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Innovation, diversification and inclusive development in Africa

Abstract

A key guiding principle of the newly adopted Sustainable Development Goals is to "leave no one behind." Bringing this vision to fruition will require eradication of poverty, fairer income distribution and sustained social progress over the next fifteen years. Furthermore, it will inevitably require creating decent employment through transformation of the production and export structures of African economies. This paper argues that technological innovation is vital to addressing both challenges of low structural transformation and lack of inclusive development on the continent. Against this backdrop, the paper discusses linkages between innovation, transformation and inclusion. It also presents stylized facts on transformation, the state of innovation and inclusion in Africa and, more importantly, offers policy recommendations on how to promote technological innovation to trigger transformation and build inclusive societies in Africa.

Key words: Africa, Diversification, Social inclusion, Technological innovation.

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1. Introduction

An overarching principle of the Sustainable Development Goals (SDGs) adopted by global leaders in 2015 is to "leave no one behind." Realizing this vision will require poverty eradication, better income distribution and sustained social progress over the next 15 years. The assessment of performance in implementation of the Millennium Development Goals (MDGs) indicated that Sub-Saharan Africa (SSA) is the only region that did not meet the MDG of halving poverty by 2015. In addition, a recent study found that Africa will increasingly be home to a large part of the world's extreme poor (Beegle et. al. 2016). These facts suggest that if the international community want to enhance prospects for achieving the SDGs, there has to be a special focus and attention on SSA, particularly the least developed countries in the region. But there also has to be a concerted effort by the international community to engender structural transformation and foster inclusive growth thereby laying a solid foundation for sustained development and ensuring that no one is indeed left behind in the development process.

Technology and innovation are crucial for addressing the challenges of low structural transformation and inclusive development in Africa. For example, technological innovation can enhance competitiveness and trigger a shift of resources from low to high productivity activities thereby inducing transformation of the structure of an economy. It can also foster inclusion through enabling the acquisition of knowledge and skills which permit economic agents to fully participate in, and benefit from, the development process.[1] Against this backdrop, this paper presents stylized facts on structural transformation, the state of innovation and inclusion in Africa and, more importantly, offers policy recommendations on how to promote technological innovation to trigger structural transformation, build inclusive societies, and enhance prospects for achieving the SDGs in Africa. The paper is organised as follows: Section 2 discusses channels through which technological innovation could affect structural transformation and inclusion. Section 3 presents some stylized facts on structural transformation in Africa while Section 4 assesses Africa's performance in achieving the goal of building inclusive societies as reflected in the SDGs. Section 5 examines the state of technology and innovation in Africa and Section 6 discusses policies that could be adopted to foster technology and innovation with a view to promoting transformation and inclusive development in Africa. Section 7 contains concluding remarks.

2. Innovation, transformation and inclusion: the linkages

The economic literature suggests that development occurs through structural changes involving movements of labour and other resources from low to high productivity activities both within and across sectors (Page 2012). Osakwe (2016) shows that African countries have not been able to successfully transform their economies and foster inclusive development despite the rapid growth experienced by the continent over the past decade. This paper argues that technological innovation will play a vital role in addressing both the challenges of structural transformation and inclusive development and African governments should, therefore, strengthen efforts to foster technological innovation. In this section, we draw on insights from the economic literature to delineate mechanisms through which technological innovation can be linked to transformation and inclusion. Economic theory suggests that technological innovation is the main driver of sustained long run growth and the diffusion of such innovation permits lagging countries to shift production towards sectors with increasing returns thereby promoting growth convergence (Verspagen 2004; Aghion and Howitt 1998). Technological innovations are associated with new products and processes and also

[1] Note that technological progress can foster inclusion only if people can access and use new technology and innovation. If some segments of society (for example, unskilled workers) do not have good and affordable access to new technology and innovation, then technological progress can indeed become a source of social exclusion.

create new patterns of demand resulting in a change in the sectoral composition of an economy. In addition, they trigger investment, enhance productivity growth and facilitate changes in the organisation of firms (Sandven, Smith and Kaloudis 2005).

In the Schumpeterian literature on economic growth, the interaction of demand growth and technological learning induces structural change in an economy towards technology-intensive sectors resulting in higher growth rates (Cimoli et. al. 2011; Schumpeter 1934). When a new technology is introduced and diffused, it tends to have a structural impact because it leads to an increase in activities that rely on the new technology and a decrease in those activities associated with older technologies. Furthermore, new technologies are generally associated with an increase in productivity and so countries that are at the technological frontier are able to compete in new sectors and to shift their economic structure towards more technology-intensive sectors. The focus of the discussion so far has been on how technological innovation affects structural change. But the literature also recognises the fact that innovations tend to evolve much faster in some activities (such as manufacturing) than in others (such as agriculture) and so the structure of an economy can also have an impact on the pace of technological innovation. For example, countries that have an industrial structure tilted towards high-tech sectors experience faster technological progress than those relying on low-tech sectors. In this context, the structure of an economy can affect the rate at which it approaches the technological frontier and so affect the technology gap between countries (Cimoli et. al. 2011).

With regard to inclusive development, the literature suggests that technological innovation plays a crucial role in determining whether or not the growth and development process in a society is inclusive. To the extent that new technologies result in better quality jobs (particularly for the poor), reduce environmental pollution, increase efficiency of resource use, and improve health, they can have a positive impact on living standards and make the growth process more inclusive (Naude and Nagler 2015). Innovation can also have a positive impact on income distribution if it gives vulnerable groups better access to markets and permits them to take advantage of opportunities created in the development process. For example, the rapid spread of mobile telephones in Africa has been credited with giving poor farmers better access to finance. It has also been used by some governments to provide input subsidies directly to farmers thereby eliminating middle-men and reducing leakages in the delivery system (Osakwe and Poretti 2015). While technological innovation could have a positive impact on growth and inclusion, there is also recognition that it can be a source of social exclusion. One channel through which innovations could contribute to social exclusion in an economy is through the nature of technological change, as reflected in new technologies being capital rather than labour-intensive. Since labour is the only asset owned by most poor people, innovations that are associated with capital intensive techniques (which use more of skilled rather than unskilled labour) make it challenging for vulnerable groups to participate in the growth process and so increase inequality. But technological innovation can also foster social exclusion through having adverse effects on the environment or environmental services which tend to have a disproportionately negative impact on the poor (UNCTAD 2017). In sum, the literature suggests that technological innovation can have a structural impact on an economy and that its effect on the distribution of income will depend in part on the nature of new innovations and on whether vulnerable groups can access and use such innovations.

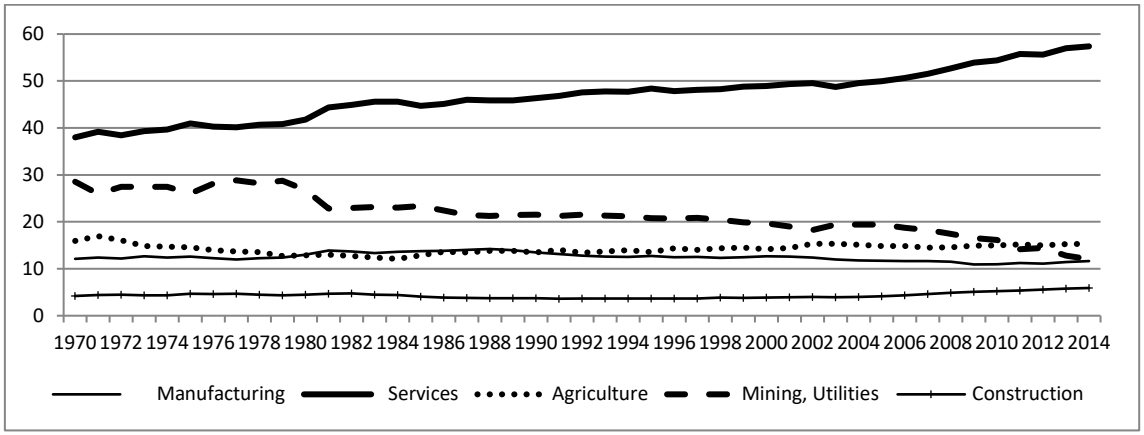
3. Scope and nature of structural transformation in Africa

To understand the scope and nature of structural changes that have taken place in Africa over the past few decades, this section examines structural transformation from both a domestic and an international perspective. At the domestic level, the focus is on the contributions of key economic activities or sectors (agriculture, manufacturing, services etc.) to output and employment. And at the international level, the focus is on the contribution of manufacturing to total exports and the contribution of technology-intensive exports to total manufacturing exports.

