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Preface

For forty years now, Germany and China have been successfully working together in development cooperation. China has developed rapidly over recent decades, enabling several hundred million people to be lifted out of extreme poverty. In parallel with China's development, the focus of German-Chinese cooperation has shifted: Traditional bilateral development cooperation between Germany and China has been phased out. Today, both partners are jointly fostering sustainable development within a global context.

With the aim of institutionalising this partnership, the Chinese Minister of Commerce, Zhong Shan, and the German Federal Minister for Economic Cooperation and Development, Dr Gerd Müller, jointly established the Sino-German Center for Sustainable Development (CSD) in 2017. The CSD provides an important platform for strengthening the political dialogue on development cooperation between the two countries. It also facilitates tangible triangular, regional and global projects and engages with the Chinese and German business sector to promote sustainable development. The Sino-German policy dialogue on development cooperation addresses questions of how both sides are approaching the development of other countries and which methods, approaches, instruments and tools are applied. Moreover, it provides a forum for discussing economic trends that may facilitate or hamper development and for advising development partners how to respond.

Further industrialisation is a vital factor in development. Historically, it has been a key to the development and creation of wealth in many countries, for example in Africa. It was industrialisation that has facilitated China's rapid economic development over the last three decades; the expansion of the manufacturing sector has been a crucial element in achieving economic growth along with reduced poverty and higher wages. These higher wages are now, however, eroding China's competitiveness in labour-intensive industries and may lead to the relocation of industries to other countries that offer lower wages, for instance in Africa. This raises important issues. Can the relocation of light manufacturing from China become a major contributor to job creation and economic development in Africa? Or will automation diminish the importance of manual labour and render relocation no longer relevant? Is the Chinese manufacturing-led path to development still open for today's developing countries? Or has the link between industrialisation and development become weaker?

Under the auspices of the CSD, the German Development Institute / Deutsches Institut für Entwicklungspolitik (DIE) and the Center for International Knowledge on Development (CIKD) have jointly conducted a study to discuss these questions. The study includes a specific analysis of the costs of production in Africa and the experience of local Chinese investors. One of the countries looked at is Ethiopia, which is particularly interesting as it is an important reform partner of the German Federal Ministry for Economic Cooperation and Development (BMZ). The authors conclude that, while automation is gaining in importance in the clothing industry, for the immediate future sewing work will continue to be carried out by hand. The paper also points out that, besides labour costs, several other factors inform a decision to move clothing production abroad, especially structural economic conditions.

China is an example of successful poverty reduction through industrialisation and economic growth. Consequently, sustainable industrialisation is one of the key sectors for joint

German-Chinese trilateral projects. The study provides a sound basis for future Sino-German-African projects in this field and also contributes to global debates on development cooperation more broadly.

Bonn, January 2020

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Bonn, January 2020

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Contents

Boxes

Figures

Tables

Annexes Tables

Abbreviations

ACP	African, Caribbean and Pacific
AGOA	US Africa Growth and Opportunities Act
API	Application Programming Interface
ATC	Agreement on Textiles and Clothing
BMWi	Bundesministerium für Wirtschaft und Energie / German Federal Ministry for Economic Affairs and Energy
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung / German Federal Ministry for Economic Cooperation and Development
BRI	One Belt and One Road Initiative
CAD	computer-aided design
CEO	chief executive officer
CIKD	Center for International Knowledge on Development
CMT	cut, make and trim manufacture
CNC	computer numerically controlled
CNTAC	China National Textile and Apparel Council
CSD	Sino-German Center for Sustainable Development
DARPA	Defense Advanced Research Projects Agency (United States)
EBA	EU Everything But Arms
ECZ	economic cooperation zones
EIZ	Eastern Industrial Zone (Ethiopia)
EPA	Economic Partnership Agreement
EPRDF	Ethiopian People's Revolutionary Democratic Front
EPZ	Export-processing zone
ERP	enterprise resource planning
ESA	Eastern and Southern African Group
ETIDI	Ethiopian Textile Industry Development Institute
EU	European Union
EUR	euro
FDI	foreign direct investment
FOB	free on board
GATT	General Agreement on Trade and Tariffs
GDP	gross domestic product
GEFP	Le Groupement des Entreprises Franches et Partenaires / Madagascar Export Processing Companies and Partners Association
GSP	Generalised System of Preferences
GVC	global value chain
IFR	International Federation of Robotics
IoT	Internet of Things
IP	intellectual property
IT	information technology
LDC	least developed country
MFA	Multifibre Arrangement
MFN	Most favoured nation
MIIT	Ministry of Industry and Information Technology (China)
MOFCOM	Ministry of Foreign Trade and Commerce (China)
MVA	manufacturing value added
OECD	Organisation for Economic Co-operation and Development
PPP	purchasing power parity
R&D	research and development
RMB	renminbi (Chinese currency)
ROO	rule of origin

SAR	Special Administrative Region
SEZ	special economic zone
SME	Small and medium enterprise
SOE	state-owned enterprise
SSA	Sub-Saharan Africa/n
UAE	United Arab Emirates
UN	United Nations
UNIDO	United Nations Industrial Development Organization
US	United States
USD	United States dollar
VAT	value added tax
WEF	World Economic Forum
WTO	World Trade Organization

Executive summary

This Discussion Paper is placed within the broader context of latecomer industrialisation. It reviews the prospects of Sub-Saharan African (SSA) countries to replicate the "Asian model" of export-oriented growth based on attracting foreign investments in light manufacturing as a springboard for industry-led economic development.

The focus is on the clothing industry and more specifically, on the question of whether SSA countries can hope to become major export locations for clothing firms, taking advantage of rapidly rising wages in China – the world's leading exporter that currently accounts for almost one-third of global clothing exports. While clothing sector investments have recently been shifted to Asian low-wage economies, such as Cambodia, Vietnam, Myanmar and Bangladesh, there is a growing inclination to also consider SSA locations. This Discussion Paper undertakes a critical review of prospects for this scenario to continue and expand. Key research questions asked include: Can some SSA countries become major clothing exporters, filling the space vacated by China as the latter climbs up the technology and productivity ladder? Or will firms stay in China due to the agglomeration effects of established industry clusters? Will at least some African countries with good business environments be able to capitalise on their low wages as a competitive advantage? What will it take to benefit from this opening window of opportunity and what may be obstacles along the way that call for industrial policy interventions?

Apart from reviewing the relevant techno-economic literature, the Discussion Paper approaches these questions from three complementary empirical angles and presents the findings of extensive field research and interviews undertaken in Germany, China, Ethiopia and Madagascar. The paper is structured along the following lines:

In view of the paper's focus on technological innovation, Section 2 explores, within a medium-term perspective, how the clothing industry will be affected by digital automation trends in general, and robotics in particular. Which process innovations are technologically feasible and, among those, which ones will be economically viable to be scaled up and substitute cheap labour globally? How are digital technologies likely to interact with other business trends in reshaping the global division of labour in this sector? The answers distilled from interviews with leading German textile and clothing technology experts point to a high level of complexity. While there is a strong trend towards robotics also in the clothing industry and specifically in sewing operations, only a few cases of incipient commercialisation of robotic assembly lines are known in the market. A gap persists between what is technologically feasible and what is economically viable at scale. Accordingly, there is an expert consensus that low wages will continue to be a determinant of investment decisions and that SSA countries will enjoy a time window of 10-15 years before being fully hit by a new wave of digital automation.

Section 3 adopts a broader economic and political economy perspective and looks at the main factors determining global competitiveness in clothing production and hence investment flows – ranging from direct costs (wages, energy, transport) to indirect cost elements related to trade preferences, the overall investment and business climate, industrial policy incentives as well as networking and agglomeration advantages. Within this bigger picture, how attractive are SSA countries really as new investment locations?

Section 4 addresses the role played by globally operating Chinese firms in this context. How do they deal with rapidly increasing industrial wages – will they invest abroad or automate at home? Are investments in SSA countries being considered at all by Chinese investors as an alternative to relocating to low-cost Western Provinces within China or to neighbouring Asian countries? The section starts with a brief profile of China's textiles and clothing industry and its recent developments, which is followed by a discussion of the coping strategies of clothing companies faced with rapidly rising wages at home. The findings of available studies on this question are complemented by two case studies at company level (Shenzhen International Group and the Esquel Group) and one case study at cluster level (Dalang sweater cluster). From these studies, it emerges that the country's clothing manufacturers are reluctant to move to SSA, which for many companies remains uncharted territory compared to neighbouring Asian low-wage locations which are indeed benefitting from Chinese factories being relocated. While fully-fledged robotisation of clothing assembly is not yet economically viable, certain product groups and processes can be automated and these potentials are used by Chinese firms at home to reduce their wage bills. In particular, the advantages of agglomeration and proximity in home-grown industrial clusters act as a strong deterrent to relocation.

Section 5 substantiates the economic and technological evidence of the preceding sections with two country case studies focusing on what lessons can be derived from the experience of Ethiopia and Madagascar. Both countries have only recently appeared in the spotlight of international clothing companies, including those from China. The former is widely considered as the most promising candidate for light manufacturing exports, based on a combination of low wages, a large domestic labour market and proactive government policies. The latter, while politically not very stable, has recently become the top SSA clothing exporter, receiving investments from neighbouring Mauritius which used to be the most successful clothing exporter in SSA but is now losing competitiveness due to rising wage costs. Both countries, however, have so far only captured a tiny fraction of worldwide investments in clothing production. Southeast and South Asian competitors so far offer more attractive investment conditions, combining low unit labour costs with proximity to related industries, skilled labour, reliable transport and energy infrastructure, the provision of dedicated industrial parks and political stability.

Section 6 presents the main conclusions with a focus on the key requirements of a proactive industrial policy. In addition to international trade policies and, specifically, the significant influence of preferential trade agreements on future investment flows to SSA countries, three domestic policy dimensions are key: First, the creation of attractive investment conditions through industrial parks and the concomitant fiscal, financial and infrastructural incentives; second, targeted efforts at deepening the industrial structure for which joint campaigns with global buyers towards attracting their first-tier suppliers ("follow sourcing") are key; and third, using the remaining window of time to act quickly and build up infrastructure; create a reliable, skilled and productive workforce; and monitor technology and market trends closely to be able to adapt before the time window closes. Obviously, the above policy measures need to be accompanied by political stability. As the cases of Ethiopia and Madagascar have shown, foreign investors respond with great sensitivity to perceived risks of political turmoil and conflict. In essence, we argue that the massive relocation of clothing production capacities to Africa is not yet happening. However, there

are opportunities to put the continent on the global map of export-oriented light manufacturing. The biggest risk for this scenario is not technological but political.

1 Introduction

China's rapid economic rise in recent decades has turned the country into a major player in the world economy. So unique is its influence that it has become standard practice to present global statistical breakdowns separately in terms of including or excluding China. Based on the country's seemingly unlimited pool of cheap labour, coupled with rapidly increasing productivity levels, excellent energy and transport infrastructure and a strategic industrial policy, China has become home to a diversified range of manufacturing industries, a substantial share of which have gradually been relocated from previous high-cost locations in OECD (Organisation for Economic Co-operation and Development) countries. These industries can tap into both the huge domestic market and the many export markets they are linked with through regional and global value chains (GVCs) thus creating unique economies of scale. In 2017, China's share in global manufacturing value added (MVA) stood at 25 per cent while the manufacturing sector accounted for a staggering 32 per cent share in the country's gross domestic product (GDP) (UNIDO [United Nations Industrial Development Organization], 2018).

In particular China has assumed a predominant role in the world's clothing market during recent decades. With 31 per cent of global clothing exports in 2018, it accounts for a higher share than all 28 European Union countries together (28 per cent) and also exceeds by far the combined share of Bangladesh, Vietnam, India, Turkey, Indonesia and Cambodia (WTO [World Trade Organization], 2019). Thus, the future of clothing production and related investment flows from China will be a key factor for the position of other countries in this rapidly growing market. For many years, China's clothing exports had been enormously competitive due to a combination of low labour costs and the economies of scale and scope of huge industry clusters which

> provide firms in the cluster with the advantages of shared knowledge, availability of specialist inputs and a developing pool of experienced labour […] until African cities can establish such clusters, firms in Africa will face costs that will be above those of Asian competitors, but because costs are currently higher individual firms have no incentive to relocate. (Collier &Venables, 2007, p. 1)

However, recent steep wage increases in China's coastal regions may give rise to a different scenario in which China itself becomes a driver rather than a destination of industrial outsourcing.

The above overall scenario shapes our leading research questions: Against the backdrop of rapidly rising manufacturing wages in China's coastal regions, is there now an opportunity for African countries to venture into light manufacturing industries as a springboard for industry-led development? Will the "flying geese" pattern[1] ultimately reach sub-Saharan Africa (SSA), that is, can some SSA countries move into these industries and fill the space vacated by China as it climbs up the technology and productivity ladder? Or will firms stay in China due to the agglomeration effects of established industry clusters? Will at least some African countries with good business environments be able to capitalise on their low wages as a competitive advantage? What will it take to benefit from this opening window of new opportunities? What may be key obstacles along the way and what are the prospects of

1 On the "flying geese" model, see subsection 2.1.

creating clothing industry clusters in Africa? But, above all: Will technological innovation in terms of enhanced automation and robotics change the entire equation and deliver productivity increases that could outweigh wage cost advantages in SSA countries? In other words: Can "botsourcing" – that is, robots accomplishing human tasks at home – replace outsourcing? Meaningful, evidence-based answers to these questions require research covering the following main dimensions, which will guide the structure of our paper:

- In view of this paper's focus on technological innovation (often labelled as the next "production revolution" or "Industry 4.0"), Section 2 explores, within a medium-term perspective, how the clothing industry will be affected by digital automation trends in general and robotics in particular. Which process innovations are technologically feasible and, among those, which ones will be economically viable for scaling up in global production structures? How are digital technologies likely to interact with other business trends in reshaping the global division of labour in this sector? Do they have the potential to stop late industrialisation efforts in SSA countries in their tracks?

- Section 3 adopts a broader economic and political economy perspective and looks at the main factors determining global competitiveness in clothing production and hence investment flows – ranging from direct costs (wages, energy, transport) to indirect cost elements related to trade preferences, the overall investment and business climate, industrial policy incentives as well as networking and agglomeration advantages. Within this bigger picture, how attractive are SSA countries really as new investment locations?

- Section 4 looks at the role played by globally operating Chinese firms in this context. How do they deal with rapidly increasing industrial wages – will they invest abroad or automate at home? Are investments in SSA countries being considered at all by Chinese investors as an alternative to relocating to low-cost Western Provinces within China or to neighbouring Asian countries?

- Section 5 illustrates the more general considerations of the preceding sections with two country case studies focusing on what lessons can be derived from the recent experience of Ethiopia and Madagascar.

In terms of methodology, our paper is based on both a review of the existing literature and our own empirical research. More specifically, the latter includes in-depth interviews with experts on automation technology for the clothing industry in Germany, several case studies of clothing firms and clusters in China exploring their strategic choices, as well as field research undertaken in Ethiopia and Madagascar. In sectoral terms, much of what is presented in this paper would seem to hold for a range of light manufacturing industries (from clothing to footwear, toys and electronics assembly). However, we focus more narrowly on analysing the clothing industry.[2]

2 As an exceptional sideline, technological trends in the footwear industry are considered with reference to the case of the Adidas speedfactory (see subsection 2.2) while occasionally the textiles industry (yarn and cloth production) comes into the picture in view of attempts to foster backward integration of clothing investments, as is for instance happening in the case of Ethiopia (see subsection 5.3.3).

2 Digitalisation prospects for the clothing industry: automation, robotics and new business models

This section begins with a brief synopsis of the recent debate on how the digital industrial revolution may generally affect the prospects of latecomer industrialisation in low-income countries (subsection 2.1). Following this broader picture, we focus on the clothing industry and assess the potential for its transformation from a labour-intensive to a highly automated and robotised manufacturing process (subsection 2.2). Obviously, technological innovation is but one of many drivers of the industry's future international division of labour. There are a host of other determinants exerting a strong influence on evolving patterns of production, investment and specialisation. Whether the still incipient relocation of clothing manufacturing from China to Africa will gain traction, depends as much on technology as it depends on markets, costs, skills, quality, delivery and the broader institutional and political environment prevailing in various locations. However, if the current digital innovation wave is as powerful and disruptive as it is often portrayed – if technology-induced productivity gains, quality improvements and customisation potentials are indeed outcompeting labour cost advantages in low-income countries – then the door for future outsourcing to African countries may be rapidly closing. Let us take a closer look.

2.1 Digitalisation of manufacturing and the future of latecomer industrialisation

Currently, we are witnessing a confluence of new digital technologies, which in their combined impact are transformational in nature, cross-cutting and pervasive in their innovative application across the various sectors of industry, and leading towards a growing homogeneity of industrial processes in functions ranging from design all the way to monitoring and control. The new digital technologies thus represent the latest generation of "general purpose technologies" (Jovanovic & Rousseau, 2005) as did steam engines and electricity in earlier industrial revolutions. They generate wide-ranging implications for industrial organisation and the future role of human labour. The manner in which industrial companies produce goods and services, compete with each other, engage in global trade and value chains, interact with customers, and adopt new business models will be subject to fundamental change. Many of these changes are already happening; others are visible on the horizon and can be predicted with reasonable likelihood, while much future innovation may surprise even the community of experts. The combined impact of digitalisation is widely considered to be of a disruptive nature. However, as we will argue in subsection 2.2, for the case of clothing companies, disruption and continuity may co-exist side by side.

Digital innovations are taking place from digital enablers (such as big data, cloud computing and the Internet of Things) to new production systems comprising additive manufacturing, digital sensors and actuators, sophisticated visioning and materials handling capabilities, voice and pattern recognition all the way to autonomous machines and robotics, either stand-alone or in growing interaction with human labour (for a comprehensive review, see OECD [Organisation for Economic Co-operation and Development], 2017; for a synopsis of key trends and their impact, see Lütkenhorst, 2018).[3] The new digital technologies will have a

3 Global assessments of digital automation trends and their likely impact are provided by Arntz, Gregory, & Zierahn, 2016; ADB [Asian Development Bank], 2018; OECD, 2015; Baldwin, 2016; BCG [Boston

profound impact on future employment levels and patterns as well as on future skill requirements. Exactly how this will play out in terms of magnitudes involved and countries most seriously affected is still subject to controversy. More specifically, the range of research findings based on different methodologies is such that, depending on the approach chosen, either Norway or Ethiopia are considered to be at the highest relative risk of losing jobs to digitalisation (Berger & Frey, 2017; Hallward-Dreimeier & Nayyar, 2018). However, it is patently clear that future ambitions for manufacturing-based development paths will be crucially affected by digital automation.

Implications for latecomer industrialisation

The stylised picture of successful cases of latecomer industrialisation starts out from labour-intensive, low-skill export manufacturing often based on foreign investment (typically in clothing industries), which then moves on to more sophisticated sectors, such as consumer electronics, accompanied by a continuous upgrading process. More advanced skills and capabilities are being developed, the mastery of technologies increases and gradually leads to the build-up of a domestic manufacturing base that goes beyond supplying just simple parts and components. This upgrading process is accompanied by rising wage levels that in turn lead to a shift in investments to countries with lower labour costs, thereby making room for other low-income countries to start their industrialisation drive. The prototypical example for this pattern has been East Asia with its "flying geese" dynamics (Akamatsu, 1962; Ozawa & Bellak, 2011), a metaphor which can help explain

> how an individual industry upgrades its processes as it goes through a cycle of importing, then producing, and finally exporting; how a variety of industries diversify and upgrade from simple to more sophisticated technologies; and how a latecomer in the development process can benefit from the graduation of industries in a more advanced, dynamically growing economy with similar features. (Lin, 2012, p. 222)[4]

Today, some observers consider the impact of new digital technologies as being so dramatic that the geese may not fly anymore; in other words, labour-saving and productivity-enhancing innovation would dry out the industrialisation potential of low-income countries. The real possibility is raised of China being "one of the last countries to ride the wave of industrialization to prosperity" (Chandy, 2016, p. 14). If this was true, then the wealth aspirations and hopes of developing countries, which are greatly pinned on benefitting from continued manufacturing foreign direct investment (FDI) and industrial productivity gains, would be severely dimmed.

Recently, this debate has been further fuelled by Rodrik's econometric findings of a phenomenon that he labels "premature deindustrialisation" (Rodrik, 2015). In a nutshell, Rodrik has demonstrated that the long-term trend towards deindustrialisation (measured in

Consulting Group], 2016; McKinsey Global Institute, 2017; Norton, 2017; Oxford Martin School & citi GPS, 2016; UBS, 2016; UNDESA [United Nations Department of Economic and Social Affairs], 2017. Anecdotal evidence derived from company-level cases can be found above all in Ford, 2015; Brynjolfsson & McAfee; 2014, McAfee & Brynjolfsson, 2017; Mayer-Schöneberger & Ramge, 2018.

