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Background note for the panel on “Employment and new technologies: Opportunities for Africa’s youth”

Introduction

1. Africa has made considerable progress in economic growth. However, in many cases, the pattern of growth has not been able to generate enough decent jobs to absorb the growing labour force. Almost half of new labour market entrants since 2005 took jobs in the informal economy and one third in agriculture – jobs often characterized by low productivity, wages and technological uptake. The challenge for African countries is therefore to transform their economies in an effort to generate more and better jobs and inclusive growth.
2. Technological change can be instrumental in this regard. Technological change may be defined broadly “as the process by which economies change over time in respect of the products they produce and the processes used to produce them”.¹ The pattern of technological change not only shapes the quantity of jobs but also the type of jobs. And while new technologies may destroy jobs through automation and outsourcing to foreign countries, they also generate new types of jobs by developing new activities and insourcing, and can fundamentally transform task profiles of existing jobs.
3. A fundamental challenge for African countries aiming at generating more and better jobs is to steer technological development in a manner so as to promote patterns and paths of innovation that generate productive jobs that meet people’s needs and aspirations, and to ensure that those presently in the informal economy and low productivity sectors are not left behind.
4. The purpose of this note is to: (i) review key trends with respect to technology and jobs in Africa (section A); and (ii) identify key policy issues for discussion among policy-makers and social partners (section B).

A. Dynamics of technological change in Africa

5. Most African countries still face low levels of technology as well as limited dynamism in upgrading technologies. Production technologies in the informal economy and in agriculture – the largest economic sectors in Africa – demonstrate low sophistication

¹ P. Stoneman: *The economic analysis of technological change* (Oxford, Oxford University Press, 1983), p. 3.

which is reflected in the incidence of low productivity jobs and wages, often with negative effects on workers' health and well-being, as well as limited opportunities for learning and personal advancement. The crafts and artisan sector is characterized by a somewhat different picture. Master craftspeople and workers in some crafts tend to apply rather advanced technologies. For example, car mechanics in the informal economy in the United Republic of Tanzania are using computer-aided diagnostic tools, and carpenters and tailors producing for local markets are eager to improve designs, differentiate products and enhance quality. An ILO study shows that they also tend to have higher levels of education and more formal technical training in addition to informal apprenticeship training.²

6. Most importantly, the share of manufacturing in the GDP of African countries is still low, and so is the share of medium- and high-technology products within manufacturing. Industrial development has been identified as an engine of technological change, learning and job generation in low income countries.³ Premature de-industrialization experienced by sub-Saharan Africa has contributed to the low dynamics of technological advancement and job creation. North African countries, on the other hand, have a higher share of employment in industry, which may contribute to explaining their relatively high productivity levels compared to other African countries.⁴
7. More recently, however, a number of African countries have experienced a shift in the skills composition of the workforce (or the task profiles of jobs). For instance, in some middle-income countries – Botswana, Gabon, Mauritius, Tunisia and South Africa, as well as in low and lower middle income countries, in particular, Egypt, Ghana, Morocco and Zambia as well as Ethiopia, Liberia and Rwanda – the share of high skill-intensive jobs has been increasing. Interestingly, the pattern of change in terms of medium skill-intensive jobs and low skill-intensive jobs differs across these countries. Some demonstrate job polarization, that is, they reduced the share of medium skill-intensive jobs and enhanced the share of low skill-intensive jobs. Others increased the share of medium-skilled jobs while reducing the share of low skill-intensive jobs. These changes are signs of technological and structural transformation; however, to date, no systematic analysis of technological change, structural transformation and changing jobs profiles in African countries has been undertaken. This is an urgent research question the ILO and constituents need to address.

1. Key challenges

8. In the light of high population growth rates, and the many young people, who are increasingly educated, entering the labour force within the coming years, African countries will continue to be challenged with generating rapid technological change and diversification in all sectors of the economy – manufacturing, craft sector, agriculture and services. Succeeding in this area will not only enhance productivity, but also generate good jobs at a high pace, including for the more educated young generation.
9. Two major lessons have been learned from the rapid catching-up experience of East Asian countries. Firstly, it requires a two-pronged strategy of incremental catching-up from low- to medium- and high-technology products, and of leapfrogging into, or taking advantage of, opportunities arising from new technologies emerging in advanced countries. For

² I. Nübler, C. Hofmann and C. Greiner: *Understanding informal apprenticeship: Findings from empirical research in Tanzania* (ILO, 2010).

³ J.A. Ocampo, C. Rada and L. Taylor: *Growth and policy in developing countries: A structuralist approach* (New York, Columbia University Press, 2009).