Output and employment

There has been a significant change in the structure of African economies over the past few decades, with services playing a dominant and increasing role both in output and employment. Figure 1 shows that the share of services in value-added increased from 38 per cent in 1970 to 57 per cent in 2014. This increase in the share of services went hand in hand with a decrease in the share of mining and utilities in total value added. With regard to agriculture, its share has been relatively low and flat over the period and in 2014 it accounted for just 15 per cent of total value added in Africa. As with the agriculture sector, the share of manufacturing in value added remains very low relative to the share of the services sector. In fact, in 2014 manufacturing accounted for only 12 per cent of total value added, which is lower than its peak value of 14 per cent in the 1980s.

Figure 1. Share of economic activities in real value added in Africa (%), 1970-2014



Source: UNCTADStat database (http://unctad.org/en/Pages/statistics.aspx).

Note: Value-added measured at 2005 constant prices.

Another approach to examining the nature of structural change that has occurred in Africa at the domestic level is to look at the share of various activities in total employment. It is well-known that most of the continents labour force is in the agriculture sector. In particular, in most countries, two-thirds of the labour force works in the agriculture sector (figure 2) which accounts for a low share of value added, indicating that average labour productivity is much lower in agriculture than in other key sectors. The finding that labour productivity in agriculture is relatively very low suggests that there is a need to reallocate some labour to productive activities in industry and services. While some of this reallocation is already taking place, they seem to be going mostly to the services sector and, more importantly, to low rather than high productivity activities in the services sector.

To further explore the productivity issue, we computed relative productivity levels across sectors using an extended version of the Groningen Growth and Development Center (GGDC) database, which provides disaggregated data on employment and value-added for 13 African countries beginning in 1960.[2] The results suggest that in 2010 (relative to the situation in 1960): (1) labour productivity in manufacturing either declined or remained largely unchanged in most of the countries in the sample, Botswana being an exception; (2) in most countries labour productivity levels were relatively high in the mining sector; and (3) a lot of the labour that moved from agriculture and industry into the services sector ended up in the category "other services" which consists of: community, social and personal services; government services; and trade, restaurants and hotels. These activities classified under "other services" have very low productivity compared to the other components of services such as "finance, insurance, real estate and business services" and

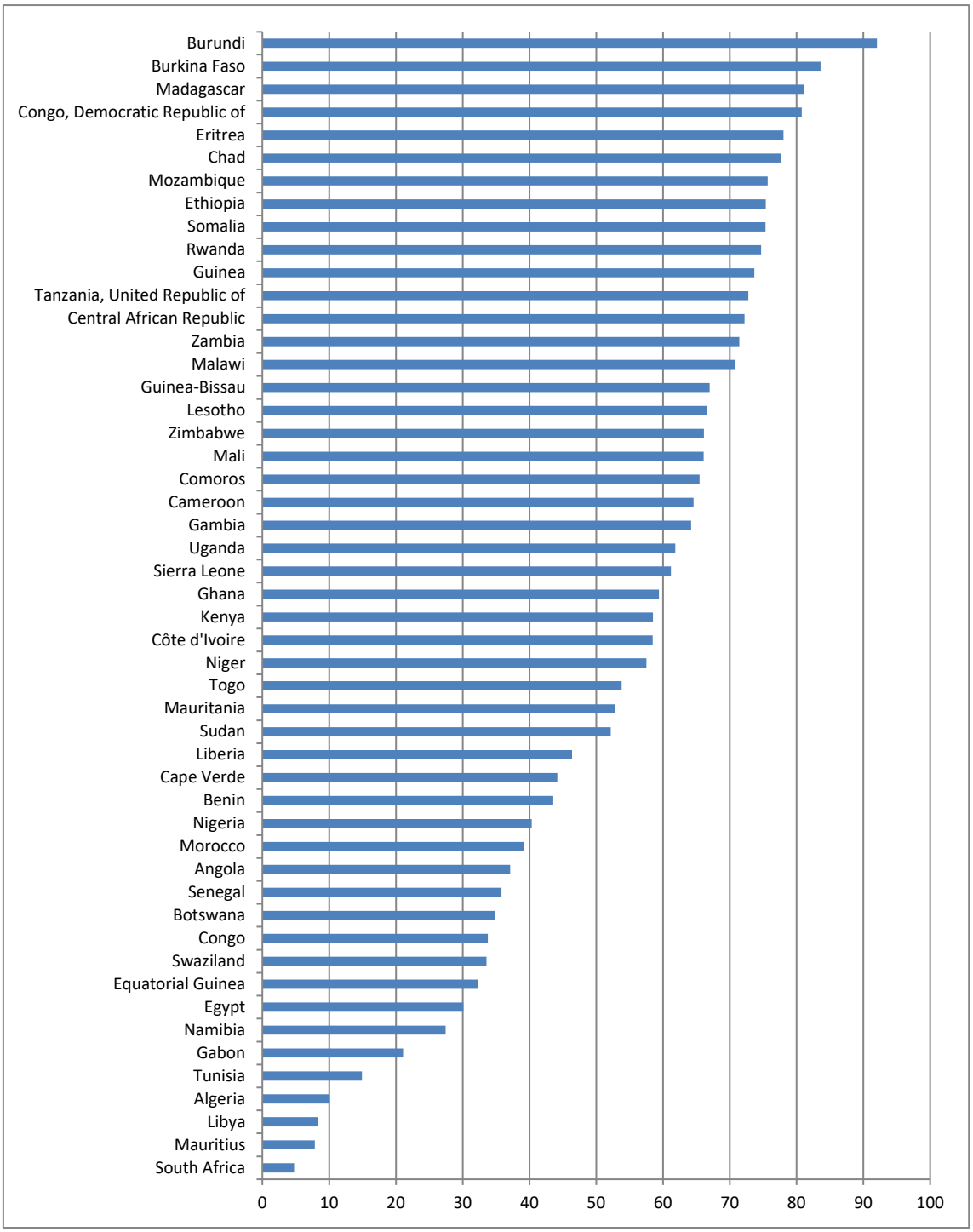
[2] The countries are: Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, United Republic of Tanzania, and Zambia.

"transport, storage and communications." The category "other services" also has the second lowest productivity level after agriculture. Historically, at the initial stage of development labour tends to move from agriculture to manufacturing and then, as incomes rise, to services. However, African countries seem to be by-passing this normal process of structural change, with labour moving from agriculture and industry to low-productivity services. This development is of concern to African countries because it has negative consequences for their ability to exploit the potential of industrialisation for employment generation.

An interesting question to pose at this stage is what factors drive productivity changes in Africa? Following McMillan and Rodrik (2011) and de Vries et. al. (2015), we decompose labour productivity growth into three components: the within effect (which captures productivity growth within sectors); the between-static effect (which reflects differences in productivity levels across sectors); and the between-dynamic effect (which reflects differences in productivity growth across sectors). The within effect will be positive when labour productivity growth in the sectors is positive and the between effects are positive when labour moves from a less to a more productive sector. Figure 3 shows that a lot of the productivity growth that occurred in African countries in the sample in the period 2000-2010 was driven by positive productivity growth within sectors (the within effect) and a reallocation of labour from sectors with low productivity levels to those with higher productivity levels (the between-static effect). The results also show that the reallocation of labour across sectors also created dynamic losses in the sense that the marginal productivity of additional workers in the expanding sectors has been below those of existing activities in other sectors and this is reflected in the fact that the between-dynamic effects are negative.

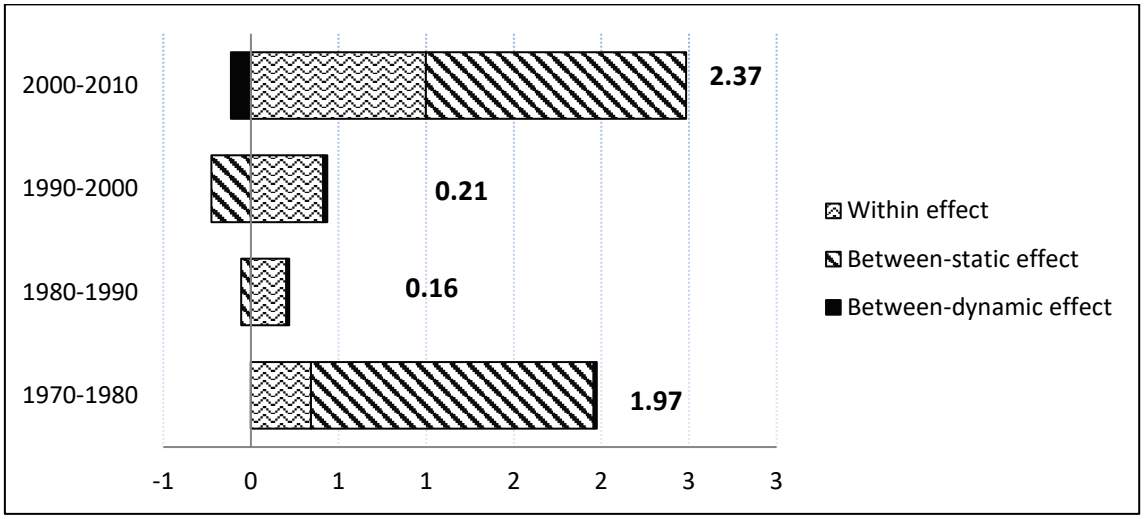
Africa's patterns of structural changes and productivity growth are quite different from those of developing Asia, where all three components of productivity growth made positive contributions over the past four decades (Figure 4). In the 1990s and 2000s, within sector productivity grew in all sectors, but mostly in manufacturing, boosted by high investment levels, which in turn generated various linkages and positive effects of economies of scale, technological advance, and knowledge and skills acquisition (UNCTAD 2016). This process generated a positive dynamic reallocation effect that has been growing over the decades, indicating that the movement of workers affected positively the growth of productivity in the expanding sectors, which was mainly manufacturing.

