of industrialization and transformation.

Use industrial policy strategically to gear productive capacities development towards achieving the goal of industrialization and transformation in Africa

In most economies, the bulk of production of and trade in goods is done by the private sector. But the state plays an important role in redirecting production into activities and sectors that are dynamic, sophisticated and with higher value addition. Throughout history, especially in the advanced and emerging economies, the state has successfully played this transformative role through the judicious exercise of industrial policy (UNCTAD and UNIDO 2011). However, in Africa, the state has been unable to effectively use industrial policy in support of industrialization and transformation of the production and export structures of economies in the continent. Some of the reasons for the ineffectiveness of past industrial policies in Africa include government provision of support to domestic firms without challenging them to perform; low interaction between the state and the private sector; incoherence between industrial policies and other macroeconomic policies; a focus on import substitution and neglect of export promotion; and high production and trade costs due to weak infrastructure and burdensome regulation. African policymakers have recognized the mistakes of past industrial policies and have in the past few decades started to adopt a more strategic and pragmatic approach to industrial policy which has led to positive outcomes in some economies. For instance, industrial policy contributed to the development of the leather, textile and garment, cement and floriculture sectors in Ethiopia. It also played an important role in the development of ICT-based services and tourism in Rwanda (UNECA 2016). A key industrial policy instrument that African policymakers could deploy to build productive capacities and industrialize their economies is the establishment of special economic zones for targeted industrial activities. Another policy is to make monetary and macroeconomic policies consistent with the goal of industrialization and transformation

by ensuring that domestic interest rates are not prohibitive and that local firms have access to long term capital for productive investment.

Promote entrepreneurship and enhance competitiveness of domestic enterprises

The promotion of entrepreneurship is important in developing a vibrant and dynamic domestic private sector that can support the building of productive capacities and the structural transformation process. In Africa the level of entrepreneurship is quite low, which limits the continents industrial potential and capacity to produce goods generally. So far, efforts to address this problem has been mostly focused on the constraints that are external to firms: weak infrastructure, skills shortage, small size of African economies and markets, and regulatory barriers. However, firms also face internal constraints that affect their survival and growth such as: the size of firms, capacity to learn and innovate, managerial capabilities, funding level, degree of customer orientation, networking ability, and efficiency of supply chains (Page 2012; UNCTAD 2018). In this regard, an effective policy package to promote entrepreneurship must address both the external and internal constraints facing domestic firms.

One of the issues that African policymakers must address to promote entrepreneurship is to improve the quality of human capital in the continent. The stock and quality of human capital affect the productivity of firms and their ability to absorb technologies as well as innovate. Against this backdrop, African policymakers should increase investments in education, especially in the areas of science, technology, engineering and mathematics. In doing so, however, they should redesign the educational curriculum and gear it towards skills acquisition to ensure that students graduate with skills that can respond to the demands of domestic industries (Signé 2018). There is also the need to promote vocational and on-the-job training and to incorporate it into the formal education system. A key reason why existing Technical and Vocational Education and Training (TVET) schemes in African countries have not had the desired impact on skills acquisition is that they are regarded as schemes designed for students who do not have the intellectual capacity to go through the formal education system (that is, non-achievers). As a result of this stigma, the youth are not motivated to participate in TVET programmes and governments also do not accord them the attention they deserve. It would be desirable for African policymakers to integrate the TVET programme into the formal education system to remove the stigma attached to it and increase its appeal to the youth.

Another measure that African governments could take to promote entrepreneurship is to strengthen infrastructure development at the national level, particularly in the area of energy and transport. This will permit domestic enterprises to reduce production costs significantly and enhance their international competitiveness. Strengthening infrastructure development in Africa requires increasing the quantity and quality of infrastructure and improving access to existing infrastructure services. It also requires creating political, regulatory and legislative environments conducive to private sector participation in infrastructure development. It is estimated that insurance companies, pension funds, sovereign wealth funds and other institutional investors have about $100 trillion dollars in assets that could potentially be deployed to finance investments in African infrastructure (AfDB 2018). Yet the private sector currently plays a very limited role in the financing of African infrastructure, accounting for about 2.8 percent in 2017. Blended finance is increasingly discussed as an innovative mechanism to leverage private finance for infrastructure investment in Africa. It involves the use of development resources to alter the risk-return profile of an investment to attract commercial finance (OECD 2018). Given the high risks associated with private investment in Africa it is a potentially useful instrument for attracting commercial finance. But it must be deployed in a holistic manner for it to play a transformative role on the continent. That is, the focus should not only be on boosting the amount of private investment but also on enhancing the efficiency of existing investments and ensuring that new investments go to priority sectors of the economy, especially manufacturing activities. Furthermore, the effectiveness of blended finance in attracting significant commercial capital will depend on whether appropriate measures are taken to lift the binding constraints to private investment in developing countries. These include low expected returns due to high risks, challenging investment climates, weakness of domestic financial markets, and weak investor understanding of available investment opportunities due to knowledge and capacity gaps (OECD and WEF 2015).