⁴ ILO: *World Employment and Social Outlook: The changing nature of jobs* (2015).

example, the Republic of Korea adopted computer-aided manufacturing (CAM) technologies that had emerged during the 1970s; Costa Rica, India and South Africa attracted call centres, back-office services, data processing and other IT-enabled business services outsourced by firms in high-wage countries; and China became an exporter of high-technology goods by taking advantage of emerging value chains enabled by the simultaneous IT revolution and the global market revolution.

10. Secondly, the transfer of technology to a domestic enterprise is not like transferring a physical product. It is fundamentally a learning process and one of gradually building up capabilities to innovate, imitate and invest. By accumulating sector-specific knowledge and competencies in relatively low-technology activities within a particular sector, workers and enterprises can develop the capability to diversify gradually into the more sophisticated and higher technology activities. Most important in this process, the labour force develops a diverse set of distinct technical skills and competencies which can be recombined for producing new products. Domestic firms learn to innovate and manage technology transfer, and institutions evolve with high competencies to support innovation and technological change. These are the capabilities which enable the country to also leapfrog and take advantage of new opportunities arising from leading technologies emerging in advanced countries.
11. Light manufacturing (apparel, leather products, wood products, metal products, agribusiness) is a promising starting point to enter an incremental process of innovation (new to the country, but not new to the world), learning and job creation. Only a few sub-Saharan countries so far have succeeded in developing a significant light manufacturing industry despite comparative or latent comparative advantages in low-tech manufacturing, abundance of natural resources for inputs and energy supply, and privileged access to markets in advanced economies. Major bottlenecks are poor infrastructure, low quality of domestic inputs, limited access to finance and low capabilities of the labour force and small enterprises.⁵ Recent ILO research identifies low shares in the labour force of lower and upper secondary educated graduates as a critical impediment to developing manufacturing.⁶
12. Prospects for technological change in manufacturing are set to change as the region promotes industrialization. African governments have collectively taken initiatives to promote industrialization under the theme “Industrialisation of Africa” at their 2008 summit (UNECA and AU 2013), which was reaffirmed during the 34th Ordinary Summit of Southern African Development Community (SADC) Heads of State and Government in August 2014. This objective is to promote diversification into higher value-added products, and to enhance beneficiation by moving from exporting to processing of natural resources. Regional groups have an important role to play in developing local and regional vertically integrated value chains.⁷
13. Digital technologies have rapidly diffused to African countries, though largely by the use of mobile phones. Although access to the fixed-line Internet and mobile broadband is still limited, in particular in rural areas, declining prices in mobile phones have increased the

⁵ World Bank: *Light manufacturing in Africa: Targeted policies to enhance private investment and create jobs* (2012).

⁶ I. Nübler: *Education structures and patterns of productive transformation: Lessons for education policies in African countries*, UNU-WIDER Conference on Learning to Compete: Industrial development and policy in Africa (Helsinki, June 2013), <http://www1.wider.unu.edu/L2Cconf/sites/default/files/L2CPapers/N%C3%BCbler.pdf>.

⁷ I. Salim: “Sub-Saharan Africa in the global apparel value chain” in *World Economic Forum: The shifting geography of global value chains* (2013).

use of mobile phones. Only 45 per cent of African firms reported to have used email exchange with clients, against an average of 61 per cent in East Asia and 86 per cent in Latin America. However, many citizens and business people have benefited from the Internet in different ways. Digital information and communications technologies (ICTs) allow people to pursue new opportunities to generate income, reduce transaction costs and lower the costs of participating in markets – such as paying bills in Kenya and registering birth certificates and drivers’ licences without long-distance travelling in Uganda. The challenge is to increase access to the Internet, to support the development of IT-enabled services, and attract new business models that create good jobs. The impact of ICTs and the Internet on jobs, types of employment and inequality in African countries, however, has not been systematically explored. The forthcoming *World Development Report* will address some of these issues.

2. New technologies and windows of opportunities

- 14.** In order to achieve rapid job creation, African countries are also challenged with taking advantage of opportunities arising from new technologies in advanced countries and leapfrogging into newly emerging technologies. New technologies such as robots and the “Internet of things”, IT-enabled cloud sourcing and cloud computing, Industry 4.0 and “smart” machines with self-learning algorithms, may provide new opportunities to domestic enterprises to provide services, develop new products and to leapfrog into new technologies. Experience shows that countries can benefit from this only if they have developed relevant capabilities through past experiences. This challenges African countries to understand the current wave of new technologies and the opportunities arising from new business models adopted in advanced countries. Furthermore, governments and enterprises need to understand their country-specific capabilities, and the feasible options for process and product innovations.
- 15.** Cloud sourcing represents a new business model where enterprises use Internet platforms to access global labour markets in search of specialists, experts, and IT services on demand. Organizations assemble ad hoc teams to provide sales and customer support, help with editorial work, conduct research, and perform many other tasks online instantly. The cloud economy is expected to grow rapidly, thereby opening wide opportunities for workers and firms in developing countries. It provides jobs for educated workers who are attracted by the promise of high earnings and flexible conditions. Mobile and web developers as well as graphic designers and translators are among the most highly sought after workers.⁸ For example, in South Africa, the cloud computing market is growing significantly, due to the evolution of data centres which are used to house all the computer systems and all the associated components and to store information.⁹ Cloud sourcing requires easy access to the Internet, reliable electricity supply, online payment systems, skilled workers and professionals, and institutions that provide data security, privacy, and compliance with international standards.
- 16.** New production technologies in industries have fundamentally changed the quantity and types of jobs. A highly competitive environment forces industries to replace tasks of workers by machines (automation) or to outsource labour-intensive tasks to low-wage countries. Robotization has largely replaced medium-skilled workers while the share of high-skilled and low-skilled workers increased. These technologies will make it increasingly difficult for African countries to leapfrog into cutting edge manufacturing