Figure 2. Agriculture's share of total employment in 2012 (%)



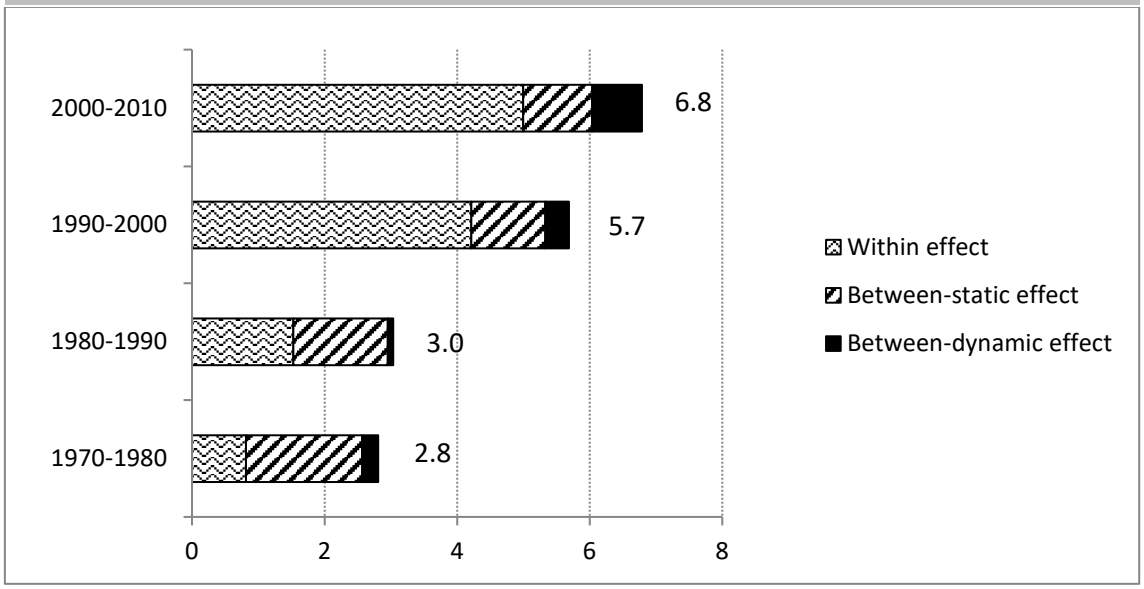
Source: Compiled based on data from the ILO's GET 2014 database, http://ilo.org/global/research/global-reports/global-employment-trends/2014/WCMS_234879/lang--en/index.htm).

Figure 3. Average annual labour productivity growth in Africa by driving factors (%), 1970-2010



Source: Computed based on data from the GGDC database (http://www.rug.nl/ggdc/productivity/10-sector/).

Figure 4. Average annual labour productivity growth in Asia by driving factors (%), 1970-2010



Source: Computed based on data from the GGDC database (http://www.rug.nl/ggdc/productivity/10-sector/).

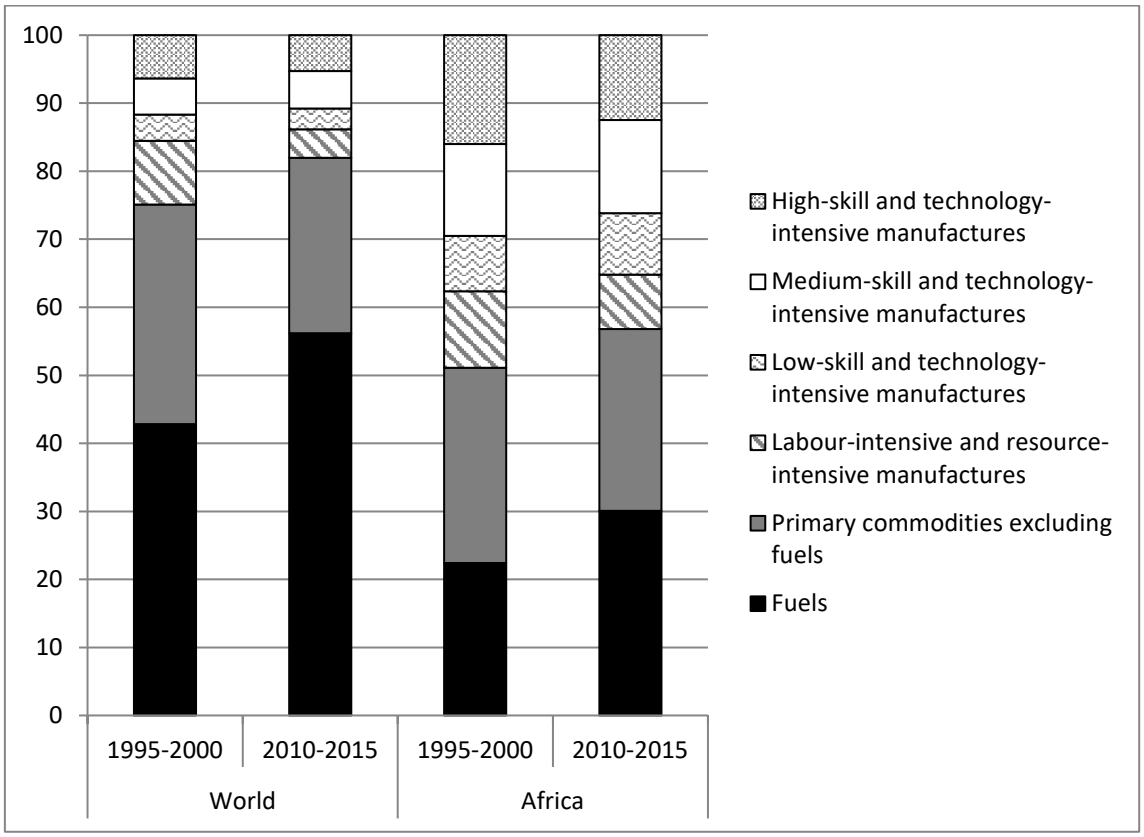
Notes: 1. Labour productivity is expressed in constant 2005 PPP dollars per employee.
2. Calculations are based on weighted average for the following countries: China, Hong Kong (China), India, Indonesia, Republic of Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand.

Structure of Africa's exports

The structural changes that are taking place in Africa can also be examined from an international perspective. A key feature of Africa's participation in international trade is that the continent is an exporter of primary products and an importer of manufactured goods and services (Wohlmuth et. al. 2007). Furthermore, this dependence on primary commodity exports has increased over the past few decades (Figure 5). As a result of the increase in commodity prices in the early 2000s, there was an increase in the

share of primary goods in the value of SSA's total merchandise exports (from 75 per cent in 1995-2000 to 82 per cent in 2010-2015) and, consequently, a decline in the share of manufactured goods (from 25 to 18 per cent).

Figure 5. Technology composition of Africa's merchandise exports to the world and Africa (%), 1995-2015



Source: UNCTADStat database (http://unctad.org/en/Pages/statistics.aspx).

Note: Data used for computation of shares of each category are in current prices.

Not only do African countries export mostly commodities, their exports are also highly concentrated in a few commodity products, and this pattern has accentuated in recent years (table 1). While in 1995-2000, Africa's top 10 export products accounted for about 54 per cent of the value of total merchandise exports and included two manufacturing products (men's clothing and articles of apparel), in 2010-2015 they represented about 65 per cent and were exclusively composed of commodities.

Another feature of Africa's commodity exports is their low level of processing, which reflects the fact that technological capacities for upgrading and value addition are low on the continent. In 2014, the share of un-processed commodities in Africa's total merchandise exports was 57 per cent (UNCTAD 2016). The most vivid illustration of Africa's low capacities in processing its natural resources is that of petroleum products. The continent exports petroleum in raw form, and re-imports it transformed into intermediary and finished products. The lack of local processing of Africa's resource exports leads to loss of scarce foreign exchange and has important negative implications in terms of local employment, knowledge and technology acquisition.