4 Scholars already critiqued the flying geese argument in the 1990s, arguing that China's development pattern through GVCs, especially regional GVCs, breaks the flying geese pattern (see Bernard and Ravenhill, 1995).

terms of shares of employment and shares of manufacturing value added in GDP, which has been the general pattern observed in developed countries) is even more pronounced in the case of low-income and middle-income developing countries. In their post-1990 development trajectory, the peak GDP shares of manufacturing employment and value-added are both lower than for developed countries and, moreover, occur at lower per capita income levels. In other words: deindustrialisation kicks in at earlier points in time and, in this sense, can be considered as premature. This trend may well get reinforced by the added constraining impact of digital innovation on low-cost manufacturing.[5]

Importantly, the new digital technologies change the role played by human labour and skills. They tend to raise the skill content of industrial work and make it harder "for unskilled labour to substitute for other production inputs, including skilled labour, capital, and other capabilities. In other words, the elasticity of substitution between unskilled labour and other factors […] drops" (Rodrik, 2018, p. 9).[6] Recent manufactured export data (for countries as diverse as Ethiopia, the Philippines and Thailand) already point to a significant reduction in jobs created per unit value of export (Rodrik, 2018, p. 21).

To gauge the likely future impact of digital innovation on low-wage manufacturing in low-income countries, a global value chain perspective is key. GVCs have been the key conduits for the fragmentation of production processes, the optimisation of cost structures and the outsourcing of labour-intensive, low-skill operations to developing countries, where in turn latecomer industrialisation was fuelled, new employment created and skill upgrading triggered.

The critical question in the context of the digital revolution is thus whether or not the outsourcing process may be slowed down, come to a halt or even get reversed, that is, whether there will be a tendency for outsourced operations to be backshored to their original home countries. In the past, bringing production back to home markets in industrialised countries was often induced by quality and delivery considerations in production or by dissatisfaction with the host country's regulatory environment or more specifically its intellectual property practices. Backshoring caused by disruptive digital technologies is a more recent phenomenon that can capitalise both on changing cost structures and on new flexibilities based on customised batch production at scale. However, so far documentation of this emerging trend remains rich on anecdotal evidence and non-representative surveys while being poor on in-depth studies.[7] It is fair to state that this question has remained greatly under-researched to date.

In this context, the potential impact of additive manufacturing on GVCs is currently receiving the greatest attention. Additive manufacturing – normally known as 3D printing

5 At the same time, there are various trends in the direction of an increasing "servicification" of manufacturing based on an enhanced role of embodied and embedded services in final products (Hallward-Driemeier & Nayyar, 2018; Lodefalk, 2017) and the question is being discussed if the role of a growth escalator is moving gradually from manufacturing to services (Ghani & O'Connell, 2014) and to what extent digitalisation can act as an accelerator.

6 In a recent study on the Indian garment sector, the lack of skilled labour is cited as a major constraint to introducing digital automation technologies (Vashisht & Rani, 2019).

7 On the available evidence, see De Backer, Menoni, Desnoyers-Jamesi, & Moussiegti, 2016; De Backer, DeStefano, Menoni, & Ran Sun, 2018; Stentoft, Olhager, Heikkilä, & Thoms, 2016; Barbieri, Ciabuschi, Fratocchi, & Vignoli, 2017; Ellram, 2013; Heikkilä, Martinsuo, & Nenonen, 2018; Krenz, Prettner, & Strulik, 2018.

– allows producers to manufacture entire products and, even more so, parts and components in a decentralised manner by reliance on electronic files that feed customised designs into printers. While hard to predict, expert opinion seems to converge around a medium-term scenario in which progress in this technological domain would pose a serious danger for many developing country investment locations. It all hinges on how fast additive manufacturing will move from its current focus on prototyping and product development towards high-volume batch production of final goods from multiple materials. Only then would offshore assembly operations be seriously jeopardised. In such a scenario, trade would increasingly take place in the form of transferring data rather than products (OECD, 2017a) and the trade-disruption potential of additive manufacturing may reach a considerable level of 5-15 per cent of global trade (Hallward-Driemeier & Nayyar 2018, p. 137). First developments in this direction are visible in shoe manufacturing as illustrated below in the case of the Adidas speedfactory (see subsection 2.2).

Ultimately, there is a possibility (and even a significant likelihood) that the latest generation of digital technologies may to some extent undo or slow down the expansion of GVCs, which ironically was made possible by earlier progress in digital communication technologies. "The jury is still out" and systematic studies at both corporate and sectoral level are urgently required to move from conjectures to hard evidence. Importantly, such studies must go beyond specific business cases in which a backshoring of production actually took place. It is equally, if not more important, to gauge the magnitude of new investments that are undertaken in company home markets in lieu of opting for outsourcing alternatives (see also the Chinese case studies presented in Section 4).

For African countries, this is the most critical question. The future of manufacturing in Africa is distinctly not jeopardised by a reshoring scenario (given that Africa's present manufacturing capacities are still at incipient levels and predominantly oriented towards domestic markets) but by a potential "drying out" of future outsourcing investments, that is, by the commercial feasibility of relying on high-productivity robots at home in developed economies ("botsourcing") rather than moving production overseas.

In a nutshell

- The impact of a whole range of new digital production technologies is pervasive, disruptive and fast. It will create new systems of human-machine interaction that – albeit at different time scales and levels according to sector specificities – may change the reality of manufacturing operations.

- Exactly how the impact on employment will play out is as yet uncertain. Far more research is needed to establish the magnitude of job losses to be expected as well as the sectors and countries most seriously affected. For instance, it can be expected that the time line for the commercial application of digital technologies will be longer for clothing (see subsection 2.2) than for automotive and electronics industries.

- GVCs will be partly redefined due to changing cost structures caused by digital automation. This will challenge the conventional growth model of latecomer industrialisation with low wages losing in significance as a determinant of foreign investment flows.

The question of how the digital revolution will work its way through the global economy and just how it will affect developing countries can only be answered by looking at sectoral specificities. In the following subsection, we focus on the clothing industry.

2.2 Technological and economic trends shaping the future of the clothing industry

This subsection takes a closer look at recent research findings on the clothing sector both in terms of realistic prospects for productivity-enhancing innovations based on digitalisation and by factoring in key trends in new business models and their impact on investment and sourcing strategies. The focus is on the clothing industry proper which is still immensely labour-intensive, rather than the broader textiles industry (namely, yarn and fabric manufacturing via spinning, weaving and knitting) in which digital automation started as early as in the 1980s (Wad, 1982; Hoffman, 1985; Kaplinsky, 1985) and has penetrated production lines across countries in terms of the widespread use of computer numerically controlled (CNC) machinery. On the other hand, some recent developments in the footwear industry (shoe manufacturing) will be included as well in this subsection.

As was the case in the historic transformations from agrarian to industrial societies, most notably in the first industrial revolution, 20th century economic development trajectories were also often kick-started by rapidly growing light industries. Successful industrialisation, such as the exemplary rise of export-oriented East Asian developing economies, owes much of its dynamism to the initial reliance on labour-intensive, low-skill clothing industries, which did not require knowledge of sophisticated and complex technologies. These industries enabled countries to create mass employment, enhance productivity, participate in global markets and generate much needed export earnings[8] – as a stepping stone for subsequent diversification and upgrading strategies (see subsection 2.1. above). The outsourcing of garment and footwear manufacturing within global value chains governed by powerful transnational corporations has played a major role in this regard. Today, some 60 million workers are employed in the clothing industry worldwide.

However, the defining characteristics of the clothing industry also imply that it is subject to intense competition. It has low capital requirements, is easy to enter and relatively footloose, as production and trade patterns can be adjusted quickly to changing market conditions. Competition among an increasing number of supplier firms and countries orchestrated by global buyers and their purchasing strategies have led to a "squeeze" on supplier firms that face low prices, stringent requirements, small margins for error and pressure towards problematic working conditions.

Hence, for today's low-income countries it is critically important to assess the continued validity of this historic development path. Will it still be able to deliver the jobs for their rapidly growing populations or will digital innovations render this scenario irrelevant for the years to come? It is this question that necessitates a closer look at the main current and expected technological innovations. Exactly how – and how fast – are state-of-the-art

8 In 2016, the broader textiles, clothing and footwear sector accounted for 94 per cent of total exports in Bangladesh and 73 per cent in Cambodia. The shares for Ethiopia, Vietnam and Myanmar were 27 per cent, 23 per cent and 22 per cent, respectively (Heinemann, 2018).

production techniques that currently employ millions around the globe in manually assembling clothes changing and what are the implications for the business models of globally operating corporations?

The literature on digital automation in the textiles and clothing industry is growing rapidly and has recently moved from an initial technology pessimism to a stronger emphasis on the innovation potential offered by new digital technologies and robotics, also in sewing operations. In what follows, we provide a synopsis of how the manufacturing process is organised and in which processing segments digital automation is currently happening (Nayak & Padhye, 2018a; Gries & Lutz, 2018; Jana, 2018; Weinswig, 2017). The entire production process can be described as a sequence starting from a number of preparatory steps (design, product planning, sampling, raw materials sourcing, selection of trims and accessories) followed by the processing of fibres (natural or synthetic) into yarn and fabric, which then move towards spreading, cutting and ironing. The next step is the actual sewing of garments before eventually garment finishing as well as a range of post-production (packaging, distribution) activities take place. Importantly, while textiles manufacturing is a capital-intensive and skill-intensive process, labour inputs are heavily concentrated in the sewing phase (accounting for two-thirds of total employment) where the skill requirements are low, that is, where no formal education and only a minimum of on-the-job training are required (Chang, Rynhart, & Huynh, 2016).

In terms of a cost breakdown, a typical manufacturer in Asia would have 40 per cent direct material costs and 20 per cent labour costs with the remainder being accounted for mostly by factory overheads and by sales commissions and profits. In contrast, a typical manufacturer in an advanced OECD country would see labour costs at a level of more than 30 per cent (Chang & Rynhart, 2017). Obviously, such a high share of wages within the overall cost structure creates strong economic incentives for automation – in particular in light of the fact that about 80 per cent of overall production time of converting fabrics into garments are accounted for by the handling of materials (Gries & Lutz, 2018).

However, in the past, the introduction of automated machinery and robots has proven to be a difficult challenge in particular for sewing operations due to the limpness of fabrics, the frequent need for manual pulling and slipping of material, and the complexities of the non-linear needle-fabric interaction during sewing. Genuine artificial intelligence applications in garment technologies are at an embryonic stage and are just beginning to explore the possible use of artificial neural networks in woven textiles (Nayak & Padhye, 2018b). To put the use of robots into perspective, the following comparison is noteworthy: In 2017, global robot sales to the textiles/clothing industry amounted to just 443 – which is equal to 0.35 per cent of robots sold to automotive industries. Of these 443 robots, 64 per cent were sold to China alone (data provided to the authors by the Statistical Department of the International Federation of Robotics (IFR)). Thus, in a somewhat stylised manner, it can be said that, while the textile industry was the first to become mechanised, the clothing industry may be among the last to get fully digitally automated.

At the same time, the last couple of years have witnessed exciting technological innovations that may well herald a digitalised future also for the garment industry (Mitchell, 2018; Guizzo, 2018; Gries & Lutz, 2018). The specific commercial examples of technological

breakthroughs presented below deserve particular attention.[9] They focus on sewing operations where labour costs are concentrated and the introduction of digital technologies has so far remained rather limited (Berg, Hedrich, Lange, Magnus, & Mathews, 2017; Minian, Martinez, & Ibanez, 2016). Other manufacturing process areas in which digitalisation is currently advancing include fabric cutting with laser technology and the use of robots in fabric pressing (Nayak & Padhye, 2018a). In addition, there is significant progress in applying digital solutions to managing the entire garment supply chain: Examples range from design (digital design software, virtual sampling, 3D printing) to distribution (autonomous vehicles, blockchain technology) and sales (cloud computing, multi-channel customer integration, social media) (Weinswig, 2017). The most recent McKinsey survey of Chief Purchase Officers of more than 60 globally operating clothing companies (Berg et al., 2017) underlines that the full benefits of digitalisation can only be reaped by covering the entire supply chain from capacity planning to electronic supplier collaboration portals down to logistics.[10] More specifically, it is in assortment planning and design where digital technology opportunities are considered to have a particularly high impact: 73 per cent of respondents expect a high impact from predictive analytics, 56 per cent from 3D design and prototyping, and 41 per cent from automated manufacturing.

In what follows, we focus on automated manufacturing, because this is what might substitute the employment of millions of workers in developing countries. Some of the key state-of-the-art digital sewing technologies are briefly introduced. The coverage is not intended to be exhaustive but seeks to capture the scope and diversity of the main innovations present in the market. The descriptive presentation of these technologies is followed by a more analytical section, which assesses the current situation in the light of innovation theory concepts.

Digital innovation in clothing and footwear manufacturing: key new technologies[11]

Sewbo: The company is a Seattle-based startup established in 2015 that has introduced a fully automated, robot-based sewing process for T-shirt production. The approach taken is unique and relies on completely stiffening the fabric (in this case cotton) like cardboard thus allowing most fabrics (however, not leather or wool) to be handled by an adapted off-the-shelf robot in conjunction with most available sewing machines. The stiffening agent used is a liquid, water-soluble polymer, which can be easily washed off after the sewing operation. Of course, both the polymer agents and the washing operation do cause additional costs. In the current pilot operation, the robotic arm used costs approximately USD 35,000 and it takes 30 minutes to produce a T-shirt – a time that would need to be reduced significantly to be competitive in large-scale assembly-line operations to (Raphael, 2017).

9 The focus here is on garment manufacturing, in particular sewing operations. In a broader perspective, it bears mention that there is a confluence of digital innovations in production processes and in various properties of products. Examples include body scanning technology, 3D component printing and new trends in wearable technology, such as built-in sensors and monitoring devices for technical textiles.

10 For the role of various types of digital innovation on different segments of the supply chain (the so-called supply chain 4.0), see also WTO et al., 2019, Chapter 5.

11 In addition to the sources explicitly quoted at the end of each company example, this subsection also draws on the relevant company websites.

SoftWear Automation: The company, a Georgia Tech spin-off founded in 2016, is based in Atlanta and offers a method of automating sewing operations that is radically different from that adopted by Sewbo. Whereas the properties of the material are left untouched, the company uses robots with highly advanced visual identification and tracking capabilities. The camera used is capable of locating and following single threads in a fabric within 0.5 mm of accuracy, based on capturing more than 1,000 frames per second and relying on image-processing algorithms. The camera is mounted on a four-axis robotic arm that relies on a vacuum gripping device for handling the fabric. The technology owes its breakthrough to the cooperation with Walmart Foundation and a 2012 research grant from DARPA (the Defense Advanced Research Projects Agency of the United States). While significant further unit cost decreases are expected, currently a single robot system costs between USD 50,000 and 100,000.

The Softwear Automation technology is currently used by Tinyuan Garments, a Chinese company with a new plant in Little Rock (Arkansas) planned to produce one T-shirt every 22 seconds for Adidas. With three to four workers per robotic production line, labour input is reduced by around 60 per cent while output increases by some 70 per cent. Softwear Automation now offers its robotic system, also as a rental lease service to manufacturers, brands and retailers and claims that the latest vintage can be widely deployed for the automated production of items as different as rugs and towels as well as textiles for automotive and medical use (Berg et al., 2017; Innovation in Textiles, 2019; Device Plus, 2018; Abnett, 2016).[12]

Brother Vision Sewing and Vetron AutoSeam: In principle similar to the approach of Softwear Automation, both Brother and Vetron rely on automated vision sewing, that is, on high-speed image capturing and processing, which guides programmed mechanical action. Brother's system relies on a PC linked with software, camera and lighting for automatic pattern stitching around the perimeter of an object (for instance, a label or patch) that can be either regularly or irregularly shaped. Thus it enables customisation of clothing items at a sewing speed of up to 2,800 stitches per minute. The systems can perform the multi-layered sewing of letters or numbers and has the added advantage that an unskilled operator can handle several machines simultaneously.

Vetron (now a subsidiary of Typical International Corporation and presenting itself as combining German engineering with Chinese cost-effectiveness) focuses on the vision-guided stitching of two-ply materials. Its Vetron AutoSeam system is also steered by smart cameras and is capable of sewing two textiles with different edge contours and creating a 3D seam. The machine can also handle heavier materials required for applications in the automotive or furniture industries (Jana, 2017; Gries & Lutz, 2018).

KMF Maschinenbau: The section on KMF summarises a personal interview undertaken with the plant manager, Dietmar Kuhn, in April 2019. In view of the wider applicability of the arguments developed in the interview, also for other vision-based sewing systems, more space has been allotted to the case of KFM (see Box 1).

12 As pointed out by Kucera (forthcoming), the specific quantitative claims on productivity increases and related cost implications still differ widely according to the source quoted. However, this does not cast into doubt the fundamental impact this technology has on the economics of garment manufacturing.

Box 1: KMF Maschinenbau

KMF is a German machinery company that has been specialising in the production of textile machinery since 1973. It originally started as a subsidiary of Pfaff, a company with a long history in this sector which used to be one of the leading manufacturers of sewing machines. Today, KMF is part of the broader Gansler Group with approximately 120 employees. Three-quarters of machines are being exported with a geographical range from Eastern Europe and Russia to Africa and the United States. Currently, the focus of KMF is on introducing robotics for complex sewing operations needed for automotive seat covers.

Based on earlier robotic technology use in spray-glue applications, KMF has recently introduced robotics for sewing operations aimed at leather seats in high-end cars (BMW, Mercedes). The technology package has been fully developed over a two-year trial-and-error period by KMF, as a system integrator in collaboration with Yaskawa (one of the leading Japanese robot manufacturers), Bader (a large German leather-processing company) and various potential customers. It is marketed under the name RoQom 6000 and consists of Yaskawa's generic six-axis robot Motoman GP7, an automatically controlled sewing machine, a visioning system, a safety PLC (programmable logic controller) and a framing template, into which the leather is placed. The system's advantages can be summed up as:

- Precision, accuracy and speed: The acceptable tolerance level for parallel decorative seams is half the yarn width, that is, 0.2 mm. This requirement is delivered by the system with its maximum level of variation in repeat stitching operations of 0.03 mm. It currently operates at 900 stitches per minute. For instance, at a stitching length of 4mm, the sewing speed is 3.6 meter per minute. The next step, which will be based on a revised high-speed camera, is to move up to 1,200 stitches per minute. "Hence, beside cost reduction via speed, the unique selling point is the ability of producing in accordance with demanded specifications".
- Quality and reliability: The system generates reliable quality in production, which leads to significant reductions in rejection ratios (4-5 per cent as compared to 10-20 per cent in conventional manufacturing) and thus also additional economies in material use. The installed camera is a critically important component for ensuring real-time monitoring of the stitching operations and instantly triggering incremental corrections whenever needed. "It is the camera that replaces the previously necessary touching, feeling and moving of the material by an experienced human operator. However, the technical challenge is not the camera itself but the processing of its data to the robot-movement within [a] few milliseconds."
- Design flexibility: The system allows large variations in designing different patterns including complex curved shapes, which can respond to the strong trend for more individuality in automotive interior design. The latter is one effect of the trend towards increasingly autonomous driving. "More and more, car models base their distinctive features on interior characteristics and less on engine power." Moreover, the system can handle different, also opaque, materials.
- Scalability: The single robot can be easily upscaled into a larger automated production line and the leather framing templates can be enlarged to dimensions significantly beyond those used at present (780 x 920 mm).
- Online service packages: The camera installed in the system allows long-distance online maintenance and repair services via a combination of data transfer and visual monitoring. This addresses the growing trend of customers favouring hardware-cum-service packages as a contractual basis for their investment decisions.

In essence, this robot-based technology has not only been developed in response to cost-cutting imperatives but mainly as a solution for quality features that human labour simply cannot deliver. It is just the placement of the leather and its removal from the template that are still undertaken manually. However, in the future use of RoQom 6000 in entire assembly lines (planned for 2020), additional operations will be performed automatically.

KMF sees great potential in wider applications of robot technology in other sewing operations for clothing production but also for more specialised niches like orthopaedics. Its commercial success demonstrates what is possible even in meeting demanding challenges for sophisticated market segments with difficult materials like leather.

Note: Text parts in inverted commas are direct quotes from the personal interview undertaken with the plant manager, Dietmar Kuhn, in April 2019.