In addition to exploiting opportunities created by blended finance, African governments can also generate substantial resources to finance infrastructure projects by stemming illicit financial flows (IFF). It is estimated that the continent loses about $50 billion per year as a result of IFF and a large part of the loss is due to trade-related commercial activities of multinational corporations and organized crime. To curtail IFF and release development resources for infrastructure projects, African governments should strengthen their legal and regulatory frameworks, improve tax and customs administration, enhance supervision of banks and non-bank financial institutions, and promote good governance. At the international level, there is the need for more international cooperation on tax matters, adoption of country-by-country accounting reporting standards for multinational corporations and making international transfers more transparent (UNCTAD 2016).

Most explanations for the low investment in African infrastructure tend to focus on the availability of finance. ICA (2018) argues that the lack of bankable projects rather than the availability of resources is the most binding constraint and needs to be addressed. Because of the long-time horizons as well as the high risks and costs associated with infrastructure projects, private investors are generally reluctant to invest in the preparation of infrastructure projects. African governments also face serious challenges in preparing such projects because of weak administrative capacities and financing constraints. Against this backdrop, there is the need for donors and international organizations to strengthen capacity-building support for preparation of infrastructure projects to enhance their attractiveness to private investors. There is also the need for African governments to strengthen the legal, regulatory and institutional frameworks to incentivize the private sector to invest in African infrastructure.

In addition to the policies discussed above, there are other actions that African governments could take to promote entrepreneurship such as: reducing bureaucratic red tape and corruption to reduce trade and transactions costs; providing support to entrepreneurs to connect them to potential investors; assisting entrepreneurs to better understand potential markets and how to adapt to changes in these markets; and strengthening export promotion activities because of the positive impact it can have on firm performance.[11]

Enhance support for technology and innovation

Technology and innovation are key drivers of productive capacity development and industrialization in an economy and so efforts to foster these goals in Africa must include a strategy to promote technological innovation. UNCTAD (2015) suggests that African countries have not been able to effectively harness innovation policies for industrial development due largely to: policy incoherence both in design and implementation; weak monitoring and evaluation systems; gaps in policymaking structures; and lack of integration of private sector perspectives in policy frameworks and strategies. Osakwe and Moussa (2018) identified some policy measures that African policymakers should consider adopting to foster technology and innovation in support Africa's transformation agenda. First, is the development of coherent STI policies which require the coordination of STI policies with other development policies, particularly industrial development and trade policies. Second is the need to increase domestic expenditure on R&D in African countries to the 1 percent (of GDP) target set by the African Union. Third, is the importance of strengthening linkages between research institutes and universities and the domestic private sector to ensure that graduates of these institutions have the skills required by domestic enterprises. Fourth, is the need to promote innovation at the enterprise level through provision of good infrastructure, reduction of regulatory barriers facing enterprises, support for training programmes at the firm level, and promotion of clusters and technology parks. Finally, there is the need to increase awareness of intellectual property rights in Africa to foster technology and innovation, especially by the youth and young entrepreneurs.

Fully exploit the potential of regional cooperation for development

Given the small size of African economies and the enormity of their investment needs, regional cooperation has a crucial role to play in fostering productive capacity development and industrialization in the continent. The integration of labour, goods, and capital will permit African countries to facilitate migration of skilled workers within the continent, relax domestic demand constraints through increasing market size, better reap

[11] There is evidence that exporting increases productivity of African firms (Page 2012).