Table 1. Africa's top 10 merchandise exports, 1995-2000 and 2010-2015

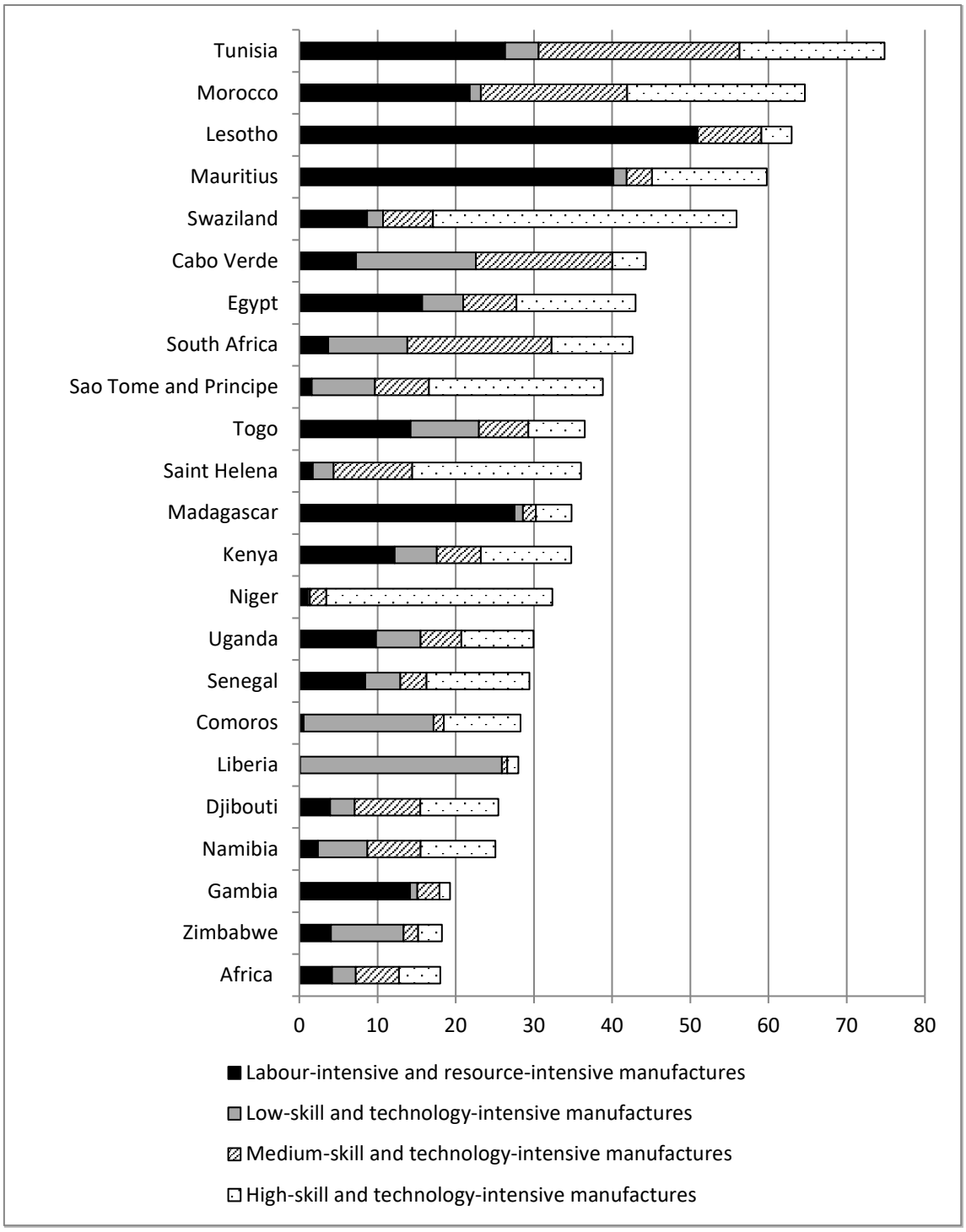
1995-2000	Share in total (%)	2010-2015	Share in total (%)
Petroleum oils, oils from bitumin. materials, crude (SITC code 333)	30.1	Petroleum oils, oils from bitumin. materials, crude (SITC code 333)	41.3
Petroleum oils or bituminous minerals > 70 % oil (SITC code 334)	5.7	Natural gas, whether or not liquefied (SITC code 343)	6.2
Pearls, precious & semi-precious stones (SITC code 667)	4.7	Petroleum oils or bituminous minerals > 70 % oil (SITC code 334)	5.1
Natural gas, whether or not liquefied (SITC code 343)	3.4	Gold, non-monetary (excluding gold ores and concentrates) (SITC code 971)	3.1
Cocoa (SITC code 072)	1.9	Pearls, precious & semi-precious stones (SITC code 667)	1.9
Men's clothing of textile fabrics, not knitted (SITC code 841)	1.8	Copper (SITC code 682)	1.8
Articles of apparel, of textile fabrics, n.e.s. (SITC code 845)	1.8	Cocoa (SITC code 072)	1.6
Silver, platinum, other metals of the platinum group (SITC code 681)	1.8	Iron ore and concentrates (SITC code 281)	1.5
Cotton (SITC code 263)	1.6	Liquefied propane and butane (SITC code 342)	1.4
Fruits and nuts (excluding oil nuts), fresh or dried (SITC code 057)	1.5	Fruits and nuts (excluding oil nuts), fresh or dried (SITC code 057)	1.3
Total top 10 products	54.3	Total top 10 products	65.1

Source: UNCTADStat database (http://unctad.org/en/Pages/statistics.aspx).

This aggregate picture does not reflect the export patterns and experience of all African countries. There are a number of countries where the share of manufactures in total merchandise exports is significant. Figure 6 shows that over the period 2010-2015, manufactures exports accounted for at least 30 per cent of total merchandise exports in 15 African countries. In fact, the share was more than 50 per cent in Tunisia, Morocco, Lesotho, Mauritius and Swaziland. That said, the bulk of the continent's manufactures exports is concentrated in a few countries, with only four accounting for more than three quarter of the total in 2010-2015: South Africa (39 per cent), Morocco (14 per cent), Tunisia (12 per cent) and Egypt (12 per cent). Within the category of manufactures exports, medium skill and technology intensive manufactures had the highest growth rate (11 per cent) while labour intensive and resource intensive manufactures had the lowest growth rate (5 per cent) over the period 1995 and 2015 (table 2).

Another interesting fact in the data is that Africa's intra-regional merchandise export has a different pattern from its total merchandise export to the world. In particular, unlike the continents exports to the world, Africa's intraregional exports are almost equally distributed between manufactures and commodities. That said, the share of commodities in Africa's intraregional exports has increased from 51 per cent in 1995-2000 to 56 per cent in 2010-2015 (see Figure 5) as a consequence of the strong rise of commodity prices since the early 2000s. The implication of this is that intraregional trade has the potential to foster economic diversification in Africa. Despite the modest share of intraregional exports in Africa's total merchandise exports (14 per cent in 2010-2015), it accounted for 35 per cent of Africa's total manufactures exports in 2010-2015 (up from 23 per cent in 1995-2000).

Figure 6. Share of categories of manufactures in total merchandise exports in selected African countries, 2010-2015



Source: UNCTADStat database (http://unctad.org/en/Pages/statistics.aspx).

Note: The countries selected are those whose share of manufactures in total merchandise exports is higher than Africa's average share. Data used for computation of shares of each category are in current prices.