Source: Authors

Grabit: Evolving from a Silicon Valley non-profit organisation, the company was established as a startup in 2013 and soon thereafter managed to attract Nike Inc. as a potent investor. Its technological innovation builds on handling materials by means of electro-adhesion (rather than using robotic "fingers"); a flat pad of electrodes is attached to a robot and generates an electric field for attracting a wide range of possible materials.[13] This approach, for which Grabit holds a large number of separate patents, enables it to automate the most labour-intensive operation in the production of shoes and garments. In the specific case of sneakers, up to 40 pieces of material need to be stacked and heated, which takes a human worker some 20 minutes as compared to just 50 seconds for the robot, which is used in Nike's "Stackit" system for sneakers production and is claimed to have a cost recovery period of just two years.

Significant efforts went into the configuration of the most appropriate robot system. In close partnership with Toshiba Machine (TM), an off-the-shelf robot (THL 1000 SCARA) was modified and customised to meet the technical requirements in shoe manufacturing. This involved complex intertwined aspects like robot reach, precision levels, inertia, repeatability and rotation (Link, 2018).

MAICA: Originally an Italian company, MAICA went into Chinese ownership in 2017. The company has a 40-year history of producing sewing machines for shirt manufacturing. To date, its technological approach continues to rely on a process that effectively combines conventional sewing machines, CNC machinery and human labour for manual material feeding operations. Rather than moving into sophisticated robotic systems, MAICA has thus chosen a different technological trajectory based on a hybrid semi-automated system. Its client base is diversified and ranges from Zara in Portugal to a Sri Lankan shirt manufacturer (Kucera, forthcoming).

Adidas speedfactory: The speedfactory programme is based on a strategic partnership initiated by the sports shoe manufacturer Adidas. Key partners comprise Oechsler Motion (specialised in polymer-based components and automation solutions for a wide range of industries and now managing the speedfactory for Adidas), Siemens (for designing a virtual replica of the speedfactory), and the US technology company Carbon (focusing on 3D printing). The programme, which is co-funded by the German Federal Ministry for Economic Affairs and Energy (BMWi), is based on a technology, which combines an innovative robotic sewing system that allows the fully automated sewing of multiple layers of textiles monitored by an advanced vision system coupled with 3D printing of customised soles.

The main commercial offshoots are the "speedfactories" opened by Adidas in Ansbach (Germany) in 2016 and in Atlanta (United States) in 2018. In the German factory, approximately 160 employees (mostly in R&D (research and development); IT (information

13 To date, the seemingly simple operation of gripping soft material has remained an exceedingly complex challenge for robotic automation. The human grasp is influenced by a multitude of factors (from distance to gravity, surface properties, friction, shape, pressure, and so on), which different technologies are trying to emulate. In principle, the handling technologies can be impactive (grasping upon direct impact), ingressive (with pins or needles) or astrictive (relying on suction forces, such as adhesion in the case of Grabit). Ultimately however, a machine would need to combine all three types of grippers to achieve the same versatility as a human worker (Devine, 2018).

technology); and maintenance and monitoring) produce 500,000 sneakers annually. With the same output targeted for the Atlanta factory, one million pairs of sneakers would be reached, which is significant yet currently represents just 0.3 per cent of Adidas' global output. While the speedfactories are thus meant to be complementary to more traditional sourcing strategies, their relative importance is expected to rise fast: according to Morgan Stanley, up to 20 per cent by 2023. For Adidas, the key goals are to allow fully flexible mass customisation; cut down the time from design to delivery by locating production in close proximity to customers; reduce the need for large expensive inventories; and achieve cost savings in production (Bain, 2018a; Green, 2018).

In November 2019, Adidas announced it was discontinuing its sneaker manufacturing operations at the speedfactory in Ansbach, Germany and Atlanta, United States by April 2020 at the latest. This confirms an overall trend that we are not actually seeing a rapid paradigm shift from manual to fully robotised assembly but rather an experimental stage at which new technologies are being tested and, if successful, gradually incorporated into traditional production processes. However, the speedfactory concept will not in fact be given up but transferred to two main suppliers in Asia where it can be applied more economically – which also shows that automation may not lead to relocation to high-income countries. Also, its technology partner Oechsler Motion, will continue collaborating with Adidas to further develop digital printing of soles (Ritzer, 2019).

Levi-Strauss: The leading manufacturer of denim jeans is rapidly moving into the use of digital imaging for laser robots (a technology developed more than a decade ago) in the finishing phase to produce the worn look and rips demanded by many customers in jeans. Following a pilot operation in a Nevada distribution centre, the full roll out of laser technology to all Levi's factories is planned by 2020. Similar to the Adidas speedfactory case, the commercial impact will be threefold: reducing finishing time (from 20 minutes to 90 seconds); allowing a faster response to changing demand patterns and the trend towards customisation; as well as cutting production cost by automating the current use of manual labour. More specifically, the new technology will allow Levi-Strauss to reduce its stocks to just three basic jeans of different colour, which could be processed into a large number of customised finishes by lasers located in all strategic markets (Donaldson, 2018; Donnan, 2018).

Digital sewing in the innovation cycle[14]

The essence of the company cases above is synoptically presented in Table 1, which demonstrates the diversity of the current scenario in several dimensions: While the corporate drivers of innovation range from small startups to established machinery producers and global clothing brands, the technologies adopted also differ widely – albeit with a

14 In the following sections, frequent reference is made to views expressed during expert interviews conducted for this study. During March to April 2019, interviews were carried out with experts from three leading textile research institutes in Germany: the Digital Capability Center at the RWTH Aachen University (Volker Lutz – quoted below as VL); the German Institute for Textile and Fiber Research DITF (Alexander Artschwager – quoted below as AA); and the Saxon Textile Research Institute STFI (Yves Gloy – quoted below as YG). In addition, two experts from the McKinsey Fashion Group were interviewed (Karl-Hendrick Magnus – quoted below as KM; and Saskia Hedrich – quoted below as SH).

prevalence of innovations relying on vision sewing – and the market maturity covers a space from pilot operations to global upscaling.

Furthermore, it is important to recognise that robot applications for garment manufacturing require a multitude of capabilities from general robotics to software development, material handling, visioning systems and so on, that is, the challenge is one of designing an integrated package solution. For instance, this is reflected by Oechsler Motion operating as the integrating agent for the Adidas speedfactory.

In terms of technological innovation theory (as exemplified by Anderson & Tushman, 1990), the expert assessments provided in Box 2 clearly demonstrate that digitalisation in sewing is in the midst of an "era of ferment", which has not yet given way to a new "dominant design". While technological substitution is progressing, there is still a high level of design competition and the future pathway remains to a large extent open. However, a preponderance of innovations based on visioning systems is perceivable. These have the advantages of relying on non-contact sensors and being capable of capturing images, processing the captured image almost instantly and directing mechanical action on this basis (Jana, 2018).[15]

Seen from a global economic development perspective, the significant technological uncertainty appears to create a window of time in which low-cost, labour-intensive clothing and footwear manufacturing can remain competitive. In quantitative terms, key experts consider this window to be in the range of at least 15-20 years during which "digital automation in sewing is likely to become relevant for 20-30 per cent of the clothing market, yet not significantly more" (AA). However, in the case of simple garments, such as T-shirts, full robot-based automation may happen much faster: according to the latest McKinsey survey, it is expected to be a reality by 2025 (Andersson et al., 2018). This sceptical assessment of the speed of automation in garment manufacturing is shared by the CEO (chief executive officer) of Crystal Group, the world's largest clothing maker by volume, who recently opined that in the near term robots will not produce more cost-effectively than cheap human labour in Asia. Thus, the company will expand its operation in countries like Bangladesh and Vietnam (Bain, 2018b).

15 With regard to vision sewing systems and specifically referring to the success of Softwear Automation, Gries & Lutz (2018, p. 186) are convinced that "this technology will become the reality in [the] future world of garment manufacturing."

Table 1: Illustrative examples of digitalisation in sewing operations

Company	Type of company	Type of technology	Phase of development
Sewbo	Startup	Sewing robot working on stiffened textiles	Pilot operation without secured market demand
Softwear Automation	R&D spin-off from Georgia Tech	Robotic vision sewing	Market entry and upscaling with strong commercial partners
Brother	Sewing machinery producer	Automated vision sewing	Established market player with long track record
Vetron Typical	Sewing machinery producer	Automated vision sewing	Established market player with long track record
KFM Maschinenbau	Sewing machinery producer	Robotic vision sewing	Established market player with long track record
MAICA	Sewing machinery producer	Semi-automated sewing with manual labour	Established market player with long track record
Adidas	Sports products manufacturer	Robotic vision sewing and 3D printing for sneakers	Leading brand with global reach
Levi's	Jeans manufacturer	Laser robotics for jeans finishing	Leading brand with global reach

Source: Authors

Box 2: Digital innovation: experimentation within a technological continuum

The experts interviewed unanimously considered the prevailing views about radical technological disruption as exaggerated and emphasised instead that the introduction of digital innovation was a continuous and incremental process: "New digital technologies do not fall down from the blue sky. There are interesting new approaches now being developed but they will require long gestation periods in terms of market maturity. It is all about incremental improvements and a lot of testing, also in robot applications. Some new still immature technological innovations are hyped up as part of marketing strategies" (YG).

Generally, there was a shared assessment that, due to multiple technological challenges, digitalisation in sewing operation was still lagging far behind progress achieved in earlier stages of textiles processing:

- "There seems to be a structural divide between the long-standing application of automated machinery in large-scale standardised spinning and weaving operations on the one hand and the lagging use of such technology from the cutting process onwards, which requires a fragmentation into more customised batches and a handling of multiple pieces of cloth for garment manufacturing. It is here where digital automation runs into limitations and where existing sewing machines, representing an investment of EUR 3,000-5,000 each, and being capable of flexible adjustments, keep being competitive. In today's industry practice, digitalisation largely stops at the cutting table" (VL; see also Table 2).

- "Relatively rapid progress can be expected in material handling and simple sewing operations as in the case of T-shirts or also jeans, whereas more complex operations like draping of sleeves for shirts or the multi-layer sewing required for suits is still far removed from a satisfactory automated solution. Just a slight modification of the material (such as adding elastane yarn) has an exponential effect on the complexity of handling tasks, which lets costs explode while quality suffers – not to speak of the full blending of various materials, which causes exceedingly high costs of programming and machine setup for each batch of production. To accommodate these requirements, and the even more demanding requirements for mass customisation, machinery manufacturers would need to invest heavily in new IT system capabilities but also new hardware components. Yet the prevailing incentive structure is such that high profits can still be derived from selling machines to conventional mass producers of simple garments. So why change?" (AA).

With these caveats in mind, all experts interviewed look at the current phase as being characterised by widespread experimentation. Different technological paths are being tested and the winning option is too early to call. However, the Sewbo approach of materials stiffening is viewed rather critically:

- "This simply appears to be too complicated, adding a delicate processing step in terms of stiffening agents, then having to remove them, which creates both costs and sources of potential failure" (YG).

- "The Sewbo approach is more vulnerable as it requires an additional input, namely liquid polymers, to stiffen the cloth. Also, it cannot be used for example for leather and, most importantly, the stiff materials make it more difficult, if not impossible, to connect straight and round contours, which is a standard operation even for simple garments. I would therefore consider vision-based sewing systems as the likely future trajectory. The most significant cost factor here is the retrofitting or reprogramming, which is required as long as robotic systems are not fully capable of flexible adjustments within the initial hard programming in terms of changing models, sizes and colours" (VL).

Moreover, in the present phase of numerous piloting exercises being pursued in parallel, "the intellectual property [IP] issue is key. Many big firms are still undecided whether to keep IP at the level of their technology suppliers or build up their own IP domains, which in itself is a symptom of the incipient stage of technological innovation. And what we can see in the public domain is just the tip of the iceberg. A lot of innovation is driven by the major global brand players, yet takes place below the public radar screen" (KM)

Source: Authors

To sum up, Table 2 provides an overview of the state and prospects of automation in various different process steps and product categories of the textiles and clothing value chain.

Table 2: Automation in textiles and clothing manufacturing

Process steps and products	Already widely automated	Automation progressing fast	No full automation expected in next 10 to 15 years
Process steps	*Spinning* (ring, rotor and air-jet): auto-doffing systems, yarn handling, high-speed feeding, fault detection, bobbin replacement	*Textiles handling*: automated gripping, handling and shaping	*Garment sewing*: so far only partial automation largely limited to specified 2D-seams or programmable pocket sewing for low variety of products (see body of text for emerging robotic technologies)
	Sewing thread manufacturing: winding and doubling machines, fibre blending, mercerisation		
	Weaving: shuttleless looms (air-jet, projectile), warping, splicing, drawing, moisture control, fault detection		
	Knitting: flat knitting and circular knitting machines		
	Spreading and cutting: automated multi-ply spreading, fabric feed systems, fabric pattern matching, laser cutting		
Products	*Knitwear:* Sweaters, socks	*T-shirts and jeans:* robotic sewing *Athletic shoes:* automated knitting of mesh; 3D printing of soles	*Shirts:* sewing automats exist for labels, pockets, buttonholes, cuffs, collars, sleeves – yet not fully integrated *Jackets, skirts, formal trousers:* (also only partial automation) *Leather shoes*

Source: Compiled from Nayak & Padhye, 2018a

At the same time, "while clothing production went to Asia due to lower labour costs, it will not come back due to changes in labour costs alone" (VL). Hence, a look at the broader market picture beyond cost differentials is needed. Indeed, in addition to the cost cutting made possible by technological innovation, there is another strong trend affecting the future of the clothing industry. This concerns the radical overhaul of current business models with a view to responding to the demands of producer-consumer interaction becoming faster and more direct.

New business models are emerging

New digital technologies not only lead to labour cost reductions but also enable the introduction of new business models in which the key elements of competitive advantage are related to factors other than labour costs. This is strongly confirmed by the most recent global survey of digitalisation in the textile and clothing industry. Responses from 325

companies active in 57 countries and across all areas of the supply chain show that most digital investments are directed at "material and product trading and tracing", followed by "connected devices", "data analytics", "connected ERP [enterprise resource planning] systems" and "smart sensors". Investments in "robotic and automatic machinery" rank far behind (WTIN [World Textile Information Network], 2018). This reinforces the significance of new business models along the entire value chain, specifically related to:

- Speed: Fashion cycles are becoming ever shorter. Only recently, "a six-month fashion cycle was considered fast. Today, speedy time to market means no more than six weeks and some retailers are able to do it even faster" (Andersson et al., 2018, p. 8). Efficient communication systems, such as those linking the factory in real time to the point of sale, and rapid response capabilities are thus required to reduce the time to market, which can also contribute to reducing product markdowns that currently amount to 15-30 per cent per cycle. In this context, it is noteworthy that fast fashion and robotic automation are mutually reinforcing as different products can rely on the same basic technical blocks for production (Apparel Resources, 2017).

- Mass customisation: Enabled inter alia by the widening application of 3D body scanning, "digital twin" approaches (that is, creating a digital replica of the human customer body) and flexible automation in manufacturing, the potential for mass customisation is increasing rapidly at least in high-end clothing markets. Adapting to changing consumer preferences and to the growing trend towards individualisation requires flexibility and an almost instant response capability. This, in turn, puts a premium on the digitalisation and shortening of supply chains. (The specific case of 3D printing is addressed in Box 3.)

- Reliably high quality: As illustrated in the case of KFM above (see Box 1), upmarket leather products must conform to exacting standards of precision and consistency. One-digit rejection ratios are becoming the norm and can often only be achieved through reliance on digital technology. The choice between automation and human labour then becomes effectively a quality issue rather than a cost concern.

- Risk reduction: Digital technologies also allow a constant monitoring and tracking of all processes along the value chain and can trigger quick intervention whenever needed (Weinswig, 2017). As this often just requires a software modification, the costs associated with corrective action can also be kept low.

A business model in line with the above characteristics is quite the opposite of what the established outsourcing strategies can deliver. The latter imply long delays where speed is called for; standardisation where flexibility and customisation are needed; quality variations instead of reliability; and risks in remote links of the supply chain rather than tight monitoring and control. Hence, it is not surprising that, according to the McKinsey 2018 Sourcing Survey, almost 80 per cent of company respondents expect "that a step change in nearshoring for speed is highly/somewhat likely by 2025, especially, as the economics of nearshoring are starting to add up" (Andersson et al., 2018, p. 8).

Box 3: 3D printing in garment manufacturing: a realistic future scenario?

While the full long-term impact of 3D printing is as yet unclear, it seems that the initial belittling as a non-scalable, special-purpose niche technology has underestimated its full potential. Today, 3D printing is widely considered to morph into a truly transformative technology of the future leading to new business models, new products and new ways of organising global value chains. In a recent Delphi Survey among 65 experts (Jiang, Kleer, & Piller, 2017), it was predicted that by 2030 the distribution of more than 25 per cent of final industrial products will take place in the form of selling digital files rather than physical products.

However, in the specific case of the clothing and footwear industry, scepticism still prevails. Current applications are highly circumscribed. They relate to components of footwear (for instance, the customised soles produced in the Adidas speedfactory) and to adding functionalities to clothing items, such as safety and protective devices, sensor applications aimed at energy-efficiency or form modifications in response to temperature changes. Beyond such technical textiles, 3D printing will gain significance in design and prototyping yet – according to all experts interviewed – not in the manufacture of wearable soft clothing:

- "In principle, 3D printing would be highly attractive in clothing manufacturing to improve logistics and engage in on-demand production. However, for technical reasons it will simply not happen to replace the material properties of fibres like cotton as we are used to wearing them" (VL).
- "The business model of trading electronic files and printing products at mass scale in decentralised locations (like in automotive or electrical components) is not a realistic scenario in the global clothing industry" (KM).
- "3D printing is technically impossible for natural fibres like cotton. Traditional processing is much faster, much more cost-effective, much more robust, much more reliable" (YG).

At the same time, some pilot exercises have been reported, such as the company Electroloom seeking to print wearable garments from a polyester-cotton blend solution (Weinswig, 2015).

Source: Authors

The concept of "nearshoring" referred to in the above quote is rapidly gaining momentum as it can effectively marry a certain degree of labour cost savings (for example, by supplying the European market from North Africa or Turkey) with advantages of proximity:

> Shorter lead times will have high commercial value for on-trend items […] Not only will it be able to boost sales volumes and sell-through rates, but the company can also reduce inventory levels and mitigate the brand dilution resulting from markdowns and clearances. (Andersson et al., 2018, p. 11)

Box 4 provides an example of a company (Bivolino) combining the transport cost advantages of nearshoring with partial, gradually increasing levels of automation and customisation options for its client base.

In reality, the frequently portrayed strategic decision between low-wage workers and robots, and the concomitant decision between outsourcing and backshoring do not reflect the complex real world scenarios faced by business actors. Choices to be made are not binary. They have to account for interlinked considerations of cost, quality, technology, time and long-term sustainability. One possible future scenario could be a bifurcated market based on two partly opposing trends in different product groups:

> On the one hand the imperative to react swiftly in high-fashion market segments; on the other hand the pressure to reduce costs through upscaling in more standardised market segments. Each of these trends will require new digital technology solutions but they are unlikely to be identical. Where breakthroughs

will occur is subject to debate. This might lead to a hybrid in which outsourced and partly automated mass production is combined with producing fashion items and adding fashion components, such as buttons and other customised applications, by specialised machines closer to home markets. (KM)

Box 4: Bivolino: online sales of made-to-measure shirts

Bivolino is a Belgian firm, which was founded some 20 years ago. It is a company selling "made to measure" shirts via its own online platform to individual customers and also via other online channels, such as Marks & Spencer in the United Kingdom and Otto in Germany. Annual sales amount to 120,000 shirts. The company has only seven staff in its headquarters in Belgium (mainly for invoicing), another seven staff in Bulgaria (providing IT services) plus some 150 workers in production facilities in Tunisia, which are managed as joint ventures with two domestic companies. The latter contribute buildings and workers while Bivolino contributes the capital for machinery (from Lectra and Gerber) as well as marketing and distribution. In times of excess demand that cannot be met from Tunisia, further capacity subcontracting is undertaking to a small company in Romania. The partnership with the two Tunisian firms has remained stable over the entire period of 15 and 20 years, respectively.

Bivolino has taken a strategic decision to rely exclusively on road transport by lorries and not on air transport. In this decision, the expectation of future eco-taxes and rising air transport costs (calculated on the basis of carbon footprints) was a key consideration.