the benefits of economies of scale, and generate agglomeration economies. Furthermore, the harmonization of policies and reduction of trade barriers resulting from closer regional integration will reduce trade costs for African enterprises and make them much more competitive at the global level. Another important channel through which regional cooperation could promote productive capacity development and industrialization in Africa is the development of cross-border infrastructure, especially in the energy, transport, and telecommunication sectors. African policymakers are aware of the need to exploit the potential of regional integration for infrastructure development as evidenced by the fact that over the past decade they have strengthened efforts to collaborate on infrastructure projects. In July 2010, the Programme for Infrastructure Development in Africa (PIDA) was launched by African Heads of State and Government with the goal of connecting, integrating and transforming the continent. PIDA was subsequently approved by African leaders in January 2012 with a focus on projects covering the energy, transport, telecommunications and trans-boundary water sectors. It provides a strategic framework and a priority action plan for addressing the continents infrastructure needs. While some progress has been made in the implementation of PIDA, as at November 2018, only about 32 percent of the 400 projects in the priority action plan were either under construction or operational (Mayaki 2018). In this context, there is the need for African policymakers to redouble efforts to enhance implementation of PIDA to increase prospects for achieving their transformation agenda.

Improve effectiveness and efficiency of supply chains or networks

A major challenge that African countries face in developing productive capacities and integrating into the global trading system is the existence of weak, inefficient and poorly integrated supply chains, which introduces uncertainty and instability in the supply of raw materials and other key inputs used in the production process (Signé 2018). As a result of these defects in the supply chains, African countries generally have low capacity utilization rates in manufacturing both relative to optimal capacity and to the rates that are observed in other developing countries. Some measures that African governments and firms could take to address supply chain challenges include investing in supply chain infrastructure development, providing training and skills development to the workforce, reducing regulatory barriers to trade, and vertical integration of operations by firms to reduce the unpredictability of supplies.

Create political and macroeconomic environments conducive to production and transformation

Macroeconomic stability is crucial for attracting the level and kinds of investment needed for developing productive capacities and for industrializing African economies. Therefore, African governments are encouraged to promote macroeconomic stability through good economic management, avoiding policy reversals, and reducing uncertainty in macroeconomic policies. It is important to note that although economic factors play a key role in promoting productive capacity development and industrialization, they do not operate in a vacuum. They are effective when they are implemented in a stable political environment. Unfortunately, political instability is a reoccurring feature in many African countries, and this has had a negative impact on peace and security on the continent. While there has been significant progress made in maintaining political stability on the continent, significant challenges remain. In this context, there is the need for African governments to strengthen efforts to maintain political stability and a necessary condition for that is to make the growth and development process more inclusive than in the past to promote ownership of the process and outcomes.

Make regional and international policies consistent with the goal of productive capacity development and transformation of African economies

African countries operate in a rapidly globalizing world which means that the actions they take to foster productive capacity development and industrialization are affected by policies and developments at the regional and global levels. In this context, there is the need for integration of national, regional, and international policies to ensure that there is policy coherence and that they are used in support of the goal of productive capacities development. At the national level, there is the need to ensure that the three pillars of productive capacity development: building, utilizing and maintaining capacities, are integrated into policy design, implementation, and monitoring and evaluation. Regional policies should also be made consistent with the goals of developing productive capacities and transforming African economies. The existence of overlapping memberships of

regional economic communities in Africa has had a negative impact on productive capacity development and industrialization by making it challenging to harmonize trade policies at the regional level and gear them towards the goal of productive transformation. It has also impeded efforts to eliminate regional trade barriers, enhance the competitiveness of African firms, and facilitate their integration into regional and global value-chains. At the global level, there is also the need for trade, aid, investment and environmental policies to be designed and implemented in such a way that they are supportive of the goals of productive capacity development and transformation of African economies.[12]

4. Conclusion

The conventional wisdom in the development literature is that African countries will enhance prospects for meeting their national development objectives and achieve regional and global development goals (such as the SDGs) by developing productive capacities, transforming production structures toward manufactured goods, and diversifying exports. Despite the importance of these processes of economic development, there is very limited understanding of the linkages between the concepts and how they relate to the goal of poverty alleviation. This paper identified and examined some mechanisms through which the development of productive capacities can be linked to the processes of structural transformation and exports diversification and how they can contribute to the goal of poverty reduction in Africa. It also examined the role of infrastructure and technology and innovation in developing productive capacities and offered policy recommendations on how productive capacities could be promoted to support Africa's industrialization agenda and enhance prospects for achieving the SDGs.

[12] For instance, in the formulation and implementation of the Millennium Development Goals, there was an emphasis by the international development partners on the social sectors, which led to a reduction in the share of aid to the productive sectors of the economy with serious negative consequences for the development of productive capacities and economic transformation of African economies.

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