Table 2. Growth of Africa's manufacturing exports by components (%), 1995-2015

	Average annual growth rate between 1995 and 2015				
	Total manufactures	Labour-intensive & resource-intensive	Low-skill & technology-intensive	Medium-skill & technology-intensive	High-skill & technology-intensive
Equatorial Guinea	28	3	46	19	49
Uganda	26	30	28	22	23
Sierra Leone	24	17	40	19	22
Angola	23	13	38	13	12
Congo	22	3	45	19	10
Rwanda	21	21	24	22	18
Gambia	18	25	14	13	10
United Republic of Tanzania	18	16	30	19	21
Burundi	17	15	20	16	21
Zambia	16	7	22	19	23
Benin	16	6	38	22	12
Sao Tome and Principe	16	12	22	9	n.a.
Gabon	16	13	29	20	13
Egypt	16	12	16	20	21
Mozambique	15	3	22	10	20
Togo	14	14	17	13	14
Nigeria	13	10	24	13	13
Mali	13	8	24	12	14
Ethiopia	13	13	26	24	11
Saint Helena	13	8	15	14	11
Dem. Rep. of the Congo	12	2	10	12	20
Namibia	12	8	20	13	9
Seychelles	11	10	26	9	11
Niger	11	1	6	4	13
Burkina Faso	10	6	9	14	13
Kenya	10	10	9	12	11
Chad	10	20	9	10	8
Cameroon	10	4	16	12	14
Ghana	9	4	17	18	11
Cabo Verde	9	1	14	12	5
Madagascar	9	8	9	11	11
Malawi	8	-2	10	15	23
Morocco	8	4	12	19	8
Lesotho	8	7	5	34	10
Eritrea	8	6	9	5	9
South Africa	8	3	7	9	8
Senegal	7	15	15	9	4
Mauritania	7	5	9	9	8

	Average annual growth rate between 1995 and 2015				
	Total manufactures	Labour-intensive & resource-intensive	Low-skill & technology-intensive	Medium-skill & technology-intensive	High-skill & technology-intensive
Tunisia	7	3	12	13	10
Côte d'Ivoire	6	1	9	7	7
Algeria	6	6	-4	-3	9
Sudan (...2011)	6	-1	14	9	14
Botswana	6	4	6	5	6
Comoros	5	-1	29	1	0
Djibouti	5	1	4	4	7
Swaziland	4	-1	2	3	7
Central African Republic	3	3	2	4	3
Libya	3	-1	3	4	3
Somalia	2	7	-5	3	2
Mauritius	1	-1	9	7	9
Zimbabwe	0	-2	1	2	0
Guinea	0	8	5	10	-3
Guinea-Bissau	-1	6	6	0	-5
Liberia	-3	-5	-3	7	1
Africa	**8**	**5**	**9**	**11**	**9**

Source: UNCTADStat database (http://unctad.org/en/Pages/statistics.aspx).

4. What do we know about inclusive development in Africa?

This section discusses Africa's performance in achieving the goal of building inclusive societies which is one of the priorities in the SDGs. It does this by focusing on three key drivers of inclusive growth: the distribution of income; financial inclusion; and social progress. The focus on these indicators reflects our view that fostering inclusive development requires addressing both economic and non-economic factors that foster exclusion. When economists talk about making growth and development more inclusive than in the past the focus tends to be on income inequality on the grounds that a high level of income inequality is unfair and has undesirable effects in an economy. In particular, studies have shown that inequality can have a negative effect on political stability, investment and growth in an economy (Alesina and Perotti 1996; Ravallion 2001). It can also lead to inefficient use of resources and increase the risks of financial crises (Dabla-Norris et. al. 2015). While the prevalence of high inequality in an economy is an indication that the development process is not inclusive, inequality is only one of the varied manifestations of exclusion in a society and so there is the need to discuss trends in other indicators as well.

Recent studies on inequality suggest that relative to other developing country-groups, income inequality is quite high in SSA and that the recent high growth experienced by countries in SSA did not result in significant changes in inequality in the sub-region. Table 3 presents recent estimates of various measures of income inequality in SSA over the period 1975 to 2010. The coefficient of variation and the Gini coefficient are relative measures of income inequality while the standard deviation and the absolute Gini are absolute measures of inequality. Although many economists use relative measures of inequality in their analyses, economic theory does not provide guidance on which should be the preferred measure. Furthermore, surveys

have shown that individuals care about absolute differences in incomes and so it is an aspect of inequality that should not be ignored (Nino-Zarazua et. al. 2016). The key message from table 3 is that both absolute and relative measures of inequality suggest that income inequality in SSA increased significantly between 1975 and 2010. In other words, Africa's growth and development has gone hand in hand with an increase in inequality, indicating that it has not been inclusive.

Table 3. Income inequality estimates for Sub-Saharan Africa, 1975-2010

Inequality measure	1975	1985	1995	2000	2005	2010
Coefficient of variation	1.40	1.66	3.32	2.70	3.24	3.14
Standard deviation	2337.86	1770.68	5288.44	5021.64	5574.38	7627.56
Gini	0.54	0.54	0.68	0.67	0.63	0.63
Absolute Gini	889.91	581.41	1090.04	1252.41	1083.35	1535.17

Source: Nino-Zarazua, Roope and Tarp (2016).

Access, use and quality of financial services are crucial factors in building an inclusive society. They permit individuals and firms to exploit opportunities and contribute to, as well as benefit from, the growth and development process. Therefore the degree of financial inclusion in a society is an important driver of inclusive growth. Available data on the three main indicators of financial inclusion (ownership of a bank account, saving at a financial institution, and the use of bank credit) indicate that some progress was made in fostering financial inclusion in Africa over the period 2011 and 2014, but the degree of financial inclusion on the continent is still relatively low (table 4). In 2014, the percentage of the population in SSA that had an account at a financial institution was 28.9 per cent compared with a global average of 60.7. Furthermore, only 15.9 per cent of the population in SSA had savings at a financial institution compared with a global average of 27.4 per cent. With regard to the use of bank credit, only 6.3 per cent of the population in SSA borrowed from a financial institution compared with a global average of 10.7 per cent. Within SSA, there is wide variation across countries in the degree of financial inclusion. For example, In 2014, the share of the population with an account at a financial institution was as high as 82 per cent in Mauritius, 75 per cent in Kenya, and 70 per cent in South Africa. But it was only 9 per cent in Madagascar and 7 per cent in Burundi. Zins and Weill (2016) examined the determinants of financial inclusion in Africa and found that gender, income, education and age are important factors. In particular, being a man, more educated, richer, and older has a positive impact on financial inclusion in Africa. There is also some evidence suggesting that financial innovation is crucial in promoting financial inclusion and that the development of financial systems is a necessary but not sufficient condition for financial inclusion (Beck, Senbet and Simbanegavi, 2015). These facts underscore the need for financial inclusion policies to take into account differences across groups and also better exploit the role of technology and innovation than in the past.

Table 4. Indicators of financial inclusion (%), 2011 and 2014

Share of population	World		Sub-Saharan Africa	
	2011	*2014*	*2011*	*2014*
With an account at a financial institution	50.6	60.7	23.9	28.9
Saved at a financial institution in the past year	22.6	27.4	14.3	15.9
Borrowed from a financial institution in the past year	9.1	10.7	4.8	6.3

Source: Compiled based on data from World Bank (2015).

The degree of social progress achieved in a society is another important driver of inclusive growth. The Social Progress Imperative has developed a methodology for computing an index of social progress that captures the social performance of countries. The social progress index (SPI) measures the capacity of a society to

meet basic human needs, build the foundations of wellbeing of its citizens, and provide opportunity for its citizens (Porter, Stern and Green, 2016). Two key attractive features of this index are that: (a) it is an outcome rather than an input-based index and; (b) it focuses on non-economic dimensions of social progress thereby permitting an analysis and understanding of the linkages between economic development and social progress. The index was developed in 2014 and ranges from 0 to 100, with higher numbers indicating a higher level of social progress. The SPI is a simple average of the three dimensions of social progress mentioned above, namely: basic human needs; foundations of wellbeing; and opportunity. Based on the 2016 index, at the global level the countries with very high levels of social progress are: Finland (90.09), Canada (89.49), Denmark (89.39), Australia (89.13), Switzerland (88.87), Sweden (88.80), Norway (88.70), Netherlands (88.65), United Kingdom (88.58), Iceland (88.45), New Zealand (88.45), and Ireland (87.94). Table 5 presents information on the 2016 index and its components for African countries included in the sample. It shows that in general African countries have relatively low SPI which is consistent with the widely held view that the recent growth in Africa has not been inclusive. There is a wide variation across African countries in terms of the level of social progress achieved. For example, countries such as Mauritius, Tunisia, South Africa and Botswana have higher levels of social progress than other African countries. It should be noted that some African countries that have relatively high SPI also show weaknesses in some components of the SPI. For example, although Mauritius and Tunisia have relatively high overall SPI, they have low scores in the component of the index reflecting opportunity provided to citizens.