Specifically:

- Lorry transport takes place from Tunisia to Marseille with subsequent dispatch to European customers. This cuts transport time down to one week (total delivery time of two weeks), which is significantly shorter than the transport time of competitors relying on air transport for shirts from South and East Asia within three to four weeks.
- While production time is 120 minutes for manually produced "made to measure" shirts in Bangladesh (without any automated machinery and wages of USD 1 per hour), it takes Bivolino 68 minutes to produce a "made to measure" shirt in Tunisia (with automated single-ply cutting machines and wages of USD 2 per hour – nota bene: EUR 25 in Germany or Belgium). Hence, the company can match the production costs in Bangladesh (wages in Tunisia are twice as high yet production time is only half). In addition, there is an advantage in transport costs, which amount to USD 8 per shirt in the case of air transport whereas road transport costs are just USD 2 per shirt.

In the long run, Bivolino can benefit from two advantages: First, the company will not be negatively affected by rising air transport costs in the future; second, it can gradually improve the efficiency and thus profitability of its existing machines in Tunisia. Currently, the entire process from online orders, fabric preparation, CAD (computer-aided design) programming and CNC cutting is fully automated. The first manual operation is the placement of fabrics for the cutting machines. As far as sewing is concerned, this is still done completely manually – and the expectation is that, for the near future (up to 10 years), this will not become automated.

In addition to cost-cutting, a key driver for further automation is the enhanced reliability in terms of product quality, which is significantly superior to manual operations and creates the basis for higher customer satisfaction and repeat orders.

In terms of a scenario for the clothing industry in twenty years, a rising share of customised production (for shirts, sweatshirts, T-shirts, and so on) is seen as a strong trend, which currently accounts for only 2 per cent of the global market yet is expected to possibly move up to 10 per cent. This would also require the selling of customised garments on the big online platforms, such as Otto, Amazon and Zalando. At present, this is considered as too complicated in IT terms but may become feasible in future with "open API" (Application Programming Interface) software systems. This increased share of "made to measure" orders would, in turn, strengthen the trend of production in proximity to end consumers – in other words the case for nearshoring.

Source: Authors, based on an interview conducted in April 2019 with Michel Byvoet, the CEO of Bivolino

Furthermore, it is to be expected that the claimed "footlooseness" of investments by clothing and footwear companies (if indeed it ever genuinely existed) will give way to more stable investment patterns. "The threshold of moving into unknown territory is exceedingly high as companies cannot afford to experiment and possibly miss one entire fashion season" (KM). Also, "companies in upstream segments of the production chain have undertaken heavy capital investments and have a strong incentive to maintain their chosen location. Thus, they are not easily, or only at significant transfer costs, transplanted to another country" (SH).

Recently, clothing manufacturers have begun to push in the direction of "supplier consolidation as part of their risk management strategies, that is, they prefer to create longer-term partnerships with a small number of suppliers and are then ready to invest in their upgrading in terms of machinery for efficiency gains" (SH). In such longer-term partnerships, lead firms are also willing to invest in skill enhancement, which is required not only "to make their work force more productive but also to avoid high fluctuation rates in a high growth environment that offers employment also in other industries and locations" (SH). On the other hand, to the extent that high rates of labour turnover cannot be brought down and result in quality shortcomings, the incentive to automate even in a low-cost context tends to rise. This is particularly true for countries that offer "sizable and rapidly growing domestic markets, emerging middle classes and thus the customers of tomorrow" (SH).

Rising sustainability concerns

In addition to digitalisation challenges, a host of pressing concerns related to resource consumption, pollution and climate change is beginning to affect the clothing industry, and particularly the fast fashion business. Key issues range from water consumption and pesticides-use in cotton production – which "may well lead to ecological disasters that will reduce the future availability of cotton" (AA) – to the release of plastic microfibres, the use of hazardous chemicals, and greenhouse gas emissions. For the textiles and clothing industry, the latter amount to more than one billion tonnes annually, that is, more than those generated by international air flights and maritime shipping together (Ellen MacArthur Foundation, 2017). In recent years, the industry has thus seen the creation of numerous business initiatives around the sustainability agenda, such as the Coalition on Zero Discharge of Hazardous Chemicals, the Sustainable Apparel Coalition, the Better Cotton Initiative as well as H&M and Levi's partnerships with I:CO (a global solutions provider and innovator) [16] to promote the collection, recycling and reuse of clothing and footwear (McKinsey & Company, 2016). Industry insiders see the clothing sector on a pathway similar to what is currently happening around the challenges of plastics or meat consumption, that is, initial minority concerns rapidly entering the mainstream debate (Butler, 2018).

In this context, it bears mention that the two challenges of digital automation and sustainability are to some extent interlinked. For instance, digitalised materials processing technologies can contribute to reducing waste in garment production and thus enhance resource efficiency. An interesting case in point is the treatment of fashion jeans ("vintage look"), which normally creates an exceedingly high ecological footprint. By relying on advanced digital laser technology, the Spanish company Jeanologia has designed an automated process that does not rely on toxic chemicals and reduces water consumption

16 For more information, see https://www.ico-spirit.com/en/.

significantly (Herranz, 2018). Another example is the increasing significance of carbon footprinting in companies' transport strategies, which reinforces the trend towards nearshoring; in other words: considerations of market proximity and of sustainability can work hand in hand (see the case of Bivolino in Box 4).

Summing up

From both the relevant literature and the expert interviews undertaken for this paper, a highly complex picture emerges. Digital automation is undoubtedly a powerful factor in shaping the future of the global clothing industry, yet it is perceived as more in the nature of continuous progress than radical disruption. No dominant new technology has established itself while a great deal of experimentation is taking place and hence it is difficult to predict the prospects for rapid market upscaling and unit cost degression.

Furthermore, technological developments are themselves embedded in, and closely intertwined with, changes in business models driven by increasing customisation, virtual sampling, rapid prototyping and a general reduction of market lead times, all of which result in a major overhaul of conventional value chains. Most experts are agreed that the nearshoring of production is rapidly accelerating: "Reduced lead times will be key drivers of competitive advantage" (McKinsey & Company, 2019, p. 85). At the same time, there is a high degree of scepticism regarding the potential of the 3D printing of clothing items, which if feasible, would allow more decentralised manufacturing.

Most importantly, leading industrial experts expect a full-scale automation of sewing operations to materialise at best in a few decades. However, it bears mention that the degree of uncertainty remains exceedingly high. On the one hand, expert opinion seems to converge around an early full automation of simple garment production within less than a decade. On the other hand, predictions for a full automation of the entire US garment industry cover a range from less than 10 per cent to more than 70 per cent by 2030 (Andersson et al., 2018, p. 22).[17]

Hence – from a purely technological vantage point – a significant time window remains open for low-cost African countries to attract clothing investments and engage in export-oriented manufacturing. Whether this will actually happen, depends on the broader picture of prevailing investment conditions, which the following section will address.

3 Determinants of competitiveness: country-level comparisons of direct and indirect costs

The mounting wave of digital automation in light manufacturing and specifically clothing poses a serious challenge for the latecomer catch-up scenario of export-oriented development.

17 Along these lines, a simulation exercise was recently performed for the US furniture sector (Banga & teVelde, 2018). Whereas – like the garment sector – furniture-making is labour-intensive and based on low skills, it is an industry with a comparatively higher robot intensity. The result for the inflexion point, that is, the year in which the robotic system costs turn lower than those of traditional labour-intensive manufacturing, is 2034 for Kenya and, in a similar exercise, 2042 for Ethiopia. This may seem far away, yet it does imply that the time horizon for strategic responses is only about two decades.

Even if a time window for adjustment is still open, low-income economies will need to revisit the most realistic long-term options for their future development pathways.

This challenge is particularly pronounced for countries in Sub-Saharan Africa. It hits them at a time of a widespread "Africa optimism". A bright outlook for Africa has become a dominant theme in much of the relevant economics and business literature, which is moving from earlier gloom and doom stories to visions of a prosperous future (McKinsey Global Institute, 2010, 2016; McMillan & Harttgen, 2014; Yuan Sun, 2017).

At the same time though, there are more balanced and sceptical views pointing to a general lack of structural change and industrial diversification, the exceedingly small formal sector in most African economies and the phenomenon of a "missing middle" of thriving private enterprises (Rodrik, 2016; Dinh, Palmade, Chandra, & Cossar, 2012; Signé, 2018). These structural factors, in addition to political economy factors (Altenburg & Melia, 2014; Whitfield, Therkildsen, Buur, & Kjær, 2015), are holding back industrial dynamism. Thus, the key question is whether, despite these constraints, FDI in manufacturing can be attracted on a scale sufficient to put Africa on the global manufacturing landscape – where so far the entire continent has remained virtually invisible, never reaching even 2 per cent of the world's manufacturing value added (UNIDO, 2018).

Our point of departure is a counterfactual proposition put forward by Justin Lin, which has tickled the fantasy of many researchers and become widely influential:

> Let's assume that as a result of rising wages, 1 per cent of China's production of apparel is shifted to lower-wage African countries. All things equal, that alone would boost African production and exports of apparel by 47 per cent. A 5 per cent shift of Chinese export-related investments in the industry could translate into USD 5.4 billion in additional exports – a 233 per cent increase. (Lin, 2011, p. 30)

To date, clothing exports from SSA countries are exceedingly low. While in some countries they are rising rapidly due to export-oriented foreign investment, the numbers remain miniscule in comparison: In 2017, clothing exports from the six African countries covered in Tables 3 and 4 amount to just 1 per cent of China's clothing exports and only 5 per cent of those coming out of Bangladesh alone. Looking at Ethiopia as the rising star, the country's exports of garments are equal to just 0.27 per cent of those of Vietnam (calculated from the World Trade Organization (WTO) database).

What, then, are the advantages that African countries can offer to prospective Chinese firms or other investors wanting to reduce their engagement in China? First and foremost, manufacturing wages are still low in most SSA countries and could be an important basis for cost competitiveness.

Wages and productivity

In Table 3, we compare China with several low- to medium-level Asian clothing exporting countries, the leading SSA clothing exporters (including Ethiopia and Madagascar, which will be addressed in greater detail in Section 5) as well as three further countries. The latter have been selected in view of their dominant position as nearshoring locations for the European market: According to the latest McKinsey sourcing survey, 29 per cent of respondents expect

Turkey to become the most important nearshoring country by 2025, followed by 10 per cent for Morocco and 5 per cent for Portugal, respectively (Andersson et al., 2018).

Clearly, the data in Table 3 have to be interpreted with caution. First of all, the minimum wage data (with the exception of Mauritius) are country-wide and do not specifically show wage levels in the clothing sector, for which no comparable and reliable data are available. Secondly, the same applies to labour productivity figures, which are also national averages across different sectors, production modes and ownership structures. It should be noted, however, that firm-level productivity gaps can be narrowed down significantly by adopting good manufacturing practices, in particular in the case of FDI and unless work ethics differ too strongly.

Table 3: Minimum wages and productivity by country

Country	**(1) Minimum monthly wage (current USD, 2018/2019)**	**(2) Labour productivity[k] (2018)**	**(3) Wage-adjusted labour productivity (2):(1)**
China	320[a]	26,499	92
Bangladesh	95[a]	9,217	97
Lao PDR	132[b]	12,810	97
Vietnam	151[c]	11,142	74
Ethiopia	30[d]	3,836	128
Madagascar	50[e]	2,872	57
Mauritius	265[f]	47,244	178
Tanzania	63[a]	5,979	95
Ghana	58[g]	11,423	197
Kenya	132[h]	8,562	65
Morocco	278[i]	25,768	93
Portugal	700[j]	60,305	86
Turkey	406[h]	73,147	180

Sources: Data is based on the following websites:
[a] www.ilo.org/ilostat
[b] www.aseanbriefing.com
[c] www.vietnam-briefing.com (average of regional minimum wages)
[d] www.africanews.com (no legal minimum wage; refers to approximate wage in industrial parks)
[e] www.ey.com (for non-agricultural sectors)
[f] www.sourcingjournal.com (for garment sector)
[g] www.ghanabusinessnews.com
[h] www.tradingeconomics.com
[i] www.minimum-wage.org (for private sector; plus 5 per cent increase in 2019)
[j] www.theportugalnews.com
[k] www.ilo.org/ilostat (output per worker; GDP constant 2011 international dollars in purchasing power parity)

With these caveats in mind, the following broad conclusions can nevertheless be drawn:

- Wage differentials are enormous, with China having a minimum wage level twice as high as Vietnam and roughly 10 times higher than Ethiopia. Among the SSA countries covered, only Mauritius gets close to the wages paid in China while Portugal exhibits a wage level more than twice as high as China.

- However, a similarly wide spectrum also applies to labour productivity levels, which are lowest in Madagascar and Ethiopia and highest in Turkey and Morocco. Here, China is positioned pretty much in the middle of the range.

- As a result, wage-adjusted labour productivity (as a proxy for unit labour costs) shows less divergence across countries. While half the countries covered occupy a narrow range, Madagascar stands out with the lowest level, while Ghana, Turkey, Mauritius and Ethiopia are the most attractive locations in terms of unit labour costs.

Broader investment determinants: energy, logistics, infrastructure

The relative advantages in unit labour costs can be easily nullified by other indirect cost components related to the broader investment climate prevailing in a country. Additional operating costs may above all originate from the non-availability and/or low quality of inputs; difficult access to land and finance; limited technical and entrepreneurial skills; weak trade and transport infrastructure; and lacking networking and cluster effects. Importantly, the net result differs tremendously from sector to sector: For instance, whereas in wood manufacturing the total unit production costs in many African countries (specifically in Ethiopia, Tanzania and Zambia) are considerably higher than in China, they are at much lower levels in the case of clothing industries (Dinh et al., 2012). In particular, the attractiveness of Ethiopia has been corroborated by more recent research (Ceglowski, Golub, Mbaye, & Prasad, 2018) leading to speculation that on the basis of low unit labour costs "investors may choose to leapfrog over most of Africa to settle only in the poorest countries" (Gelb, Meyer, Ramachandran, & Wadhwa, 2017, p. 3),[18] However, this may be an overly stylised scenario. In reality, the attractiveness of SSA countries, including Ethiopia, still leaves a lot to be desired as a look at qualitative investment determinants demonstrates. After all, low unit labour costs are just a necessary and not a sufficient precondition for overall competitiveness.

Against this backdrop, Table 4 takes a closer look at a variety of indirect cost and investment climate dimensions, which in their entirety and combined impact shape the competitiveness at country level. As in our brief discussion of Table 3, we are not interested in the specifics of data comparison but want to derive a broad-brush picture.

Obviously, countries differ starkly in each aspect covered. While China is topping the list in domains like electricity access and contract enforcement, Portugal is strongest in cross-border trading, logistics and infrastructure. Comparing Asian low-income countries with

18 Coupled with a reasonably good transport infrastructure, a well-educated workforce and a strategic policy commitment towards industrialisation, Ethiopia could be well poised to become an attractive garment manufacturing location (see Section 5) and develop into a future "China in Africa".

Table 4: Indirect costs and general competitiveness scores by country (2018)

Country	Trading across borders score[a]	Price of electricity in USD cent/kWh[a]	Getting electricity score[a]	Enforcing contracts score[a]	Logistics performance score[b]	Infra-structure score[c]	Global compete-tiveness score[c]
China	82.59	14.0	92.01	78.97	3.61	78.1	73
Bangladesh	31.76	9.2	30.81	22.21	2.58	53.4	52
Lao PDR	78.12	12.9	52.77	41.99	2.70	57.5	49
Vietnam	70.83	12.3	87.94	62.07	3.27	65.4	58
Ethiopia	56.00	3.9	59.71	62.77	2.38 (2016)	45.5	44
Madagascar	60.95	15.7	22.48	46.55	2.15(2016)	n.a.	n.a.
Mauritius	81.00	19.6	86.24	70.37	2.73	68.0	64
Tanzania	20.21	12.3	74.61	61.66	2.99(2016)	46.0	47
Ghana	54.84	22.2	74.02	54.00	2.57	50.3	51
Kenya	68.06	21.5	76.08	58.27	3.33(2016)	54.8	54
Morocco	83.58	12.3	81.34	60.93	2.54	71.5	58
Portugal	100	25.2	86.45	67.91	3.64	83.3	70
Turkey	42	10.1	81.23	71.78	3.15	62.0	62

Sources and notes: Data is based on the following websites:

[a] World Bank Doing Business Report (www.doingbusiness.org); scores range from 0 (lowest) to 100 (highest)

[b] World Bank Logistics Performance Index (https://lpi.worldbank.org/); scores range from 1 (lowest) to 5 (highest) and reflect customs, infrastructure, international shipments, logistics competence, tracking and tracing, and timeliness.

[c] Word Economic Forum, Global Competitiveness Report (http://www3.weforum.org/docs/GCR2018/ 05FullReport/ TheGlobalCompetitivenessReport2018.pdf); scores range from 0 (lowest) to 100 (highest)

n.a. not available

SSA countries yields a rather mixed picture. For instance, Ethiopia offers by far the lowest electricity tariffs[19] and is vastly superior to Bangladesh in terms of electricity access and contract enforcement. However, it falls behind all Asian and African countries covered in terms of infrastructure. As a result, at the most aggregate level of global competitiveness rankings, the Asian comparator countries still outperform SSA countries. It is noteworthy that, while competitiveness rankings are notoriously controversial in terms of their methodology, roughly the same ranking is obtained in both the qualitative World Economic Forum (WEF) Index used in Table 4 and the trade-theory-based Competitive Industrial Performance Index developed by UNIDO (UNIDO, 2019).

The immense importance of a number of qualitative determinants of competitiveness is obvious. Foremost among these are various components of a country's infrastructure (trade, transport, energy), legal security and – not even considered in Table 4 – the overall political and governance system. Weak infrastructure will inevitably result in higher operating costs and thus act as a productivity penalty, which is particularly pronounced in the case of

19 However, the country is planning a major, possibly fourfold tariff hike. At the same time, it needs to be factored in that tariffs differ depending on consumption volumes and the applicability of special pricing regimes in industrial parks.

electricity access costs. In a comparative study for East Africa, the latter were shown to have the highest elasticity of firm output (Iimi, Humphrey, & Melibaeva, 2015).

The role of industrial parks (special economic zones)

Against this backdrop, the question arises as to how the high overall costs of doing business can be counterbalanced by industrial policy measures with a view to capitalising on existing unit labour cost advantages. General shortcomings related to infrastructural facilities and adverse business environments, which characterise most African countries, cannot be remedied at firm-level by company strategies. Where infrastructure is left wanting, the establishment of managed "dedicated spaces" aimed at creating pockets of efficiency and stability for investors has been a frequent policy approach. In recent years, it has become almost a cliché to end long lists of investment deterrents with a bright outlook on the potential offered by economic zones as a silver bullet.[20] Clearly, as a determinant of attracting foreign investment, they deserve special attention.

The role of a wide variety of "dedicated spaces" for industrial development and structural diversification has been a prominent subject of economic research for several decades. No attempt is made here to review the general literature available.[21] The collective efficiencies created by such zones are derived from firm-level economies of agglomeration and proximity, which are further reinforced by shared infrastructure as well as special fiscal, financial and trade incentives offered by governments. Early East Asian experience with export-processing zones (starting in the late 1960s) was a key building block of successful latecomer industrialisation, subsequently followed by China's reliance on special economic zones (SEZs) in opening up its economy to foreign investment in the 1980s.

A conceptual note on terminology is necessary. Economic zones appear in many different forms depending on the policy objectives pursued, which can range from facilitating cross-border trading operations all the way to supporting ambitious economic reform programmes. With no claim for completeness and in a somewhat stylised approach (based on Zeng, 2019), we here make the important distinction between "industrial parks" that mainly offer good infrastructure and some shared facilities without any special economic incentives; "export-processing zones" (export-oriented industrial estates with prefabricated infrastructure, a liberal regulatory environment, and special financial and tax incentives); "free trade zones" (duty-free areas with various bonded warehousing, storage and trade support facilities); and "special economic zones" (broader geographical areas for which special rules and regulations apply, like in the Chinese Shenzhen case). Moreover, "special-purpose zones" have recently proliferated in terms of science and technology parks, eco-industrial zones (for example, focusing on collective efficiencies in water and energy management), logistics parks and so on, all of which may in addition be targeting selected industrial sectors, such as electronics assembly or clothing manufacturing. Moreover, the

20 "SEZs are considered a manageable and realistic option to overcome some of the policy-related constraints in developing countries […] the best investment advice for manufacturers looking to invest in Africa is to identify optimal SEZs for the relevant subsector" (Signé, 2018, pp. 25-26).

21 For the fundamentals of the economics of trade and geography, see Krugman (1991); for a review of the evolution and impact of export-processing zones see Engman, Onodera, & Pinali (2007); for the more specific case of SME-focused industrial clusters, see Schmitz (1995).

zones – as an infrastructural policy tool – can be combined with broader objectives, such as entrepreneurial, managerial and technical capacity-building and training.

In the debate on African industrialisation, it has become customary to talk about SEZs, which however is a technical misnomer. While we prefer the term "industrial parks", occasional reference to SEZs may be necessary in view of its widespread use in the relevant literature.