⁸ Financial Times: *New world of work: Digital marketplace reshapes casual labour*, 5 August 2015, <http://www.ft.com/cms/s/2/6a23a27c-3500-11e5-b05b-b01debd57852.html#ixzz3k6ZDHatd>.

⁹ AfricanBrains: *Cloud computing market in South Africa 2014–2018*, <http://africanbrains.net/2014/07/21/cloud-computing-market-south-africa-2014-2018/>.

technologies unless they rapidly develop a high-skilled labour force with the capabilities to implement and operate highly automated production processes.

17. Moreover, emerging production technologies may also have disruptive impact on global value chains. The new manufacturing technology, Industry 4.0, currently developed in advanced countries, aims at integrating and automating the full value chain in manufacturing. Furthermore, new robots are being developed which can perform tasks previously outsourced to low-income countries. For example, a newly developed robot can perform sewing tasks, stitching together garments which so far had remained a job for “nimble fingers”, and has been outsourced to low-wage countries. Such technologies will bring garment-making back to advanced countries, in particular where producers need to rapidly respond to new fashion and new trends.¹⁰ Insourcing will significantly limit opportunities of developing countries to attract tasks and create jobs. African countries which were expecting to attract such jobs due to rising wage levels in China and other Asian countries may not be able to realise this potential. This highlights the importance for African countries to develop regional value chains to generate jobs in textile and garments.
18. For those countries which are able to rapidly develop the right mix of skills and capabilities, the new manufacturing technologies may open up the opportunity to jump into the cutting edge technology by attracting foreign direct investment (FDI), and learning to master the new technology. China has recognized this opportunity and has recently established cooperation with German industry to develop and transfer the Industry 4.0 (considered as the fourth industrial revolution) manufacturing technology to China.
19. Jobs in professions will also be affected as the new technologies are increasingly applied in the profession. These technologies are expected to fundamentally transform jobs of professions in a wide range of sectors, in particular in aviation, law, medicine, petroleum geology, architecture, research and development, teaching and design.¹¹ Tasks will be standardized, systematized, performed by computers and made available through online services. Professionals in Africa could benefit from these new technologies. Firstly, computers allow them to focus on core tasks that cannot be computerized. Secondly, professions may develop IT-enabled services and enter local, regional or global service value chains. For example, doctors could develop expertise in diagnostics for tropical diseases or develop tailor-made, personalized treatment and medication plans; architects and engineers could use smart machines to develop designs and building materials appropriate for local conditions; and lawyers could provide specialized legal advice with instant access to pre-prepared documents and tutorials. Moreover, the development of such hubs will generate new occupations, particularly at the intersection of professions, software and machines: big data architects and analysts, cloud services specialists, software developers, and legal knowledge engineers or legal technologists.
20. The 3D printing technology or additive manufacturing is one of the most promising technologies that can help the crafts, trade and artisan sectors to boost innovations and to create jobs. These technologies can produce objects at zero lead time, on demand, and in response to customer orders when and where it is needed. It allows producing tailor-made shapes as demanded for by clients, as well as shapes that cannot be created through traditional methods such as carving, cutting, or moulding. Furthermore, additive manufacturing allows one entrepreneur to produce a wide variety of consumer products, as a single 3D printer can make a vast number of different shapes, and produce at different levels of complexity. These technologies enable the crafts and trade sector to provide

¹⁰ The Economist: *Technology Quarterly*, “Made to measure”, 30 May 2015.

¹¹ R. Susskind and D. Susskind: *The future of the professions: How technology will transform the work of human experts* (Oxford University Press, 2015).

goods and services that meet the needs of local people, and we may even think of artisans producing high quality customized and tailor-made products for export.

B. Policy issues

21. Technological development is fundamentally a process of investment in productive capacities – physical and human capital, infrastructure, and of building domestic capabilities through learning. Governments play a key role in promoting both processes. There is no one-size-fits-all policy approach. Policy-makers need to develop country-specific strategies, taking into account the country’s conditions and capabilities. Innovation, investment and learning strategies need to be formulated in the light of the country’s development objectives and aspirations. Formulating and evaluating such strategies need to be supported by country-specific studies and research, and based on sound data.