Table 5. Measuring Social Progress in Africa, 2016

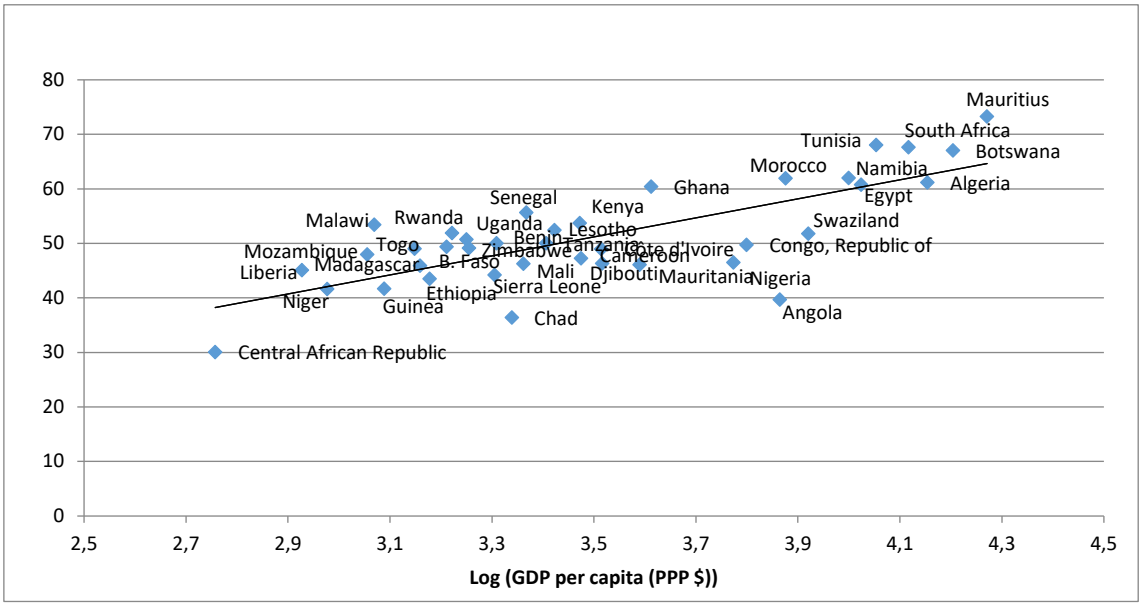
Country	Social Progress Index	Components		
		Basic human need	Foundations of wellbeing	Opportunity
Mauritius	**73.24**	89.44	72.84	57.46
Tunisia	**68**	82.17	74.6	47.23
South Africa	**67.6**	66.95	68.23	67.61
Botswana	**67.03**	71.94	70.37	58.77
Namibia	**62.01**	61.75	66.14	58.14
Morocco	**61.92**	78.09	69.89	37.8
Algeria	**61.18**	79.58	69.54	34.41
Egypt	**60.74**	82.07	65.49	34.66
Ghana	**60.37**	60.41	68.59	52.12
Senegal	**55.64**	65.31	58.6	43.01
Kenya	**53.72**	52.4	67.96	40.79
Malawi	**53.44**	54.62	57.82	47.87
Lesotho	**52.39**	53.44	51.56	52.17
Rwanda	**51.91**	57.26	59.25	39.21
Swaziland	**51.76**	58.08	56.33	40.87
Uganda	**50.69**	52.13	60.21	39.72
Benin	**50.03**	53.35	58.26	38.47
Tanzania	**49.99**	47.13	60.95	41.9
Congo, Republic of	**49.74**	45.88	64.19	39.16
Burkina Faso	**49.34**	51.77	53.46	42.8
Zimbabwe	**49.11**	51.29	62.33	33.72
Togo	**49.03**	50.19	56.53	40.38
Côte d'Ivoire	**48.97**	54.24	57.37	35.31
Mozambique	**47.96**	45.5	58.76	39.62
Cameroon	**47.22**	52.7	56.19	32.75
Nigeria	**46.49**	46.63	60.47	32.38

Country	Social Progress Index	Components		
		Basic human need	Foundations of wellbeing	Opportunity
Djibouti	46.3	64.65	42.63	31.63
Mali	46.24	53.46	50.89	34.38
Mauritania	46.08	55.26	52.97	30.01
Madagascar	45.91	43.76	56.91	37.05
Liberia	45.07	45.99	48.97	40.24
Sierra Leone	44.22	41.05	55.2	36.39
Ethiopia	43.5	50.57	52.25	27.68
Guinea	41.66	45.58	51.23	28.18
Niger	41.63	48.11	45.15	31.64
Angola	39.7	43.74	49.73	25.65
Chad	36.38	36.75	45.27	27.11
Central African Republic	30.03	29.84	41.42	18.83

Source: compiled based on data from (http://www.socialprogressimperative.org/global-index/).

Although the SPI focuses on non-economic aspects of social performance, as shown in figure 7 there is a positive correlation between the index and economic indicators such as income per capita. This may reflect the fact that African countries with higher income have more resources to invest in the social sectors and so tend to have better social indicators. But this does not mean that having higher income is a sufficient condition for social progress because there are some countries with high levels of income that have low levels of social progress and vice versa. For example, Angola has much higher levels of income than Malawi and Rwanda, yet the latter have achieved higher levels of social progress than the former (figure 7). This indicates that income or economic development in general does not automatically translate into higher levels of social progress and that policies that promote growth have to be complemented with other policy measures to foster social inclusion.

Figure 7. Relationship between Income per capita and the 2016 Social Progress Index



Source: Computed based on data from UNCTADStat database (http://unctad.org/en/Pages/statistics.aspx); and http://www.socialprogressimperative.org/global-index.

In sum, data on the three indicators of inclusive development analysed in this section suggest that although African countries have made modest progress in promoting inclusion, they are still a long way from achieving their overall objective of creating an inclusive society. In this context, there is the need for African governments to ratchet-up efforts to engender inclusive growth and this would require addressing both economic and non-economic factors that affect inclusive development.

5. What is the state of technology and innovation in Africa?

Technology and innovation will play a vital role in poverty reduction and development in Africa. In particular, it is crucial to addressing the challenges of low productivity and lack of structural transformation required to achieve the SDGs in Africa. Over the past few decades, African governments have strengthened efforts to promote technology and innovation on the continent. At the continental level, in 2005 the African Union adopted Africa's Science and Technology Consolidated Plan of Action covering the period 2005-2014. This has now been superseded by the Science, Technology and Innovation Strategy for Africa (STISA) adopted at the 23rd African Union Summit in June 2014 to cover the period 2014-2024. African regional economic communities have also developed regional visions on science and technology. For example, in 2011 the Economic Community of West African States (ECOWAS) adopted the ECOWAS Policy on Science and Technology and the Southern African Development Community (SADC) has a protocol on Science, Technology and Innovation dating back to 2008. At the national level, many countries have either developed or revised their Science, Technology and Innovation (STI) policy over the past decade (Box 1). For example, Angola adopted an STI policy document in 2011 while the United Republic of Tanzania revised its 1996 science and technology policy in 2010 (UNESCO, 2015).

Box 1. UNCTAD's Science, Technology and Innovation Policy Reviews in Africa

The experiences of developed countries and emerging markets show that technology and innovation are crucial drivers of productivity and sustained growth in an economy. In recognition of this important role of technology and innovation in the development process, UNCTAD assists developing countries in building and strengthening domestic capabilities in the field of Science, Technology and innovation (STI). Over the past decade, it has conducted and published STI policy reviews in four African countries: Angola (2008), Ghana (2011), Lesotho (2010) and Mauritania (2010). The Reviews provide an independent and constructive assessment of STI capabilities and policies, identify major areas of weakness, and suggest concrete policy actions that should be implemented to better harness the potential of STI for development, given each country's specific circumstances.

Three of the four African countries reviewed (Angola, Ghana, and Lesotho) had established formal institutional arrangements and elaborated national STI policy and strategy at the time of the review. Mauritania, however, had no public body mandated to oversee STI issues and also had no clear STI strategy. While there are differences among the four countries, the Reviews suggest that there are weak links and inadequate coordination among the different stakeholders of the STI system (ministries and other governmental bodies, research institutes and the private sector). Another interesting finding in the Reviews is the supply-driven character of these countries' STI system, reflecting the fact that there is over-reliance on the public budget and donors. One consequence of this funding mechanism is that funding allocations for STI do not reflect the priorities of key domestic actors such as the private sector, research institutes, and universities. It is also one of the reasons why STI systems in Africa often do not adequately address countries' socio-economic needs.

The Reviews underscored the need to strengthen efforts to convert STI policies into implementable initiatives. They also emphasized the need to better integrate STI policies into national development strategies for coherence and also to ensure that it supports the development of productive capacities and promotes economic diversification and structural change. Other recommendations of the reviews include: identifying STI needs at the national and sector levels; establishing mechanisms for monitoring and evaluation; forecasting technology needs and foreseeing STI direction; placing emphasis on the growth of the science, engineering and technical workforce through investing in education and training to meet the needs of a modernized economy; and establishing support mechanisms for private-sector innovation, technology absorption, and industry-driven research.

Sources: UNCTAD (2008); UNCTAD (2010a); UNCTAD (2010b) and UNCTAD (2011).

There is no doubt that the recent measures taken by African countries at the national, regional and continental levels have had an impact on the state of technology and innovation in Africa. Over the past few decades, there have been noticeable improvements in some technology and innovation indicators. For example, the number of researchers in SSA per million inhabitants increased from 65.8 in 1996 to 91.4 in 2013 (table 6). Similarly, domestic expenditure on research and development (R&D) in SSA increased from 0.37 to 0.42 per cent of GDP over the same period (table 7). However, it should be noted that when compared to the world average, SSA is not doing very well on these indicators. One of the interesting findings from the data on the number of researchers is that there is a gender gap in all regions of the world. For example, in 2013 female researchers as a percentage of the total number of researchers was 28.4 per cent for the world, 36.8 per cent for the Arab States, 39.9 per cent for Central and Eastern Europe, 47.1 per cent for Central Asia, 22.6 per cent for East Asia and the Pacific, 44.3 per cent for Latin America and the Caribbean, 32.0 per cent for North America and Western Europe, 18.9 per cent for South and West Asia, and 30.0 per cent for SSA. Closing this gender gap is necessary to enhance prospects for meeting the SDGs by the 2030 target date.