African countries were rather late in adopting an industrial zone-based development model, with some countries initiating zones in the context of structural adjustment in the 1990s and others starting to set up such zones around the early 2000s, partly triggered by export opportunities stemming from the EU Everything But Arms (EBA) Initiative and the US Africa Growth and Opportunities Act (AGOA). To date, most Sub-Saharan countries have established industrial zones (for an overview, see Newman & Page, 2017). However, their impact has remained limited and the general verdict ranges from "largely disappointing" to "complete failure", "highly inefficient" and "bumpy road ahead" (Farole & Moberg, 2014; Bräutigam & Tang, 2014; Newman & Page, 2017). In particular, significant evidence of political capture has been identified, ranging from self-enrichment by politicians (among other things through access to cheap land) to serving local constituencies, corruption in connection with business contracts as well as widespread smuggling (Yuan Sun, 2017). This seems to confirm earlier negative assessments, according to which most African industrial zones were plagued by poor planning, suboptimal locations, weak infrastructure and insufficient implementation capacities (Farole, 2011; Dinh et al., 2012).[22]

The question arises whether this bleak picture (largely originating from studies carried out a few years ago) needs to be revisited in the light of institutional and policy learning that in recent years has led to improved approaches in some African countries (see the case of Ethiopia in Section 5). In particular, recently established Chinese zones in various African countries may represent a special case as they are based on a non-conventional business model (Bräutigam & Tang, 2014; Newman & Page, 2017). A growing number of Chinese economic cooperation zones (ECZs) – while being an integral component of China's official development cooperation programme – are set up by private Chinese firm, that is, within a market- and profitability-driven approach. These firms are selected within China through government tenders based on a set of performance criteria (linked to detailed feasibility studies, proven implementation capacity, and so on) and supported by grants and cost-sharing incentives from the Trade and Economic Cooperation Zone Development Fund of China's Ministry of Foreign Trade and Commerce (MOFCOM). As a result, 16 proposals were selected by 2013 and, after a gestation period of several years, have since led to private zone investments in at least five African countries (Egypt, Ethiopia, Mauritius, Nigeria and Zambia). Whereas this approach can ensure a strong commitment on the Chinese side, it also however constitutes an additional risk factor in terms of possibly conflicting strategies between private investors and African public authorities that would need to be aligned.

22 This general assessment is also confirmed by one of the few available in-depth reviews at country level. Concerning the effectiveness of industrial zones in Tanzania, Kinyondo, Newman and Tarp (2016) conclude that public policy support is disorganised, many firms are not operational, energy supply is not reliable, labour of the requisite skills is not sufficiently available, and linkages to the local economy are almost non-existent.

Notwithstanding the serious shortcomings prevailing in many African industrial zones, they do constitute a space in which Chinese investors feel relatively comfortable and prefer to operate (Bräutigam, Tang & Xia, 2018; Signé, 2018). On the one hand, co-location with other Chinese firms provides a sense of a shared ethnic community and can thus reduce the psychological distance to an entirely new location. On the other hand, being inside a zone confers advantages of security and, as mentioned above, at least a modicum of the necessary energy, transport and communication infrastructure. For instance in Ethiopia, special government support is available for setting up a dedicated electricity grid for industrial zones (Gelb et al., 2017).

While industrial zones by their very nature embody an enclavistic approach towards industrial development (by offering a geographically bounded special investment regime), they can foster advantages of agglomeration. Stated objectives often include the co-location of enterprises within a given value chain with a view to creating complementarities, which would allow cost advantages (for instance, reduced transportation costs compared to imported inputs) and stimulate technological and managerial learning.[23] Such co-location benefits could be achieved in three different ways: i) through the relocation of entire industrial clusters; ii) by relocating a large lead firm that would subsequently exert a pull effect on its suppliers ("follow sourcing"); or iii) by drawing domestic companies into the zone as suppliers of inputs and ancillary services. So far, there is little evidence of such co-location happening in African industrial zones (Bräutigam & Tang, 2014; Gebrewolde, 2019, Whitfield & Staritz, forthcoming). Trade disputes between China and the United States may however encourage Western fashion companies to push their suppliers to establish clusters that are independent from China. Box 5 shows how one global buyer is already encouraging co-location in Ethiopia.

Preferential trade agreements

Preferential market access has been of crucial importance for competitiveness in clothing export sectors and a key motivation for FDI and buyers to invest in or source from certain countries. This is because the clothing (and textile) industry has been one of the most trade-regulated manufacturing activities in the global economy. Until 2005, textile and clothing trade had been governed by a system of quantitative restrictions (in other words, import quotas) under the Multifibre Arrangement (MFA), which was signed in 1974. The objective of the MFA was to protect the major import markets (Europe, United States, Canada) by imposing quotas on the volume of textile and clothing imports for most countries. Important textile and clothing exporter countries were thus restricted by these quotas, whilst other countries had available quotas or no quota restrictions at all. The quota restrictions hence led to global spreading of production from quota-restricted countries to countries with free quotas or no quota limitations, allowing lower income countries to establish a clothing industry (Gereffi, 1999). When manufacturers, mostly from Japan, South Korea, Hong Kong (Special Administrative Region (SAR)), Chinese Taipeh and later mainland China, reached quota limits in their home countries, they searched for producer countries with under-utilised quotas or for countries with no quota to set up clothing plants or to source from existing firms. Many

23 The fact that China is the leading supplier of yarns and fabrics constitutes a challenge even for nearshoring strategies of US and European companies: "One of the biggest challenges currently is the sourcing of raw materials, fabrics, and ingredients. Only a co-located value chain can offer the full speed and flexibility in the supply chain" (Andersson et al., 2018, p. 12)

of these countries previously had no important clothing exporting industry, which is why they initially faced no quota restrictions under the MFA. This was also the case for Sub-Saharan Africa where "quota hopping" investors had played a role in the 1990s and particularly in the early 2000s (see Section 5 on development of SSA clothing sectors).

The Uruguay Round of the General Agreement on Trade and Tariffs (GATT) brought the clothing and textile trade under the purview of the newly founded WTO. The 1994 Agreement on Textiles and Clothing (ATC) aimed to phase out the MFA by the end of 2004. This allowed buyers to freely source clothing globally,[24] leading to a consolidation of supplier countries with earlier quota-restricted countries gaining market shares (Frederick & Staritz, 2012). While quotas have been eliminated, tariffs still play a central role in the global clothing trade. Most favoured nation (MFN) tariffs on clothing imports are on average around 11 per cent for the European Union and the United States with considerable variations for product categories (US tariffs varying between 0 and 32 per cent for synthetic products). In this context, preferential market access has a substantial impact on global clothing trade patterns. Major preferential market access schemes can be divided into two types of agreements: regional or bilateral trade agreements; and the Generalised System of Preferences (GSP) (Frederick & Staritz, 2012):

- Developed countries, in particular the European Union, Japan and the United States, have negotiated regional trade agreements to advance regional production networks. Lower-income countries have also increasingly negotiated a variety of regional trade agreements. However, negotiations and implementation have been slow, and clothing and textiles are often excluded. In addition to regional agreements, countries have increasingly negotiated bilateral trade agreements, with the European Union and the United States being most active in this regard.

- Twenty-seven developed countries have provided tariff preferences to over 100 beneficiary countries through the GSP. However, tariffs for clothing products are only marginally reduced in the standard EU and US GSP. Within the GSP, some countries have negotiated preferential access for least developed countries (LDCs) – for example, the EU's Everything but Arms and the Lomé Convention and its successors, the Cotonou Agreement and the Economic Partnership Agreements (EPAs), as well as the US's Africa Growth and Opportunity Act (AGOA).

Preferential market access in these agreements is governed by more or less restrictive rules of origin (ROOs), which ensure that the actual products of trading partners receive preferential market access and that exporters from third countries do not use transshipment and "light" processing to circumvent external tariffs (Brenton & Oezden, 2009). They are either stipulated as a certain percentage of the total value of products or certain production steps that have to take place in the beneficiary country. For clothing, ROOs are commonly differentiated in "single transformation" where only the sewing stage has to take place in the beneficiary country (fabric to clothing); "double transformation" where also one input production step has to be conducted such as knitting or weaving of fabric (yarn to fabric); and "triple transformation" where in addition to knitting/weaving also the spinning of yarn has to take place in the beneficiary country (fibre to yarn). A motivation behind restrictive ROOs is to

24 With the exception of some temporary restrictions of Chinese imports until the end of 2008.

support backward integration and also regional integration as special provisions often allow for the use of regionally produced inputs. Restrictive ROOs may however hinder market access in particular for low-income countries, given the capital- and scale-intensive nature of textile production that makes establishing competitive textile sectors challenging.

Although trade preferences are crucial in the clothing sector, they are eroding due to generally decreasing tariffs through trade negotiations at different levels and access to tariff preferences for more countries. In particular at the bilateral level, the United States and the European Union are negotiating preferential trade agreements with an increasing number of countries, which makes preferential market access less valuable; but some countries may also lose beneficiary status as they graduate out of the LDC group. This might be the case for Bangladesh which is likely to lose LDC status within the next five years. Preferential market access relying on unilateral market access stipulations such as EBA for the European Union and AGOA for the United States might also be changed or even stopped unilaterally by importing countries. This is a particular concern for AGOA that is only installed for a limited time period, although so far it has been repeatedly renewed.

For Sub-Saharan African countries, preferential market access to the European Union and the United States is of crucial importance. This issue will be taken up again in Section 5.

4 Chinese textiles and clothing manufacturing: really moving to Africa?

So far, we have reviewed current and prospective technological trends in the clothing industry (Section 2) as well as main drivers of the industry's competitiveness, which are shaping its international division of labour (Section 3). Against this backdrop, in Section 4 we move to the perspective of Chinese clothing manufacturers. How are they likely to respond to new technological scenarios and relocation options? A brief profile of China's textiles and clothing industry and its recent development is followed by a discussion of the coping strategies of clothing companies faced with rapidly rising wages at home (subsection 4.1). The findings of available studies on this question are complemented by three case studies at firm level (subsection 4.2).

4.1 Coping with rising wages: recent trends in China's textiles and clothing industry

Globally, China is the largest manufacturer of textiles and garments with large-scale production capability, strong export competitiveness and comprehensive value chains. As shown in Table 5, employment in the textiles and the clothing industry, respectively, is almost identical, reaching a combined level of close to eight million. At the same time, the textiles industry has a higher number of firms and a sales volume of about 1.7 times that in the clothing sector. While privately-owned firms clearly dominate the industry (relatively stronger for textiles than for garments), a comparatively high share of foreign-owned firms is noteworthy for the garment sector where the 20 per cent of foreign-owned firms generate almost one-third of employment and more than one-quarter of sales.

In 2017, Chinese exports of textiles and clothing reached USD 110 billion and USD 158 billion, respectively, which translates into global export shares of 37 per cent and 34 per cent (WTO database). In terms of firm size, the sector covers the full spectrum from large

companies with export levels above USD 50 million, which contribute 30 per cent of all exports, to SME (small and medium enterprise) clusters accounting for over 40 per cent of industrial revenue (Zhang, 2018; CCCT [China Chamber of Commerce for Import and Export of Textile and Apparel], 2018).

Table 5: Contribution of state-owned enterprises (SOEs), privately owned Chinese and foreign firms in China's textiles and clothing industries (2017)

Textiles industry				Clothing industry		
Number of firms	18,726	SOEs	0.9%	14,600	SOEs	1.3%
		Private Chinese firms	70.6%		Private Chinese firms	58.5%
		Foreign firms	11.4%		Foreign firms	19.9%
Employment	3.91 million	SOEs	3.3%	3.87 million	SOEs	2.2%
		Private Chinese firms	53.9%		Private Chinese firms	44.4%
		Foreign firms	16.6%		Foreign firms	31.7%
Sales volume	3,611 billion RMB	SOEs	2.3%	2,089 billion RMB	SOEs	1.0%
		Private Chinese firms	54.6%		Private Chinese firms	47.5%
		Foreign firms	13.4%		Foreign firms	26.1%

Note: Data based on firms with annual sales over 20 million RMB.

Source: National Bureau of Statistics of China, 2018

A recent survey undertaken by the Overseas Development Institute in the United Kingdom and the Peking University Institute of New Structural Economics (Xu, Gelb, Li, & Zhao, 2017) confirms that rising labour costs (mostly due to rising wages but also to increases in non-wage labour costs) are perceived as the most serious challenge by firms currently operating in China's Eastern provinces. More specifically, this was also the response of close to 50 per cent of highly export-oriented light manufacturing firms (home appliances, textiles, clothing, footwear and toys) in the Yangtze and Pearl River Deltas. From a survey regularly undertaken for more than 200 Pearl River Delta firms (with slightly more than 50 per cent active in electronics manufacturing and the remainder in clothing, plastics, toys and furniture), broadly similar results emerge and are not surprising, given that wages on average account for 22 per cent of total costs (Standard Chartered Bank, 2017).

In principle, there are two basic options in terms of firm-level coping strategies vis-à-vis rising wages: either relocating to more cost-competitive locations, or upgrading technology with a view to increasing productivity. The former may imply moving west to low-cost provinces within China or moving production to other countries. For such foreign investment, low-cost Asian countries have been the customary choice while various sub-

Saharan African countries have recently appeared on the radar screen and broadened the options for new investment locations. What does the empirical evidence tell us on these coping strategies?

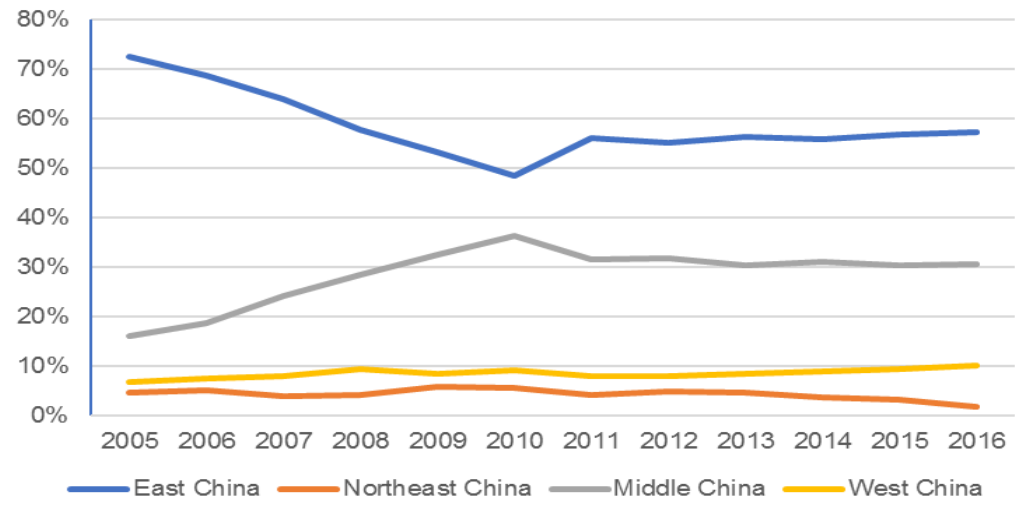
In 2009, the Textile Industry Promotion Plan put forward by the Chinese Ministry of Industry and Information Technology (MIIT) encouraged the regions in Middle and West China to actively seek industrial relocation from East China.[25] This policy acknowledged a relocation trend already visible in the preceding years (see Figure 1). From 2005 to 2010, the textiles and clothing investments in East China sharply declined from almost three-quarters to less than one-half (from 72.6 to 48.6 per cent) of the national total. In contrast, the share of Middle China more than doubled (from 16 to 36.4 per cent). However, after 2010 (with wages also gradually rising in Western Provinces), the westward relocation slowed down and regional investment shares have remained relatively stable since 2011.

As confirmed in Table 6, the gradual westward movement of the textiles and clothing industry has not fundamentally challenged the dominance of the Eastern region. The latter still accounts for more than three-quarters of all firms (76 per cent) and generates the lion's share of exports (83 per cent). To date, it still hosts the headquarters, technology and design centres of the largest companies as well as the vast majority of industrial clusters in the sector. In 2017, 164 out of 209 clusters identified by the China National Textile and Apparel Council (CNTAC) were located in East China with 75 per cent of the total located in the five coastal provinces alone (CNTAC [China National Textile and Apparel Council], 2018). In essence, a gradual relocation to the Western provinces has taken place, which however has lost some of its earlier momentum in recent years (see Figure 1).[26]

25 East China includes 10 provinces: Zhejiang, Jiangsu, Shanghai, Fujian, Guangdong, Shandong, Beijing, Tianjin, Hebei and Hainan. Middle China includes six provinces: Anhui, Jiangxi, Henan, Hunan, Hubei and Shanxi. West China includes 12 provinces: Guangxi, Chongqing, Sichuan, Gansu, Qinghai, Tibet, Ningxia, Inner Mongolia, Guizhou, Xinjiang, Yunnan and Shaanxi. Northeast China includes three provinces: Heilongjiang, Jilin and Liaoning.

26 Putting this picture into perspective, the textiles and clothing sector's investments undertaken in East China in 2017 alone (USD 117 billion, based on CNTAC online data) were about 12 times higher than its total FDI stock accumulated over the 2003-2018 period.

Figure 1: Investment in fixed assets of China's textiles and garment industries (2005-2016)



Source: CNTAC, 2018; all rights reserved, used with permission

Table 6: Regional distribution of China's textile and clothing industries (2015)

Region	Firms	Revenue	Profit	Export value
East China	76.0%	75.0%	73.2%	83.2%
Middle China	17.5%	18.1%	19.7%	11.7%
West China	4.2%	5.1%	6.0%	2.6%
Northeast China	2.3%	1.8%	1.1%	2.5%

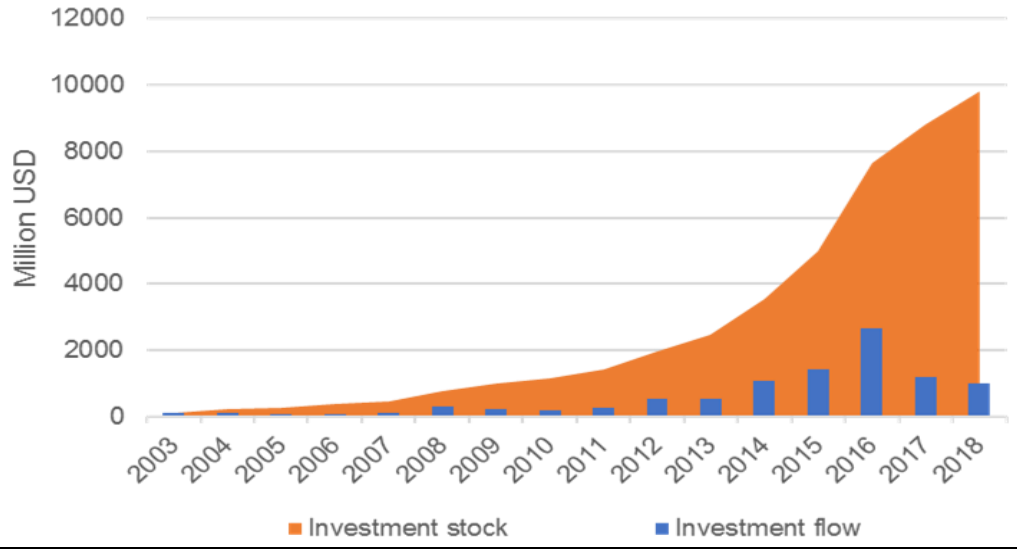
Source: CNTAC, 2018

Let us next take a look at foreign investments: In 2012, the Chinese government (through MIIT) adopted The Twelfth Textile Industry Development Plan, which officially called for a "going-out strategy" for this sector and encouraged the leading firms to build up overseas operations. In the following years, China's textiles and clothing industry became one of the largest sources of outward investment flows (see Figure 2). The sector's total FDI had reached a stock of close to USD 10 billion, with annual outflows peaking in 2016 at USD 2.7 billion before declining to less than USD 1 billion in 2018. In sectoral terms (figures for 2017), most of the outward investment occurred in the textiles industry (63 per cent) followed by clothing manufacturing (26 per cent) and chemical fibres (10 per cent). In regional terms, Southeast Asian countries were the main investment destinations accounting for more than half (56 per cent) of the accumulated FDI stock from 2003 to 2014 (Fan & Liu, 2018). Between 2013 and 2018, China's textiles and clothing FDI in Vietnam, Cambodia, Myanmar, Laos and Thailand together reached USD 1,770 million (China Garment, 2019). This trend is corroborated by Chen and Li (forthcoming) who analysed trade data. Their study shows that China's clothing exports started to decline around 2013 whereas exports from neighbouring Asian countries received an enormous boost at exactly

the same date, indicating a shift of production. Relative to the peak value observed in 2013, the authors estimate that about 25-35 per cent of clothing manufacturing (in terms of the value of exports) has shifted from China to other countries, mainly Cambodia, Vietnam, Myanmar and Bangladesh. For footwear, this figure is around 15 per cent (Chen & Li, forthcoming).