1. Promoting investment and productive capacities

22. Governments are challenged with proactively designing and implementing industrial or productive transformation policies. A key element is targeting preferred activities and technologies. Moreover, only a comprehensive, integrated and coordinated package of policies and institutions can adequately respond to the myriad challenges. This package needs to consider a coherent set of investment, trade, technology, education and training policies supported by macroeconomic, financial and labour market policies.¹² Investment in infrastructure is critical in African countries in order to improve connectivity, enhance access in urban and rural areas to the Internet, to generate a reliable supply of electricity and to reduce production, transport and transaction costs.

2. Boosting learning and capabilities

23. Governments play a key role in promoting learning at different places and levels. A comprehensive learning strategy needs to promote learning in schools, training centres, in industries and in social networks. The aim is to develop a diverse and sophisticated knowledge base in the labour force, and effective technological and organizational routines in domestic enterprises. The more sophisticated and diversified the knowledge base, and the “smarter” the enterprise routines, the more dynamic an economy can be to adopt more complex technologies, diversify into a wider range of products, and to leapfrog into cutting edge technologies, thereby accelerating the speed of jobs creation.¹³

24. The high value of school-based education lies in its ability to teach the labour force advanced technical skills and relevant attitudes even when industries cannot yet provide such learning opportunities. The development of light manufacturing requires, in particular, medium-skills occupations such as machine operators, technicians and clerks. This challenges education policies to invest in lower and upper secondary education. Most sub-Saharan African countries still have an “L-shaped” educational attainment structure (high primary, but extremely low secondary and tertiary shares), resulting in low supply of medium-skilled occupations and low capabilities for productive transformation.

¹² J.M. Salazar-Xirinachs, I. Nübler and R. Kozul-Wright: *Transforming economies: Making industrial policy work for growth, jobs and development* (Geneva, ILO, 2014).

¹³ I. Nübler: “A theory of capabilities for productive transformation: Learning to catch up”, in: Salazar-Xirinachs et al., op. cit.

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25. Formal vocational and technical training (TVET) systems need to be strengthened in all African countries. Training policies need to be closely coordinated with innovation and industrialization strategies. In addition, ILO studies show that upgrading the informal apprenticeship training system and providing advanced technical and business skills supports technological upgrading in the crafts and trade sectors enabling master craftspeople to innovate and upgrade technologies, and workers to efficiently use these new technologies.¹⁴
26. Investment policies need to support the development of technological capabilities in African enterprises by promoting both integration of domestic firms into value chains and transfer of technologies from lead firms to domestic subcontractors. A recent World Bank study has shown that technological spillover from foreign investments is still very low.¹⁵

3. **Labour market institutions and regulatory frameworks**

27. Comprehensive policy packages require institutions to coordinate different policies and integrate learning, investment and innovation strategies: labour market institutions; national competitiveness councils; sectoral councils or committees; informal networks of communities of practice; and public–private partnerships play a role. For example, national skills councils for curriculum development may facilitate the design of effective reforms of the TVET system to support technological development. Moreover, institutions reduce transaction costs and improve access to credit, an important challenge to adopt new technologies and create good jobs especially for young entrepreneurs and small enterprises.¹⁶ The case of M-PESA, a mobile money transfer service in Kenya, provides a valid example of innovation in finance which significantly improved access to credit, also in rural areas. Regulatory frameworks, particularly with respect to intellectual property rights and innovation outcomes and their enforcement, are important factors to encourage research and development activities and investment from abroad.

Issues for discussion

28. In view of the abovementioned trends and policy issues, participants to the African Regional Meeting may wish to focus attention on the following questions:
- To what extent can new technology contribute to improving the linkages between economic growth, generation of good jobs and decent work outcomes?
 - How can labour market institutions, enterprise-related policies and skill formation systems be shaped so as to boost the opportunities associated with new technology while facilitating adjustment? What is the role of social dialogue in this respect?
 - What could be the contribution of the ILO to making structural transformation and new technologies a driver of sustainable development in Africa?

¹⁴ ILO studies on informal apprenticeship in Egypt, Ghana, Malawi and the United Republic of Tanzania, http://www.ilo.org/skills/projects/WCMS_158771/lang--en/index.htm.

¹⁵ T. Farole and D. Winkler (eds): *Making foreign direct investment work for sub-Saharan Africa: Local spillovers and competitiveness in global value chains* (Washington, DC, The World Bank, 2014).

¹⁶ ILO: *School-to-work-transition-survey* (Geneva, 2015), http://www.ilo.org/employment/areas/youth-employment/work-for-youth/WCMS_191853/lang--en/index.htm.