Table 6. Researchers per million inhabitants, 1996-2013

	1996	2000	2010	2011	2012	2013
World	784.7	803.5	1022.8	1050.4	1069.6	1083.3
Arab States	406.9	394.7	382.5	397.1	409.5	416.3
Central and Eastern Europe	2209.5	1950.9	1975.3	2002.8	2030.5	2049.9
Central Asia	580.5	476	480.3	484.9	557	583.9
East Asia and the Pacific	653.6	720.5	1168.9	1231.3	1274.3	1311.8
Latin America and the Caribbean	281.1	284.8	459.3	464.4	469.2	467.9
North America and Western Europe	2685	3024.4	3757.3	3843.7	3904.5	3952
South and West Asia	144.4	112.9	170.1	169.3	170.3	171.2
Sub-Saharan Africa	65.8	71.2	89.5	90.6	91.7	91.4

Source: compiled based on data from UNESCO database (http://data.uis.unesco.org/).

Table 7. Domestic expenditure on R&D (% of GDP), 1996-2013

	1996	2000	2010	2011	2012	2013
World	1.42	1.53	1.63	1.65	1.68	1.7
Arab States	0.22	0.22	0.26	0.27	0.27	0.3
Central and Eastern Europe	0.79	0.81	0.94	0.95	1.01	1.01
Central Asia	0.27	0.22	0.2	0.2	0.21	0.23
East Asia and the Pacific	1.41	1.54	1.9	1.96	2.03	2.1
Latin America and the Caribbean	0.52	0.53	0.65	0.64	0.66	0.67
North America and Western Europe	2.05	2.2	2.36	2.39	2.43	2.43
South and West Asia	0.51	0.58	0.7	0.71	0.71	0.71
Sub-Saharan Africa	0.37	0.39	0.41	0.41	0.41	0.42

Source: compiled based on data from UNESCO database (http://data.uis.unesco.org/).

Patent applications are another useful indicator of innovation. Unlike R&D that captures innovation input, patents are the output of innovation activities and so is an indicator of the extent to which an economy has made progress in the area of technology and innovation. Table 8 presents information on the total number of patents filed (based on applicants origin). It shows that there has been a significant increase in the number of patent applications filed by applicants from African countries over the past decade. For example, in Algeria the number of patent applications increased from 46 in the period 2006-10 to 120 in the period 2011-15. In Benin, it increased from 3 to 103, in Cameroon from 5 to 509, in Kenya from 62 to 164 and in Tunisia from 108 to 190 over the same period. In fact, of the 50 African countries for which there are data, only 6 (Cabo Verde, The Gambia, Libya, Madagascar, Sudan and Zambia) experienced a decrease in the number of patent applications over the periods 2006-10 and 2011-15. Within the continent, there is a high degree of concentration in patent applications, with South Africa, Egypt and Cameroon accounting for the bulk of patent applications filed by the continent in the period 2011-15. While many African countries have made progress in terms of the number of patents filed, it is worth noting that the large economies in the continent (Algeria, Egypt, Nigeria, and South Africa) file far less patent applications than developing countries such as, for example, China, India, and Mexico. In the period 2011-15 the average number of patent applications was 120 for Algeria, 657 for Egypt, 53 for Nigeria and 2008 for South Africa. In contrast, China filed an average of 715979 applications, India 20259 and Mexico 2195.

Table 8. Total patent applications by applicants' origin, 2006-2015

	2006-10	2011-15
Algeria	46.80	120.60
Angola	1.00	2.80
Benin	3.00	103.00
Botswana	1.50	15.80
Burkina Faso	2.00	61.00
Burundi	2.50	8.00
Cabo Verde	3.00	1.00
Cameroon	5.40	509.25
Central African Republic	1.33	38.00
Chad	1.00	52.20
Comoros		17.00
Congo	2.00	64.25
Côte d'Ivoire	2.00	259.00
Democratic Republic of the Congo	1.33	1.50
Djibouti		3.00
Egypt	494.60	657.00
Ethiopia	5.50	7.33
Gabon	1.75	41.00
Gambia	2.00	1.00
Ghana	1.80	9.67
Guinea	1.50	22.67
Kenya	62.00	164.60
Lesotho		1.00
Liberia		1.40
Libya	1.75	1.67

	2006-10	2011-15
Madagascar	8.20	4.80
Malawi		5.25
Mali	4.00	46.80
Mauritania	2.00	28.33
Mauritius	42.20	81.80
Morocco	184.00	286.60
Mozambique	8.60	16.00
Namibia	2.60	9.00
Niger	1.00	93.00
Nigeria	15.00	53.60
Rwanda		17.67
Sao Tome and Principe	3.00	3.00
Senegal	1.33	235.00
Seychelles	50.20	99.20
Sierra Leone	1.00	1.75
Somalia		2.00
South Africa	2007.00	2008.60
Sudan	4.00	3.50
Swaziland	44.75	27.80
Togo		41.50
Tunisia	108.20	190.80
Uganda	6.33	6.80
United Republic of Tanzania	1.25	3.50
Zambia	12.80	8.40
Zimbabwe	2.80	4.80

Source: computed based on data from http://ipstats.wipo.int/ipstatv2/index.htm?tab=patent

Patent applications can also be analysed from the perspective of the filing office rather than the applicant's origin. Based on this indicator, there has been an increase in total patent applications filed in Africa from 10,900 in 2005 to 14,800 in 2015. Available data also shows that among developing-country regions, Asia accounts for a large percentage of global patent applications, with as much as 61.9 per cent in 2015 (table 9). Interestingly, there has been a significant decline in the share of global patent applications received by high-income countries, from 80.4 per cent in 2005 to 53.4 per cent in 2015, reflecting largely the increasing role of Asia in patent applications.

Table 9. Share of global patent applications by filing office (%), 2005-2015

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Africa	0.64	0.71	0.75	0.72	0.66	0.62	0.67	0.62	0.57	0.56	0.51
Asia	50.19	49.68	49.75	50.80	50.88	51.52	54.62	56.06	58.39	59.96	61.85
Latin America and the Caribbean	2.92	3.02	3.06	3.06	2.79	2.76	2.79	2.69	2.48	2.39	2.27
Europe	19.14	18.60	18.10	17.93	17.43	17.19	15.48	14.67	13.49	12.91	12.46
High-income	80.41	78.28	76.44	74.01	72.62	70.04	65.59	62.64	58.84	56.81	53.45

Source: computed based on data from WIPO statistics database (http://ipstats.wipo.int/ipstatv2/editIpsSearchForm.htm?tab=patent)

Information and communication technology (ICT) has also been identified as another important enabler of innovation. For example, Spiezia (2011) found that it is an enabler of both product and marketing innovation in manufacturing and services. He also found that ICT contributes to innovation through enabling firms to adopt innovation rather than increasing inventive capabilities. Table 10 shows that significant progress was made in the use of the internet in SSA over the past decade. In 2000 the number of internet users in the region per 100 people was 0.5 and by 2015 it had increased to 22.4. Similar increases were also experienced in other regions of the world. For example, in Latin America and the Caribbean the number of internet users per 100 people increased from 3.9 in 2000 to 54.5 in 2015 and in the Middle East and North Africa it increased from 1.7 to 43.7 over the same period. When compared to other regions of the world, SSA has the lowest number of internet users in 2015 followed by South Asia. North America is the region with the highest number of internet users in 2015 (table 10).

Table 10. Internet Users (per 100 people), 2000-2015

	2000	2005	2010	2011	2012	2013	2014	2015
Sub-Saharan Africa	0.5	2.0	9.8	12.1	14.6	17.1	19.6	22.4
North America	43.9	68.3	72.5	71.0	75.5	72.8	74.4	75.9
Middle East & North Africa	1.7	9.8	24.9	27.7	31.3	34.7	39.7	43.7
Europe & Central Asia	13.2	35.2	56.1	58.9	63.5	66.3	69.5	71.7
East Asia & Pacific	5.6	14.7	34.2	37.4	40.8	44.2	46.7	49.8
Latin America & Caribbean	3.9	16.6	34.7	39.3	43.2	46.3	48.8	54.5
South Asia	0.5	2.5	7.2	9.4	11.5	13.7	19.3	23.6

Source: compiled based on data from the WDI database (http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators)

Africa also experienced an increase in ICT trade. In 2000 the share of ICT goods in total exports of Africa was 0.53 per cent and in 2014 it was 0.84. Developing Asia has the highest share of ICT goods in total exports, recording 23.4 per cent in 2014. Both developing Asia and developing America experienced a decline in the share of ICT goods in total exports between 2000 and 2014 (table 11).