In recent years, Africa has gained in importance as a new investment location. China's textiles and clothing FDI in Africa increased from USD 19 million in 2015 to a peak of USD 110 million in 2017 and then fell to USD 64 million in 2018. Ethiopia and Egypt were the two largest recipients, with the investment stocks of USD 185 million and USD 147 million respectively in 2018 (Xu, 2019a, 2019b). However, the African region is still trailing far behind Southeast Asia.

Figure 2: Foreign direct investment of Chinese textiles and clothing industries (2003-2018)



Source: MOFCOM, 2019 and the authors' calculations based on various CNTAC news, all rights reserved, used with permission

In this context, it is noteworthy that wage cost differentials are obviously not the main determinant of relocation strategies as wage costs alone would have called for an even stronger trend to move production to locations outside China: While wage levels in Vietnam, Bangladesh and Ethiopia are at roughly one-half, one-third and one-tenth of those in China respectively (see Table 3), within China in 2014 wages were only 21 per cent lower in Central Provinces compared to Eastern Provinces.[27] Again, this indicates the importance of other relocation drivers as well as the generally high thresholds for investments in "unknown territory". However, according to the Standard Chartered Bank (2017), for the first time in 2017, more firms were considering to relocate overseas (17 per cent) than to move inland to China's Western provinces (10 per cent).

Finally, what is the evidence on technological innovation as a coping strategy? In a recent survey of export-oriented light manufacturing firms in the Yangtze and Pearl River Deltas, close to three-quarters (73 per cent) indicated that technology upgrading was an essential

27 Calculated from Gelb & Calabrese (2017, Table 5) for clothing and footwear industries in 2014.

part of their response strategy while only 7 per cent had engaged in relocation. Within the small number of firms engaging in production relocation, only very few (3 per cent of the total surveyed) stated that a move to other countries was their top priority. However, the adoption of relocation as a coping strategy was positively correlated with labour-intensity thus making it more attractive for garment and in particular footwear firms (Wang, Xia, & Xu, 2019; Xu, Gelb, Li, & Zhao, 2017). Similarly, there is evidence that high-end manufacturers preferred to respond by investing into automation whereas low-end manufacturers exhibited a higher preference for relocating production (Standard Chartered Bank, 2017)

Hence, in a stylised perspective, a distinct hierarchy of coping strategies can be detected. Under pressure from rapidly rising wages, investing in Western China to seek cheap labour was a popular choice among Chinese light manufacturing firms especially before 2010. However, as the wage cost differentials between the various Chinese regions started to narrow down and the industrial support infrastructure in Western regions started to develop more slowly than expected, many firms in Eastern China turned to technological innovation. This may imply optimisation and efficiency enhancements of existing processes and/or the introduction of new processes based on digital automation. Only a relatively small number of firms engaged proactively in identifying and implementing overseas investments and if so, preferred the beaten path of moving to neighbouring Asian countries over venturing into Sub-Saharan African countries. The latter are not the natural choice but still go against the grain making it necessary to overcome several layers of resistance. So far, the frequent claims of Africa being a magnet for Chinese export-oriented light manufacturing firms do not stand up to scrutiny.

This may be partly explained by the fact that the considerable business risks accompanying a cost-driven relocation of production to African countries create a collective action problem. Individual firms often shy away from leaving China because this implies a delinking from existing business networks and supply chains. Production is mostly embedded in larger sector-specific clusters of firms, which collectively serve as component suppliers, assemblers or subcontractors for larger lead firms and thus benefit from advantages of proximity. Hence, there is a strong economic case for entire clusters, or at least interconnected groups of companies, moving to new locations thus de-risking investments for individual firms. Such coordinated relocation would most likely be driven by big lead firms obliging their main suppliers to follow them to a new location. This is a fairly common pattern, for instance in the automotive and electronics industries (Altenburg & Meyer-Stamer, 1999), and it might be a game changer for African locations. While some large fashion companies are already pushing their suppliers to move to Africa in order to become more independent from China, such developments are still at an incipient stage (see also the case of the Dalang sweater cluster below and Box 5 on the evidence of “follow sourcing” in Ethiopia).

4.2 Three case studies: Shenzhou International Group, Esquel Group and Dalang sweater cluster

The existing surveys show that few firms consider relocating abroad, and even fewer moving to Africa. Yet, these surveys do not tell much about the determinants of such decisions. It makes a big difference, for example, whether companies remain in China

because they are closely networked with neighbouring firms or because they cannot assess country risks abroad. Also, the surveys leave open how strategic considerations vary across subsectors with different labour requirements. For this reason, we conducted in-depth firm-level interviews in China to better understand the underlying determinants of firms' strategies. The case studies presented below provide a summary of key findings from interviews carried out between November 2018 and March 2019 (see Annex Table A1). To ensure a degree of diversity, interviews with two large internationally operating companies were complemented by interviews with various stakeholders in one of China's largest industrial clusters composed mostly of SMEs. The profiles of the selected cases are summarised in Table 7.

Table 7: Case study profiles

Case	Type	Ownership	Market	Products	Main characteristics
Shenzhou International Group	Large-scale firm	Listed on Hong Kong Stock Exchange	Domestic and overseas	From fabrics to knitwear	One of the largest knitwear producers and exporters globally with extensive industrial relocation experience
Esquel Group	Large-scale firm	One family from Hong Kong (SAR)	Domestic and overseas	From cotton seeds to shirts	One of the largest cotton-shirt makers and exporters globally with extensive digital automation experience and worldwide operations
Dalang Sweater Cluster	Industrial cluster	Private entrepreneurs from Mainland China	Domestic and overseas	Woollen sweaters	One of China's largest export-oriented sweater clusters with successful automation and E-business

Source: Authors

Case 1: Shenzhou International Group[28]

Established in 1989 in Ningbo City (Zhejiang Province), Shenzhou International Group is China's largest export-oriented garment firm and one of the largest vertically-integrated knitwear manufacturers in the world. The Group was listed on the Hong Kong Stock Exchange in 2005 and assessed as one of the most profitable firms in its industry in recent years.[29] It is principally engaged in the original equipment manufacturing and original design manufacturing of high-end knitwear. The Group is a top supplier for major international brands including Nike, Uniqlo, Adidas and Puma. In 2018, the company had 82,700 employees, produced about 400 million pieces of knitwear and close to 190,000 tons

28 Unless stated otherwise, data for the three cases are derived from company publications and interviews.

29 In 2018, it reached a 21.4 per cent net profit margin, namely more than 3.5 times the average level of Chinese firms in this field (Shenzhou International's profit rate, 2019).

of fabrics, with total sales of 21 billion RMB (approximately EUR 2.7 billion) (China 30 per cent; Europe 18 per cent; United States and Japan 16 per cent each).

From 2005 onwards, Shenzhou rapidly expanded its operations in parallel both within China and in other Asian countries. In China, this included garment factories in Anhui Province (2008) and Zhejiang Province (2009). As early as 2005 a first foreign garment factory was established in Cambodia while in 2019 construction for another downstream garment factory began, which is expected to commence production in mid-2020. In parallel, production in Vietnam gained momentum between 2014 and 2018 with a number of fabric and garment factory investments. By 2018, the Group's regional distribution of employment and non-current assets, respectively, was 63 per cent and 54 per cent in China; 22 per cent and 41 per cent in Vietnam; and 15 per cent and 3 per cent in Cambodia.

According to Shenzhou's management, decisions on new production locations were determined by three main factors.

- The first determinant was responsiveness to the demands of strategic business partners on both the demand and the supply side. On the one hand, major global buyers put pressure on Shenzhou as a supplier to meet their requirements in terms of both the volume and the in-time delivery of products. On the other hand, the Shenzhou Group had to ensure synergies between its own production facilities and its main suppliers of yarn with a view to reaping cost, logistics and time benefits of co-location. This was one of several reasons to favour Asian over African countries when investing in new factories.

- Secondly, in view of the Group's massive resource requirements,[30] great importance was attached to the availability and prices of labour, land, water and electricity within stable conditions. Here again, Asian investment locations were prioritised over African alternatives. A premium was placed on the generally higher productivity, clarity of land ownership, stability of energy supply, and superior infrastructure.

- Thirdly, policy incentives related to taxes, costs of finance, tariffs and administrative efficiency played an important role. Such incentives were decisive for both domestic and foreign locations. For instance, the 2008 investment in Anhui Province was largely due to the preferential treatment offered in Wangjiang Textile Industry Park. Similarly, it was a sizable policy dividend that determined the 2018 investment in Vietnam despite a productivity disadvantage of 40-50 per cent compared to China. Moreover, the investments in Cambodia and Vietnam have to be seen in the broader perspective of their integration in the One Belt and One Road Initiative (BRI). While some African countries have also joined the BRI, Shenzhou had limited confidence in their policy implementation capabilities.

At the same time, the strategic importance of Shenzhou's original production base in Ningbo has remained undisputed. Employment in Ningbo has been kept stable at about 40,000, yet production capabilities have continuously grown in recent years. Ningbo's position as

30 In 2018, the Shenzhou Group consumed 586 million kWh of electricity and 32 million tons of water while its production facilities covered over 5.3 million m^2 of land and 3.3 million m^2 of factory floor. At the same time, staff costs of its more than 82,000 employees accounted for roughly one-quarter of turnover.

Shenzhou's headquarters and R&D centre is unchallenged for communicating with strategic clients, designing product styles, creating new fabrics, research on technological innovation potentials, improving corporate management and manufacturing higher-end products. Moreover, the Ningbo base is indispensable for serving the rapidly growing domestic market [31] and ensuring fast delivery and flexible responses to changing consumer preferences. This is underpinned by state-of-the-art IoT (Internet of Things)-based, real-time data and logistics management in Shenzhou's central warehouse. The high-rise warehouse can store 15,000 tons of fabrics with a daily cargo handling capacity of 1,200 tons. Each shelf and each piece of cloth are labelled with a barcode, which is permanently scanned by automated guide vehicles for transportation. The planning department can accurately monitor how many fabrics are stored and when they should be delivered, so as to achieve zero fabric inventory. This new digitised information management and the concomitant process optimisation have enabled Shenzhou to cut down delivery time to 15 days, no matter if the order amounts to 4,000 or 2 million pieces of garment.

Further productivity-enhancing measures include the introduction of a modular production approach, which was also pioneered at Ningbo headquarters before being disseminated and applied in all Shenzhou factories worldwide. The modularisation of production steps had the greatest impact in labour- and skill-intensive sewing operations where it led to reduced training costs, higher quality consistency, and improved productivity.[32] While the adoption of modularity deskills certain processes, it also creates new demands in areas such as coordination and innovation expertise, process standardisation, module design and template manufacturing for garment production.

Finally, the company introduced a wide range of automatic "intelligent" machines, such as digital printers and automated guided vehicles. Specifically, Textalk digital printers perform 10 times faster than traditional printers, which highly increased Shenzhou's production flexibility and productivity. Similarly, automated guided vehicles for fabrics supply in the workshops not only replace manual porters, but also increase the accuracy rate to close to 100 per cent thus avoiding waste and increasing efficiency. Entirely new automated machinery is at times introduced first in new overseas operations, mostly in Vietnam, to increase productivity. In contrast, at headquarters, Shenzhou prefers to replace conventional machinery gradually, with a view to extending the latter's economic lifetime and avoiding abrupt negative effects on employment. For instance, this applies to digital printers and automated guided vehicles.

In essence, the Shenzhou Group demonstrates how closely intertwined automation and relocation processes proceed and how a web of production locations both in China and abroad is strategically built up to create value chains that can simultaneously serve the domestic and foreign markets. It also reveals a distinct preference of Asian over African locations. In the words of Ma Renhe, Vice President of Shenzhou Group:

> China has unique advantages of technological experience and industrial systems in the textiles and garment industry. If we compare Shenzhou's production system to

31 From 2008 to 2018, the Shenzhou Group's share of domestic sales increased from 19 to 30 per cent.

32 For example, traditionally, new workers needed at least three months of training to produce shirt pockets at a stable output volume of 20 pieces/day. However, with the application of modular templates, the workers were able to produce at least 200 pockets per day after a few hours of training.

> a human body, we will maintain the head within China for R&D and system management and extend the limbs into other locations wherever we find advantages for manufacturing. The key is to keep our production system well integrated and highly efficient within complete industrial chains. So far, we think the Southeast Asian countries, especially Cambodia and Vietnam, are more suitable than African countries for our industries. (Ma Renhe, Vice President of Shenzhou Group)

Case 2: Esquel Group

The Esquel Group is one of the largest cotton-shirt makers and exporters in the world. Established in 1978 by a Hong Kong entrepreneur, Esquel is a fully vertically-integrated firm with operations ranging from cotton seed research to product branding and retailing. Since 2014, it has been continuously recognised by the Foshan Intellectual Property Association as a leading holder of industrial patents. In 2018, it had more than 55,000 employees producing 100 million pieces of shirts with a sales value of USD 1.3 billion (approximately EUR 165 million) (regional sales breakdown: United States 39 per cent; Europe 27 per cent; China 15 per cent; and Japan 5 per cent). It supplies products to the largest global fashion brands, including Ralph Lauren, Tommy Hilfiger, Hugo Boss, Muji and Anta, and in addition caters to its own brands (PYE and DETERMINANT).

Esquel already started its global outreach in 1978, when it acquired garment companies in Malaysia and Mauritius. This was followed during the 1980s and 1990s by setting up more garment factories in Malaysia, Sri Lanka and other countries. In parallel, the first mainland-Chinese Esquel company in Foshan City, Guangdong Province was established in 1988 with further garment factories in Foshan, Ningbo and Changzhou City in Jiangsu Province following in the 1990s. Since 1995, Esquel has continuously invested in Xinjiang for seed research, cotton farming, ginning and spinning. During the 2010s, garment production expanded to additional locations both inside and outside China. Esquel's global production footprint currently covers Coastal and Western provinces in China, various Southeast Asian countries (Malaysia, Sri Lanka, Vietnam) and Mauritius. In choosing overseas locations, trade policies were a major determinant, initially in response to the availability of quotas under the Multifibre Arrangement or to benefit from tariff preferences under various trade agreements, such as AGOA. Investments in Vietnam are to tap into the country's competitive labour force, while the newest investments into spinning and garment making in Guilin are aimed at pursuing a new development model that demonstrates environmental and social sustainability.

The evolution of the Esquel Group is broadly similar to that of the Shenzhou Group in that both rely on a three-pronged strategy with a strong Chinese base at the core, coupled to a growing number of overseas operations, and simultaneously investing in technology innovation and upgrading. However, in response to demands from major buyers, Esquel expanded earlier to Africa (Mauritius). The lower productivity levels and longer delivery times were compensated by allocating orders with less manufacturing complexity and less delivery pressure to those factories. At the same time, the Group scaled up its operations in Eastern China where it found the necessary skills to produce high-end products that could justify higher wages than in other Chinese regions.

In recent years, Esquel has placed special emphasis on pushing technological innovation with a view to fully capitalising on digital automation potentials. Together with a long-established Research & Development Department that focuses on the chemistry of materials, dyestuff, and water treatment, a combined expenditure target of up to 3 per cent of the Group's sales revenues is envisaged. An Engineering Excellence team undertakes the innovation efforts both independently (for example, on auxiliary tools like folders, attachments and moulds) and in partnership with advanced digital machinery suppliers in terms of pooling resources and expertise in developing customised robots.

In addition to developing fully automated spinning mills,[33] Esquel's main focus is on introducing digital technologies in garment manufacturing to enhance the stability of product quality and eliminate unsafe or low value-add tasks by a combination of adjusted product designs, standardised work procedures, restructured production lines and deployment of robots. Progress has been significant and is expected to continue at a fast pace. Of the 52 operations needed in woven shirt production, 71 per cent were automated by 2018 and the remaining operations not yet automated are under further study.

Similar to Shenzhou, Esquel also emphasises the crucial importance of its presence in coastal China as an indispensable base for production and innovation, above all in serving the needs of international and domestic high-end consumers through innovative fabric development, sophisticated product design, and fast delivery. Moreover, the Group's base in Foshan acts as a pioneer for digital innovation and as a demonstration facility for the latter's gradual introduction in overseas operations.

Within Esquel's management, the impact of digital automation on relocation decisions is clearly recognised. However, this is not considered a binary "either-or" decision but rather a force that will gradually shift the relative weights between domestic upgrading and foreign investments:

> With the development and adoption of new digital technology, the textiles and garment industries are becoming increasingly capital- and technology-intensive. Automation is an inevitable trend for future production. Its successful application will reduce the urgency to relocate production facilities outside China. (Zhang Yugao, R&D Director, Esquel).

If developing economies in Southeast Asia and Africa want to remain relevant as garment producers, "they will have to invest heavily in upgrading the required skills and mindsets of their workers, technicians, managers and engineers so as to be prepared for the job transformations in the years to come" (Oun Purin Kaowsiri, General Manager of Esquel's Hoa Binh garment company, Vietnam).

33 The new mill in Changji City, Xinjiang, adopted global first-class automation equipment as well as IoT and an integrated software system, with significant customisation by Esquel. Based on worker-machine interaction, just 45 staff can control 30,000 spindles over three shifts, whereas with conventional technology 150 workers were required. At the same time, the automated mill's productivity was three times higher and product quality was more consistent.

Case 3: Dalang sweater cluster

Dalang Sweater Cluster is one of the largest export-oriented sweater clusters in China. Located in Dongguan City in Guangdong Province, the cluster is part of one of the earliest regions in mainland China to develop a garment industry. After more than four decades, Dalang's sweater industry has evolved into a comprehensive industrial cluster, including R&D, manufacturing, material and accessory supply, washing and printing, logistics, trade and retail of woollen sweaters. Above 90 per cent of the cluster's firms are SMEs[34] closely cooperating in exchanging information, sharing orders, relying on a joint labour pool and fostering specialisation. Currently, the cluster features more than 10,000 SMEs with 100,000 employees, 1.2 billion pieces of annual output and RMB 60 billion (roughly EUR 7.7 billion) of annual sales revenue. Around 70 per cent of products are exported to more than 80 countries (among others United States, Russia, Italy and Brazil) while the remainder serves the domestic market.

Since the early 2000s, the Dalang cluster has been suffering from shortages of skilled labour and rapid increases in labour costs. While relocation was initially considered as an option, it has not materialised. On the one hand, the cluster's myriad of relatively small companies lacked the necessary financial resources and managerial skills for relocation. Given their dependence on well-established domestic value chains and their embeddedness in social and economic networks in Dalang, the motivation for a risky strategic relocation was also low and suffered from the usual limitations of collective action. On the other hand, the development of new technologies and the adoption of new business models have emerged as an alternative option for the cluster to enhance its competitiveness without large-scale relocation.

Technological innovation through automation has played a significant role and was proactively supported by the local government. As of 2005, special investment funds were made available and subsidy schemes introduced for SMEs to promote the use of automated knitting machines. Within one decade, this led to the fully automated weaving of sweater parts and resulted in a sevenfold increase in productivity compared to the earlier manual weaving. Currently, the Dalang cluster operates nearly 50,000 labour-saving CNC knitting machines thus greatly reducing relocation pressure. At the same time, the final step of sewing several woven segments has remained a labour-intensive process for which Dalang companies rely on nearsourcing from low-cost inland provinces.[35]

Progress in automation has been accompanied more recently by a transformation in business models. Since 2015, the local government has encouraged SMEs to capitalise on their advantages of cluster flexibility, move into e-business and respond to the growing consumer preferences for fast fashion cycles and customisation. Technical and financial support is

34 The Chinese Bureau of Statistics defines large enterprises as having more than 1,000 employees and revenues above RMB 4 million (approximately EUR 0.5 million).