Table 11. Share of ICT goods as a percentage of total exports, 2000-2014

	2000	2005	2010	2011	2012	2013	2014
Developed economies	13.61	9.68	6.89	6.1	5.72	5.42	5.54
Developing Africa	0.53	1.13	0.75	0.71	0.7	0.77	0.84
Developing America	11.14	7.92	7.51	6.07	6.19	6.2	6.81
Developing Asia	27.8	25.71	23.27	20.73	21.59	21.38	23.42
Developing Oceania	0.23	0.24	0.21	0.14	0.19	0.48	1.77

Source: UNCTADStat database (http://unctad.org/en/Pages/statistics.aspx).

In sum, over the past few decades modest progress has been made in promoting technology and innovation, as evidenced by the fact that the number of researchers on the continent has increased, patent filings by African countries have gone up, and the number of internet users has also increased. Nevertheless, significant challenges remain. For example, the level of technology and innovation in Africa remains low

relative to what is observed in other continents and also relative to the development needs of the continent. In addition, there are still very limited resources devoted to R&D, there is a gender gap in research which needs to be addressed, and the internet penetration rate for SSA is very low relative to that of other developing country-regions, thereby making it difficult for the region to fully exploit opportunities created by the rapid growth of ICT.

6. Policies to foster technological innovation for transformation and inclusive development in Africa

This paper has argued that structural transformation and inclusive growth are crucial for achieving the SDGs and that promoting technological innovation is necessary to address both challenges of low structural transformation and inclusive development in Africa. A crucial question therefore is how can African countries effectively promote technological innovation so as to foster transformation and inclusion and achieve better development outcomes than in the past? This section highlights some policy measures that African countries could adopt to effectively promote technological innovation in the continent.

Develop coherent STI policies. A first step to effectively promoting technology and innovation in Africa is for African governments to develop coherent STI policies. Over the past decade many African countries have either developed or revised their STI policies.[3] However, there is often incoherence between STI policies and other development policies. For example, UNCTAD (2015) reviewed STI policies of three countries (Ethiopia, Nigeria and the United Republic of Tanzania) and found that there was lack of coordination between STI and industrial development policies in these countries. Other areas where there is disconnect between STI and other development policies include gender and education. It is well-known that technological progress tends to be gender and skill-biased (Naude and Nagler 2015). In particular, new technologies tend to favour skilled workers and men (more than unskilled workers and women), which has negative consequences for income distribution and the quest for inclusive development. Despite the importance of these issues and the associated linkages, STI policies in Africa are developed independent of gender and educational policy. To enhance policy coherence, there is the need for STI policies to go hand in hand with educational policies geared towards enhancing the skills of unskilled workers and women to enable them take better advantage of technological progress and make the growth process more inclusive than in the past. There is also the need for African governments to strengthen efforts to align national and regional STI strategies for better development outcomes.

Increase domestic expenditure on R&D. It is a well-known fact that R&D is an important component of any effective package to promote technology and innovation. Yet African countries spend a relatively small percentage of their GDP on R&D (less than 1 per cent). In 2014, for example, gross domestic expenditure on R&D as a percentage of GDP was 0.68 per cent in Egypt, 0.27 per cent in Togo and 0.64 per cent in Uganda. These numbers are far below the 1 per cent target set by the African Union and need to be scaled-up. A related issue is the low investment rates in tertiary education in Africa which is a disincentive to R&D and also constrains technology transfer through foreign direct investment (FDI). African governments should prioritize tertiary education to stimulate R&D and also promote knowledge spillover from foreign to domestic firms. Studies have shown that when domestic workers have required skills, it facilitates knowledge spillover to domestic firms and enhances local capacity to absorb foreign technology (Farole and Winkler 2014). While we emphasize the need to increase spending on R&D, it is also important to point out that R&D is useful to the extent that it can effectively foster technological learning and building of innovation capacities in a country. It is therefore important for African governments to pay attention to the kinds of research activities they promote to ensure that they address the technology and innovation needs of the country. Furthermore,

[3] In SADC for example, only three countries (Democratic Republic of Congo, Mauritius and Seychelles) out of the 15 member States did not have an STI policy document in 2014 (UNESCO 2015).

in seeking to promote innovation through R&D, there is also the need for governments to have a comprehensive view of innovation in the sense that the focus should not be solely on the product side but also cover other dimensions of innovation as well (for example, process, marketing and organisational innovation). It is by adopting such a holistic approach to technology and innovation and directing government policy towards promoting the creation, transfer, adoption, adaptation, and diffusion of knowledge that African countries can effectively use technological innovation to foster inclusive development (Oyelaran-Oyeyinka, 2014).

Strengthen university-industry collaboration. Universities are major producers of knowledge. But for this knowledge to have impact on diversification and structural transformation, it has to address the needs of industry and also transferred or disseminated to the productive sectors. Unfortunately, in many African countries the educational curriculum is not geared towards addressing the challenges facing industries, resulting in a mismatch between university output and the labour demands of the private sector. One way to reduce this mismatch and make the growth process more inclusive is to develop effective linkages between institutions of higher learning and the industrial sector in Africa, through for example appointing Chief Executive Officers of strategic industries to sit on the boards of universities. This would encourage university administrators to involve the private sector in the design of education curricula in universities. It would also enhance the likelihood that university graduates have the skills they need to access and participate in the labour market. Governments can also incentivise industries to collaborate with universities through, for instance, providing enterprises that enter into such partnerships with grants for joint research.

Enhance implementation of existing STI policies. A major challenge facing African countries is the lack of full implementation of policies and plans at both the national and continental levels. As indicated earlier, many countries have developed an STI policy document over the past decade. Yet, some of these policies have not been implemented. In Lesotho, for instance, several of the policies contained in the National Science and Technology Policy for 2006-2011 have not been implemented. Similarly, in Malawi, the Science and Technology policy framework revised and adopted in 2002 has not been fully implemented (UNESCO 2015). These facts underscore the need for African policymakers to pay more attention to implementation of policies than in the past. Some of the measures they can take to enhance implementation of policies include: developing an implementation plan for STI policies; prioritizing data collection and introducing a monitoring and evaluation system; and making appropriate provisions for STI policies in national budgets to ensure adequate funding.

Promote innovation at the enterprise level. The creation of an environment conducive to entrepreneurship is necessary to achieve sustained progress in technology and innovation. Governments can unleash the innovation potential of entrepreneurs through providing better infrastructure, building a skilled labour force, and eliminating regulatory obstacles that drive some entrepreneurs into the informal sector. They can also encourage entrepreneurs to innovate through setting up of technology parks and providing incentives (such as the establishment of innovation prizes and entrepreneurship awards) to young potential entrepreneurs. While governments have a major role to play in promoting innovation, it is not the responsibility of governments alone. Firms also have an important role to play but they can do so effectively if they adopt a systemic as opposed to a reactive innovation strategy.[4]

Increase awareness of intellectual property rights (IPRs). Lack of awareness of existing IPRs can create a disincentive for firms to invest in R&D and militate against innovation. It can also make young potential innovators reluctant to innovate for fear that their novel ideas could be stolen, patented and used by potential competitors (Ezeanya 2013). African governments can play a crucial role in addressing this issue by increasing awareness of existing IPRs in their countries through organisation of information dissemination events and exploiting opportunities created by the rapid growth and use of social media. Intellectual property offices in Africa should also be encouraged by governments to play a more active role in facilitating access to information on IPRs and also in disseminating technological information in support of local innovative activities.

[4] Interestingly, in a survey of executives of companies in different regions of the world, it was found that firms can also foster innovation through having a diverse workforce (Forbes Insight, 2011).

7. Conclusion

This paper examined the state of structural transformation, innovation and inclusive development in Africa and showed that although modest progress has been made in each of these areas over the past decade, more needs to be done to enhance the likelihood that African countries will meet the SDGs adopted by world leaders in 2015. The paper argued that fostering technological innovation is crucial for addressing the challenge of structural transformation and inclusion in Africa. It also identified and delineated mechanisms through which technological innovation could be linked to transformation and inclusion. Finally, the paper made policy recommendations on how to foster technological innovation to trigger transformation and build inclusive societies on the continent. The policy recommendations discussed in the paper include: developing coherent STI policies; increasing domestic expenditure on R&D; strengthening university-industry collaboration; enhancing implementation of existing STI policies; promoting innovation at the enterprise level; and raising awareness of intellectual property rights.

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