35 Sophisticated whole-garment knitting machines are being offered by leading textiles machinery producers (such as Shima Seiki in Japan). However, they remain far too expensive for small companies and, above all, are not yet cost-effective. In an interview with Cixing company, it was estimated that a machine-sewn sweater costs RMB 180 (or about EUR 23) as compared to just RMB 8 (approximately EUR 1) for a hand-sewn sweater.

available to collaborate with Alibaba on setting up Taobao[36] factories. In 2018, close to 4,000 Dalang firms were engaged in e-business with a combined sales revenue of RMB 8.2 billion (approximately EUR 1 billion). They can benefit from Alibaba's data on customer preferences, access to larger markets and matching of orders with a maximum number of suppliers as well as draw on technical support to improve their internal processes and supply chain management:

> The platform economy helped SMEs to coordinate their production more efficiently at lower costs. In the future, clusters like Dalang are more likely to move towards high value-added market segments and near-source labour-intensive production segments with a view to concentrating on core capabilities and quick delivery. (Chen Jingdong, Dongguan Association of Woollen Textiles Industry)

In terms of relocating to foreign countries, the hurdles are clearly rising:

> The successful adoption of new e-business models in China depends on the existence of complete industrial value chains and a well-developed digital and logistics infrastructure. African countries still have a long way to go to establish these foundations before they can become part of the booming e-business. (Hu Xu, Senior Operation Advisor, Alibaba)

Furthermore: "collective relocation is a very difficult endeavour for SMEs" (Yang Jun, Vice Secretary-General, CNTAC).

5 Challenges and opportunities for Sub-Saharan Africa: spotlight on Ethiopia and Madagascar

The previous sections have shown that technological innovation is opening up far-reaching new digital upgrading options in the clothing industry. While these new opportunities are seized upon by large corporations in regions ranging from Europe to the United States and China, the outsourcing of clothing manufacturing to low-cost locations has remained a strong parallel trend. While it is difficult to predict to which degree automation will substitute human labour in the clothing industry and when exactly this change will kick in, our analysis has shown that a window of time remains open for SSA countries to take advantage of rising labour costs in China and engage in export-oriented clothing production. Preferential Trade Agreements may help to attract investments to SSA countries.

Still, challenging conditions need to be met in order to succeed. At a first level, low wages, a modicum of technical skills, a favourable investment climate, efficient transport infrastructure, and stable energy supplies must be in place to create a production and trading environment capable of attracting foreign investors. At a second level, if SSA countries do not want to remain at the lowest end of the global textile and clothing value chain, more specific public policies are needed: to develop high-quality infrastructure; to woo investors into higher-value functions and segments of the clothing industry; to shorten lead times to

36 Taobao is an online shopping marketplace owned by Alibaba and is currently the world's largest e-commerce website.

compete in short-cycle fashion markets; and to strengthen the role of local firms, inter-firm linkages and domestic supply.

This section reviews in greater detail the position of two SSA countries on today's global clothing landscape: Ethiopia and Madagascar have only recently appeared in the spotlight of international clothing companies, including those from China. The former is widely considered as the most promising candidate for light manufacturing exports, based on a combination of low wages, a large domestic market and strategic government policies with a strong focus on industrial parks. The latter, while politically less stable, has recently become the top SSA clothing exporter. Are they up to the challenge to compete?

In this section, we will assess the opportunities and constraints in both countries. We begin with a discussion of the role of how SSA countries are positioned in the web of Preferential Trade Agreements and how this affects the region's competitiveness vis-à-vis other clothing exporters (subsection 5.1). We then provide an overview of the development of the clothing sector in SSA generally, and the two selected countries in particular (subsection 5.2). Developments in both countries will be reviewed more specifically in terms of recent trends, determinants of competitiveness, and industrial policies adopted (subsections 5.3 and 5.4). We end with a look at the response by international investors, with particular emphasis on those coming from China (subsection 5.5).[37]

5.1 The role of Preferential Trade Agreements for SSA clothing exports

Importing countries impose different tariffs on clothing from differing countries, as has been explained in Section 3. This section explores to what extent Preferential Trade Agreements favour SSA countries, and Ethiopia and Madagascar in particular. Both countries enjoy duty-free access to the European Union and the United States, which implies tariff advantages of around 10 per cent compared to MFN provisions. Duty-free advantages are particularly favourable in the United States where only SSA countries (and regional supplier countries) are eligible, while in the EU market all LDCs are eligible within the EBA initiative, including those from outside SSA. Furthermore, AGOA has always applied single transformation ROO (see Section 3), which was only granted in the European Union under the EBA initiative in 2011 and within the Economic Partnership Agreements (EPAs). As AGOA clothing products can use duty-free fabrics and other inputs from outside SSA and these imported inputs account for up to 60 per cent of costs, the effective rate of protection (which is a more accurate measure of the level of protection) is substantially higher than the nominal rates of protection (Kaplinsky & Morris, 2008). The same is now the case for the EU market as EBA/EPAs allow third-country fabric imports to be used for clothing exports to the EU.

However, the duty-free advantage varies per type of product as there are variations in terms of tariff levels among products, particularly in the United States. Accordingly, the top

37 Methodologically, the report draws on trade and national sector data in Ethiopia and Madagascar, and original empirical data collected by the authors through repeated field trips to the two countries between 2016 and 2019. During the trips, we interviewed all local firms exporting clothing and almost all of the foreign clothing exporting firms as well as the relevant institutional actors in Ethiopia and Madagascar. In Ethiopia, this included all 12 local firms that exported some portion of their production and 41 (out of 59) foreign firms. In Madagascar, this included 28 (out of 31) local firms and 30 (out of 43) foreign firms.

clothing exports by Ethiopia and Madagascar to the United States include synthetic products given their higher tariffs in the US market. This does not undermine Ethiopia's efforts to use garment exports to boost local cotton production, as synthetic products include poly-cotton blends, and thus firms can use locally produced yarn and blend it with imported polyester yarn, as one locally-owned, vertically-integrated firm already does (albeit only for the domestic market). In the European Union, there is no systematic difference between tariffs in cotton- and synthetic-based products.

Preferential market access relying on unilateral market access stipulations such as EBA for the European Union and AGOA for the United States might be changed or even entirely withdrawn unilaterally by these countries. This is a particular concern for AGOA that has only been installed for a limited time period and has to be extended at regular time intervals, which has happened four times from its signing in 2000 and has only been secured until 2025. There are certain criteria linked to governance and democracy that African countries must fulfil in order to qualify for AGOA, and regression on any of those criteria can lead the United States to revoke a country's qualification for AGOA. Madagascar's AGOA eligibility was in fact revoked between 2009 and 2014, due to the country's major political crisis. Immediately, this led to a massive reduction of exports to the United States, from around USD 300 million in 2008 to roughly USD 50 million in 2010, thus clearly indicating the significant role that preferential market access has for the country's attractiveness as a "competitive" clothing exporting location (Morris & Staritz, 2014, p. 247).[38] The resulting uncertainty has had negative repercussions on investors, particularly regarding more long-term and capital-intensive investments in SSAs textile sector (Staritz, 2011).

The European Union's EBA arrangement is a unilateral arrangement offered to LDCs within the context of its GSP. In addition to this GSP-linked agreement, SSA countries – as part of the group of African, Caribbean and Pacific (ACP) countries – have had bilateral agreements with the European Union starting with the Lomé Convention and subsequently the Cotonou Agreements that have now been transformed into the EPAs. As part of the EPAs, EU preferential market access for SSA countries is now covered through bilateral and regional agreements and hence has a more secure basis. Madagascar is covered by the agreement between the European Union and the Eastern and Southern African (ESA) Group, which regulates duty-free market access and single transformation ROO conditions. Even though Madagascar also faces duty-free market access and single transformation ROO to the European Union through the EBA (as Madagascar is a LDC), the EPA safeguards these preferential market access conditions in the long term as they cannot be unilaterally changed by the European Union or in case of a potential loss of the LDC-status in the future. Ethiopia, by contrast, is not part of the EPAs. Hence, it still depends on unilateral market access granted by the European Union through the EBA. Should these unilateral preferential trade agreements not be renewed or disappear for any other reasons, clothing exports would be very critically affected.

38 Swaziland also lost its AGOA status between 2015 and 2018, which led to the virtual disappearance of production for the US market.

5.2 Development of SSA clothing exports

After years of decline following the end of the MFA, a few SSA countries have recently been able to attract new investment in clothing exports, which reached USD 3 billion for SSA in 2017. SSA countries still have an exceedingly small share in global clothing exports accounting for just 1.1 per cent of the world total in 2000, which increased to 1.3 per cent at the height of the MFA in 2004 only to decline to 0.8 per cent in 2008, where it remained until 2017. This is remarkably small for a whole region compared not only to China's 33 per cent but also to Bangladesh's 9 per cent and Vietnam's 7 per cent in the same year (UN Comtrade, 2019). Thus there is still a large untapped potential for developing and leveraging the clothing export sector for broader industrial development in SSA.

The clothing sector is a classic example of buyer-driven GVCs which are characterised by decentralised, globally dispersed production networks, coordinated by lead firms which control activities that add value to products (design, branding and marketing, for instance), but often outsource all or most of the manufacturing process to a global network of suppliers (Gereffi, 1999). Although buyers are not directly involved in production, they maintain significant influence over manufacturers and stipulate detailed product and process specifications, so that their sourcing practices significantly shape trade patterns and upgrading opportunities in the clothing GVC. In addition to the traditional criteria of costs, quality and reliability, other criteria are increasingly shaping sourcing decisions (Gereffi & Frederick, 2010; Staritz, 2011). One of the most influential trends is the enhanced importance of time. This is related to the shift to lean retailing and just-in-time delivery, where buyers defray the inventory risks associated with supplying clothing to fast-changing, volatile and uncertain consumer markets by replenishing items on their shelves in very short cycles and minimising inventories (Abernathy, Volpe, & Weil, 2006) as well as ever shorter fashion cycles.

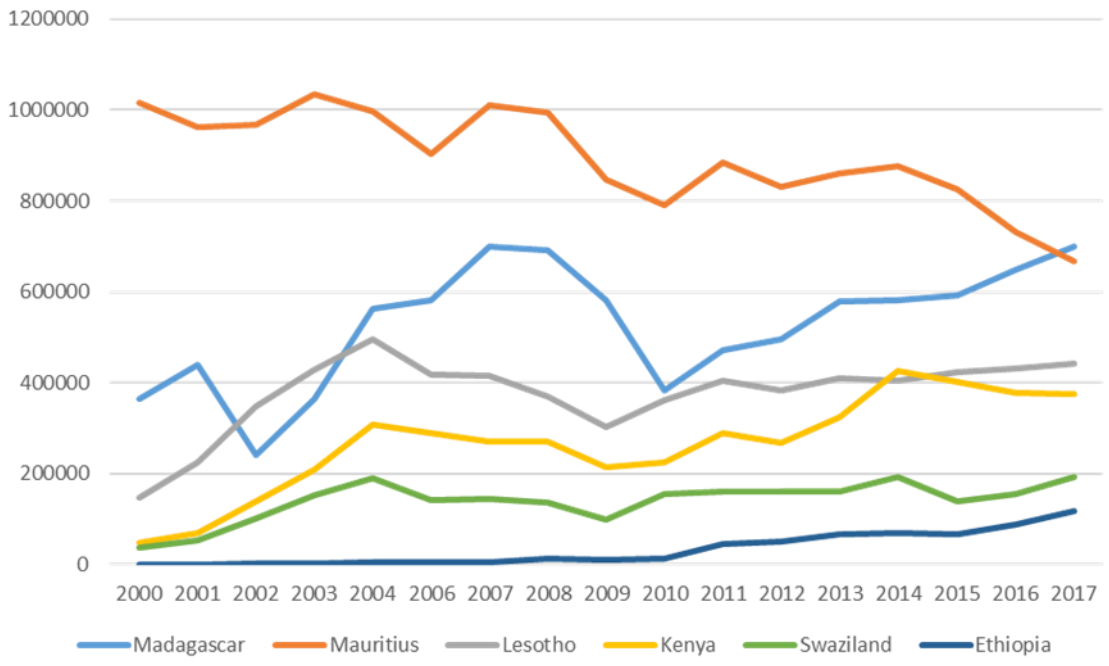
The objective of buyers to concentrate on their core competencies (that is, design, branding and marketing), reduce costs and risks, and increase flexibility has increased the functions demanded from suppliers. Besides manufacturing capabilities, buyers desire non-manufacturing capabilities such as input sourcing, inventory management and stockholding, financing, logistics and product development. This, in turn, has increased entry barriers, at least for first-tier suppliers, and led to supply chain consolidation. Further, there is tough competition as many low-income countries aim to integrate into the global clothing sector while more established suppliers offer the broader capabilities that buyers increasingly demand (Staritz & Frederick, 2012).

Besides the crucial importance of buyer and investor strategies, regulatory factors decisively influence global clothing GVC. The clothing industry – together with the textile industry – was one of the most heavily trade-regulated manufacturing sectors, governed by a system of quotas until 2004 (the MFA from 1974 and the Agreement on Textile and Clothing from 1995) and remaining high tariff rates. In this context, preferential trade agreements (see Section 3 and subsection 5.1 for SSA) have had a substantial impact on the competitiveness of supplier countries and firms.

The various drivers outlined above are reflected in the development of clothing exports in SSA. As Figure 3 shows, clothing exports increased in Madagascar, Kenya, Lesotho and Swaziland after 2001. Together with Mauritius and South Africa, these countries accounted

for the vast majority of SSA's total clothing exports in 2004. This export growth was largely driven by transnational Asian producers taking advantage of unfilled or non-existent MFA quotas and preferential market access, particularly to the United States through AGOA. Kenya, Lesotho and Swaziland exported more than 90 per cent to the US market by 2004, and Madagascar's major export market shifted from the European Union to the United States. While EU preferential market access predates the US-AGOA provisions, the former was coupled with more restrictive, double transformation ROOs that were difficult for most firms to fulfil given the more capital-, skill- and infrastructure-intensive nature of yarn and fabric production. Only Mauritius and later Madagascar exported to the European Union given the investments in yarn and fabric production in Mauritius, which some firms in Madagascar also used. The emergence of Madagascar's clothing exports was not only linked to quota-hopping Asian investors; it was also due to the upgrading and relocation strategies of Mauritian clothing firms, which started in the early 1990s due to rising production costs and labour shortage in Mauritius, and to European and particularly French investments in Madagascar that focused on the EU market (see subsection 5.4).

Figure 3: Clothing exports from top SSA exporter countries (in thousand USD) (2000-2017)



Source: UN Comtrade, 2019; all rights reserved, used with permission

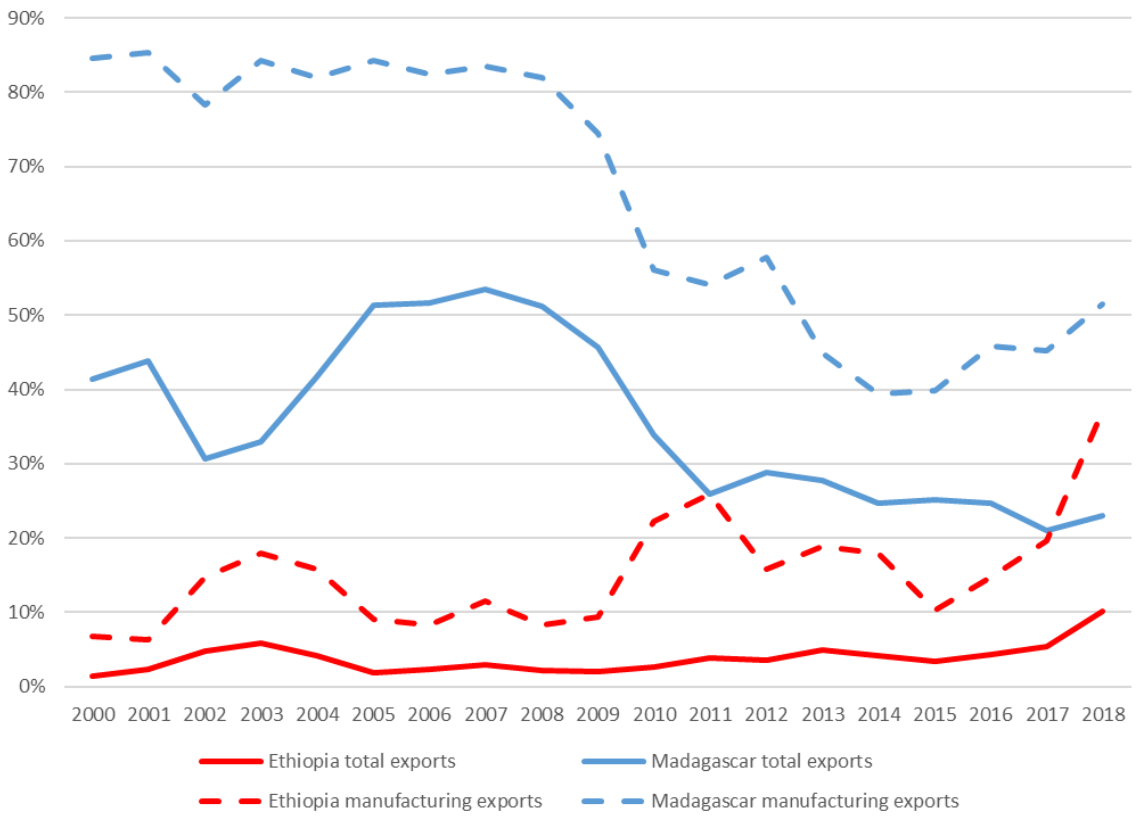
After the MFA phase out at the end of 2004, the clothing industry in most SSA countries declined, as many firms closed down, especially those of quota-hopping Asian investors (Kaplinsky & Morris, 2006; Morris, Plank, & Staritz, 2016). The end of the quota system meant that global competition increased, but AGOA and EU preferential market access provided a buffer to some extent. The trans-Atlantic financial crisis and later the Eurozone crisis led to additional export declines (Staritz, 2011). However, exports in all countries except Mauritius started increasing again from 2011 onwards, driven by new dynamics including a shift among remaining foreign investors in Lesotho, Swaziland and Madagascar to the regional South African market. Mauritian apparel exports continued to decline and some Mauritian firms shifted apparel production to their factories in Madagascar. In the 2010s,

rising wages in Asia and compliance issues in key Asian supplier countries led some large EU and US buyers to put more emphasis on sourcing from SSA as part of a strategy to reduce their dependence on Asian countries; they saw SSA as the "last frontier" region for low-cost clothing production despite initially higher production costs due to lower productivity and poor infrastructure.

Yet, only a few SSA countries have been successful in entering the clothing GVC and creating a clothing export industry of significant size despite very favourable preferential market access. These included Mauritius (where clothing exports had developed since the late 1970s), Madagascar, Kenya, Lesotho, Swaziland and more recently Ethiopia where clothing exports of a considerable size started only in the 2010s.[39]

In all these SSA countries, the clothing sector has high relevance in terms of export and employment generation and broader economic development impact. For Madagascar and Ethiopia, the share of textile and clothing exports in total exports is shown in Figure 4. In Madagascar, these industries accounted for 52 per cent of manufactured exports in 2018 with a peak of 85 per cent in 2001. In Ethiopia, the same share increased (with some fluctuations) to 37 per cent in 2018.

Figure 4: Share of textile and clothing in total exports and manufacturing exports (2000-2018)



Source: UN Comtrade, 2019; all rights reserved, used with permission

39 South Africa is an important clothing producer country but exports have been minimal in recent years – hence it is not among the top six SSA exporter countries.

In Madagascar, the clothing sector employs around 150,000 people thus accounting for almost one-third of the country's industrial jobs. In Ethiopia, we estimate that at least 60,000 are employed in clothing exporting firms, with nearly 50,000 located in industrial parks. Over the next five years as all the industrial parks become fully operational, we estimate that they are likely to generate at least 150,000 jobs. In both countries, the majority of these workers are women, accounting for on average around 80 per cent of sewing operators and coming from rural areas and poorer urban households. Hence, the economic and social impact of this employment is of crucial relevance.

5.3 The case of Ethiopia

5.3.1 Development of clothing exports and foreign investments

The clothing export sector only took off in Ethiopia after 2010. Clothing exports rose from less than USD 1 million in 2001 to USD 13 million in 2010 and USD 117 million in 2017. Textile exports initially increased significantly on the back of several Turkish investments in textile factories, but declined after 2014 due to the shutdown of these textile firms, leading to clothing exports dominating overall textile and clothing exports. This rapid rise in exports was due to some global buyers and producers searching for new low-cost locations, coupled with local contextual factors such as political stability and safety, low electricity and water costs, low wages and a large pool of trainable labour, as well as preferential market access to the European Union through EBA and to the United States through AGOA (see subsection 5.3.2). Clothing exports focused on the European Union in the first half of the 2010s but, with a handful of top US buyers encouraging their suppliers to invest in production in the newly emerging industrial parks, exports to the United States have increased considerably since 2015 and overtook exports to the European Union in 2017 (data from UN Comtrade, 2019).

Ethiopia's emergence as a clothing sourcing location was significantly driven by government industrial policy (see subsection 5.3.3 for details) focusing on labour-intensive and low-tech industries with linkages to the agricultural sector based on improved quality of locally produced cotton (Bräutigam, Weis, & Tang, 2018; Gebreeyesus, 2013). In addition to strategically targeting global buyers and encouraging them to pull their first-tier suppliers into the country's industrial parks (Staritz, Plank, & Morris, 2016; Staritz & Whitfield, 2019), the government built five clothing-specific industrial parks with full amenities: Bole Lemi, Hawassa, Kombolcha, Mekelle, and Adama. The industrial park in Dire Dawa also has textile firms, and a few small industrial parks with only basic infrastructure are in the process of being built and may have some clothing firms. There are two privately-owned clothing-specific industrial parks that are in the process of being built, which each have the clothing factory of a first-tier supplier at their centre – Velocity (United Arab Emirates (UAE/Indian owner) and DBL (Bangladesh) – and will provide all production inputs and services to other investors.

By mid-2019, there were at least 118 textile and clothing firms in Ethiopia, of which we estimate that 75 could be considered exporting firms with at least a portion of their production being exported. As shown in Table 8, of the 75 exporting firms, only 16 are

locally owned, and most of them primarily produce for the domestic market.[40] Foreign investors come predominantly from Asian countries with significant clothing export industries. Chinese investments are the largest group with 21 firms. While this is partly a result of the Chinese-owned Eastern Industrial Zone (EIZ), Chinese firms have also invested in factory sheds in the government-owned industrial parks and are building vertically-integrated textile and clothing factories in the vicinity of the parks. Some degree of clustering by nationality can also be observed, with Chinese firms in Adama (which is close to the EIZ and a large Chinese community) and Kombolcha, while Indian and Bangladeshi investments dominate in Mekelle.

Most foreign firms in the industrial parks supply the same handful of global buyers, which have sourcing offices in the region: PVH, The Children's Place (TCP), VF, H&M, Decathlon, and Calzedonia. The US buyers PVH, TCP, and VF have a publicly stated African sourcing strategy, aimed at shifting 15 to 35 per cent of their sourcing currently undertaken in Asian countries to SSA countries. Within a broader strategy of risk diversification – that is, of reducing dependence on Asian countries such as Bangladesh where wages and environmental and social standards are increasing – these global buyers have made a strategic decision to source from Ethiopia and are thus willing to be more patient on issues like lead-time and productivity.

Table 8: Number of export firms in Ethiopia's textile and clothing sector

Nationality of investor	Located in industrial parks	Located in other areas	TOTAL
TOTAL	51	24	75
- China	17	3	20
- Ethiopia	4	12	16
- India	6	1	7
- South Korea	5	1	6
- Sri Lanka	4	--	4
- Bangladesh	3	--	3
- Others	12	7	19

Source: Compiled by the authors based on firm lists provide by the Ethiopia Investment Commission, export data from the Ethiopian Textile Industry Development Institute (ETIDI), and field visits to the industrial parks (except for the EIZ). Data on the EIZ comes from a firm list provided by Weiwei Chen, PhD candidate at the School of Oriental and African Studies, University of London

Generally, in terms of investor origin in the SSA clothing industry, a distinction can be made between first generation East Asian investors (mostly from Hong Kong (SAR), Chinese

40 Overall, the share of local firm exports in total clothing exports declined from 50 per cent in 2005 to just 20 per cent in 2016/2017 (unpublished data received from ETIDI in 2018).

Taipeh, and South Korea); second generation Asian investors (mostly from mainland China, India, Sri Lanka and Bangladesh); European investors (often based on traditional colonial ties); and regional investors (for instance from Mauritius). Clearly, second generation Asian investors dominate in Ethiopia. They provide the lion's share of FDI in the industrial parks (above all in Hawassa, Mekelle, Kombolcha and Adama) and are typically driven into relocation due to rising costs and/or shortage of labour at home. Often, they have selected Ethiopia for their investment as a result of marketing by the Ethiopian government and the existence of the country's industrial parks. In what follows, we focus on the Chinese investors, which account for the largest share of foreign textile and clothing firms (see Table 8).

The first wave of Chinese investment consisted of small private Chinese clothing firms mainly interested in the protected domestic market but, with the emergence of industrial parks and the government's promotion efforts, this changed. The second wave was completely export-oriented, or producing inputs for clothing exporting firms, and a few of them were major players in the global clothing value chain. Thirteen Chinese firms with factories in the various government-owned clothing-specific industrial parks are engaged in different segments along the textile and clothing sector.[41] The major players cluster in Adama industrial park close to Addis Ababa with a strong Chinese community. A separate Chinese-owned industrial park is planned in Adama and interviews indicate that more large Chinese clothing firms are likely to join.

The Chinese clothing and textile firms in Ethiopia are diverse. Many are just in the process of establishing operations, so it is difficult to gauge their level of technology, business strategies and upgrading and linkage trajectories, but our interviews have provided some idea for the firms that have already started production and in which we were able to visit the factories.

Chinese firms dominate FDI in Ethiopia in yarn spinning and fabric production for export or indirect export (selling to exporting clothing firms), which has been a key part of the government's proactive industrial policy to increase value addition and bring more of the supply chain and the related linkages potential to Ethiopia. The only other textile mills in and around the industrial parks are Carvico (Italy) in Kombolcha industrial park, which produces synthetic fabric for swimsuits, and Intrade (United Kingdom), which is currently in the process of setting up in Mekelle industrial park. Other than Saytex, which uses old equipment, the Chinese textile and integrated firms (JP Textile, Sunshine and Kingdom) seem to be setting up state-of-the-art factories that are comparable with Carvico. Hence, Chinese textile firms have played an important role in the recent progress in extending investments from clothing to the more capital-intensive textile sector and producing export-quality fabric, while linkages to the local cotton sector have remained limited.[42] However, the rather strong emphasis of Chinese investment in textile firms or integrated

41 These firms include: Saytex (spinning), JP Textile (weaving), Shabglex and Wuxi (spinning and textiles), Kingdom and Sunshine (fully integrated), and Zhejing Menga, Trybus, KGG, Indochine, Royal Medical, Antex and Sumec (clothing).

42 Previously textile firms did exist in Ethiopia, but they did not produce export-quality fabrics suitable for producing high-quality fashion products. Most of them were state-owned textile firms that had been privatised in the 2000s, and produced coarse fabrics for use in made-up textiles such as bed sheets and towels as well as canvas bags. Local private investments in greenfield textile factories produced knitted fabric for use in basic T-shirts and polo shirts.

textiles/clothing firms – in contrast of other FDI being predominantly concentrated in the clothing sector proper – already points to different business strategies in terms of capital and skill content and a longer term perspective.

Chinese clothing companies use typical sewing machines and the production setup is not as highly automated as is generally the case for the large majority of clothing export firms in Ethiopia. There are only three exceptions: the clothing factories of Everest (Chinese Taipeh) and PVH-Arvind (US-Indian) in Hawassa industrial park and of Velocity (UAE/Indian) in Mekelle are the only ones with highly automated production lines, by comparison.

PVH-Arvind and Velocity are the most highly automated firms in Ethiopia. Velocity produces jeans and uses automated machines for the jeans styles and state-of-the-art liquid-free washing machines. According to its CEO, the PCH-Arvind factory was set up to be a centre of excellence to demonstrate to customers and suppliers how to make men's shirts faster. The factory was expected to cut production time in half and thus reduce costs.

The production line includes automated cutters, a highly automated "sub-assembly section" with machines producing pieces for shirts (managed by graduates of technical colleges) and an assembly section that uses a hanger system. All sections are monitored through an electronic system that provides actual times per worker per piece. However, by May 2019, two years after the firm started production, it had not reached the efficiency level required to cover its operating costs. Despite more automation, labour productivity was still considered too low. In essence, there is a whole range of structural factors affecting productivity that are external to the firm and that need to be addressed before such automated factories can be profitable. Among these, the most important factor is the creation of a working class with factory skills and discipline.[43]

Everest is the other highly automated factory in Hawassa industrial park. It is a specialised textile firm from Chinese Taipeh that has factories producing high-tech fabric in Tainan, Shanghai and Bangkok. While these few factories have more automated machines and electronically monitored production lines, sewing itself is not automated. Clothing production remains highly labour-intensive, yet in these more automated factory setups it requires higher skill levels. Thus, automation is not seen as a solution to low labour productivity in Ethiopia as it requires more training, not less.

In respect to types of product and end markets as well as functional upgrading and linkages to local firms, there seem to be no systematic differences between the Chinese clothing export firms in the industrial parks and other FDI clothing firms so far. Where supply chain linkages are concerned, there tends to be a high level of sourcing from Chinese textile firms. In terms of skill development, most Chinese firms have recruited recent university graduates and taken them to their firms in China to be trained. Subsequently, they become middle-level managers responsible for training the low and unskilled local workers. However, this is a common practice among other Asian firms as well. All foreign firms indicated their aim to replace foreign expat managers with local managers as soon as possible, pointing to a

43 In a low-income context like Ethiopia, we do not see fully automated factories, but rather semi-automated machines combined with automated processes of moving parts along the assembly line as well as digitalised labour monitoring systems. Factories still embody a large amount of labour, often at higher skill levels to operate the partially automated machines.

general trend toward skill development. However, we estimate it may take five or more years for this to actually happen. In Hawassa, for example, there were issues with high turnover among the local middle managers that had been trained abroad, forcing foreign firms to reinvest in training managers.

5.3.2 Determinants of competitiveness[44]

Wages and productivity

Despite low wages in the clothing export sector, SSA is generally not a "low labour cost" location compared to Asian competitor countries. The exception is Ethiopia, which has the lowest labour costs among relevant global clothing exporter countries (see Table 3). However, actual wages in Ethiopia are higher than the USD 30 listed in Table 3 and the USD 26 reported in a recent New York University study (Barrett & Baumann-Pauly, 2019). Our own research shows that, for instance, the monthly entry wage in Hawassa is closer to USD 35, due to the complicated way in which firms add benefits and incentives onto the base wage. The entry wage rises after six months as a way to reward workers that stay, putting the average operational wage closer to USD 40-50 and even more with attendance allowance and productivity bonuses. Wages in industrial parks in other parts of the country are also higher. In Mekelle, the average wage for a sewing operator can reach up to USD 90, excluding non-wage benefits such as transport and meals. Thus, while wages in Ethiopia are undoubtedly very low by international comparison, they are rising quickly as firms face high rates of labour turnover and low job uptake.

A further concern for clothing firms is labour flexibility with regard to overtime, flexible work and piece rate wages. Labour regulations in SSA countries are generally stricter than in many Asian countries and secure some minimum rights for workers, at least in the formal sector and on paper. This can be regarded as an opportunity to position SSA as a "supplier of choice" for responsible global buyers (Staritz & Morris, 2013). Labour compliance has become central in the sourcing policies of many global buyers and basic labour standards often constitute a precondition for firms to enter sourcing networks. Labour laws in Ethiopia are fairly protective of workers' rights and provide for higher payments for overtime. In July 2019, the parliament passed a new labour law which, however, did not contain any fundamental changes, except a move toward establishing a minimum wage through the creation of a Wage Board.[45]

Clearly, the most pressing labour problem in SSA, and particularly in Ethiopia, is productivity. Factory-level productivity depends on a host of factors, including labour costs, production methods, managerial and technical skills, staff turnover as well as capital and technology. Compared to Asian competitor countries, productivity in Ethiopia is low (see Table 3). Many firms see this as normal within the context of an incipient clothing export sector and an inexperienced industrial workforce. A key EU buyer reported that production costs are on average 20 per cent higher than in Bangladesh as a result of low productivity and infrastructural challenges. There were considerable differences in the efficiency rates

44 For a comparison of cost structures in Ethiopia and Madagascar, see Annex Table A2.

45 For more information, see https://www.africalegalnetwork.com/ethiopias-new-labour-proclamation/.

reported by firms just starting to export and firms that had been operational since 2015/2016. Most foreign firms interviewed expect productivity levels to reach internationally competitive levels within the next two to three years.

Energy, infrastructure and access to production inputs

Access to raw materials, in particular yarn and fabrics, is crucial for clothing exporters. The SSA clothing export industry depends almost completely on imported yarn, fabrics and accessories; local sourcing is very limited with the exception of Mauritius (and South Africa). Most textile imports come from China and other Asian countries: in the case of Ethiopia, 31 per cent originate from China and 16 per cent from India (latest available data for 2016).

Becoming a competitive fabric and yarn producer is challenging. Investments in the textile sector are much more capital-intensive than investments in the clothing sector. Minimum investments involve USD 30 to 40 million but often require up to USD 100 million. As a comparison, a medium-scale clothing firm requires an investment of around USD 2 million. SSA suppliers have a disadvantage due to comparatively limited access to and the high cost of finance in the region, which limits new investment and increases the cost of existing production. Moreover, investments in the textile sector rely even more on infrastructure than in the clothing sector, in particular on reliable electricity supply as well as reliable water sources and water treatment facilities. Direct electricity costs account for around 35 per cent of total operating costs in spinning and for around 20 per cent in weaving/knitting, compared to just 5 per cent in clothing manufacturing. Generally, the textile sector is scale-intensive and needs a critical mass, long runs and predictability. Thus, a thriving and relatively stable clothing sector is an important competitive factor for the production of textiles, as it can secure sufficient levels of stable demand.

Notwithstanding these challenges, backward integration will be central to increase competitiveness with regard to lead times, production flexibility and costs (that is, transport, port and customs clearance) as well as to increase domestic value added and local linkages and spillovers. In particular, reducing lead times is a critical issue in SSA's clothing sector. While it is neither possible nor desirable to produce all types of yarns and fabrics locally, there are strong opportunities in basic cotton-based products.

Ethiopia has been successful in attracting textile investment in the new industrial parks as a result of proactive government efforts that coincided with the business strategies of new Asian and particularly Chinese investors. Hawassa industrial park has a woven textile mill, while several foreign investments in textile mills and vertically-integrated clothing and textile factories are underway around the Mekelle, Kombolcha, Adama and Dire Dawa industrial parks. Rising costs of production in supplier countries such as China and Bangladesh have led supplier firms to invest in Ethiopia where they aim to replicate their home country investments, including investments in textile. Most of the new mills will not initially be using local cotton due to the inability to supply the large volumes and high quality needed and the non-availability of certified organic cotton. However, there is already one Chinese-owned spinning mill in Kombolcha industrial park that sources all of its cotton locally. There are also increasing investments in the industrial parks to produce accessories and packaging, primarily by foreign firms that play an important role in supplying inputs globally but also by a few local firms. Hence, the frequent negative conclusions on

backward integration potentials (Barrett & Baumann-Pauly, 2019; Gebrewolde, 2019) may have to be revisited (see also Box 5 concerning evidence of "follow sourcing").

While lead times are an increasingly important factor in the sourcing strategies of global buyers, Ethiopia's lead time from order to delivery is currently 13 weeks, including 1 month manufacturing, 20 days for export (1 week to port) and 45 days for import. Larger foreign-owned firms tend to have common fabric in stock, which allows them to react more quickly to standard orders. As a result of a high-level meeting with global buyers in 2018, the government implemented a series of measures to bring down the lead time and cost of transport. An insider on logistical matters working with a large European buyer stated that, within two years, the logistics problems in Ethiopia would most likely be rectified, resulting in a competitive lead time.[46]

5.3.3 The role of industrial policy

In contrast to the other top SSA clothing exporters, only in Ethiopia, and to a lesser extent in Mauritius, have governments pursued strategic industrial policy that aimed to attract specific types of global buyers and FDI firms that have broader upgrading and linkage potential and also support locally-owned firms. The Ethiopian government's clothing sector-specific industrial policies have evolved importantly through trial and error and can be grouped into four key areas, which have largely followed each other chronologically (Staritz & Whitfield, 2019; Whitfield, Staritz and Morris, forthcoming): offering fiscal and financial incentives; promoting skill and productivity upgrading; establishing industrial parks; and fostering backward linkages.

The first wave of industrial policies in the early 2000s included fiscal and financial incentives such as subsidised loans from state-owned banks, priority foreign exchange allocation, fiscal incentives such as tax holidays on corporate and income tax, duty-free import of machinery, equipment and spare parts, and duty-free import of inputs for producing export products (Gebreeyesus, 2013). However, there were no sanctions on firms that benefitted from these incentives but failed to export their production. Furthermore, these fiscal and financial incentives to encourage firms to export included only marginal additions to the general incentives that the government created to encourage investment in manufacturing regardless of whether it was for export or the domestic market (Gebreyesus & Demile, 2017). Hence, these policies created the critical minimum conditions for some local entrepreneurs to invest in clothing exports in the second half of the 2000s and also led to some FDI that came predominantly from Turkey, but local firms struggled to enter and remain competitive in clothing GVCs.

Against this backdrop, the second wave of industrial policies in the early 2010s aimed to increase skills and productivity of local firms. With funding from development aid donors, the Textile Industrial Development Institute provided local firms with free benchmarking studies, salary contributions when hiring foreign experts, free training for sewing machine

46 The new Addis Ababa-Djibouti railroad (operation started in 2018) will bring down lead time significantly, in particular as the government reduced fares in 2019 to ensure cost competitiveness with truck transport.

operators, and cost-sharing to participate in trade shows abroad as well as sending prospective buyers to local firms. However, these activities and related incentives were not linked to performance requirements and reciprocal controls. While the government financed the expansion of technical and vocational education and training, and more universities established degrees in textile and clothing engineering, the curricula were not updated and thus did not reflect the state-of-the-art required for the clothing export industry.

The third wave of industrial policies in mid-2010 involved a more strategic investment promotion strategy and was linked to the industrial park concept. The industrial parks were sector-specific in order to promote cluster and agglomeration benefits, and they were to provide factory shells and extensive infrastructure including electricity, water, effluent water treatment, communication, banking, and customs clearance services. The park concept also included links to a new electric railway system that was being built to connect the parks to the Djibouti port in order to reduce logistics cost and delivery time. The first clothing-specific industrial park in Bole Lemi, on the outskirts of the capital city, was suggested and financed by the World Bank, based on its "plug-and-play" sector-specific industrial park concept, but it was reserved for foreign investment only.

The next industrial parks were financed entirely by the government and implemented by the Ethiopian Investment Commission and the Industrial Park Development Corporation. The first park, built in the town of Hawassa, was developed with PVH, a major US clothing buyer, which was convinced by the government to choose Ethiopia for its new major investment in East Africa (Mihretu & Llobet, 2017). The Hawassa industrial park is the largest of its kind in SSA, with 52 sheds, and the first eco-industrial park, with a zero-liquid discharge plant. Clothing industrial parks on a smaller size but with a similar concept were constructed in Kombolcha, Mekelle, Adama and Dire Dawa. However, it proved difficult to replicate the model of Hawassa – with a major global buyer as an anchor – in the other industrial parks. The government increasingly encouraged the private development of industrial parks and has approved a handful, including clothing-specific parks in Mekelle.

The industrial parks were crucial for attracting first-tier foreign clothing firms, which was seen as a critical lever to access global markets, technology and skills as well as to ensure quick outcomes in terms of exports, foreign exchange and employment. At the same time, a few sheds in the industrial parks were reserved for local firms and coupled with support in accessing finance, linking to buyers and hiring experts. However, by mid-2019, only two local investors that had taken over sheds in Hawassa industrial park to produce clothing as most interested local entrepreneurs lacked the basic knowledge that buyers and foreign firms required. In response, the Ethiopian Investment Commission encouraged a particular type of joint venture between foreign knowledge and local capital (which consisted partially of state capital through subsidised loans).

Ethiopia's government also encouraged linkages between clothing, textile and agriculture by promoting the use of local cotton. Together with various donors, it is working to expand cotton cultivation, improve production and ginning quality, attract local and foreign investors, and develop linkages to textile firms. Recognising the difficulty in producing the right quality and quantity of cotton for textile factories, however, the government also strengthened trade logistics and allowed firms to import cotton free of duties if local supplies were not available or did not fulfil export standards (Staritz et al., 2016). Whether this will succeed is yet to be seen. Some textile firms use local cotton, but only for particular types of coarse fabrics as

further improvements in cotton growing and ginning are required before local cotton can be used to produce the finer fabrics required in fashion clothing.

While fiscal and financial incentives in Ethiopia are considerable, the country suffers from foreign exchange scarcity. To confront this scarcity, the government introduced foreign exchange controls. Foreign clothing firms face strict regulations on the repatriation of profits for companies and incomes for expatriate staff. These restrictions have led many foreign clothing firms to limit their operations in Ethiopia to cut, make and trim manufacture (CMT), which means keeping the merchandising functions at their firms in other countries and only charging a CMT price for the products exported from Ethiopia. The CMT price is lower than a free on board (FOB) price, which involves sourcing inputs, and thus foreign firms reduce the profits that they have to keep in Ethiopia. The Ethiopia Investment Commission and the National Bank are trying to reduce the negative effects of foreign exchange scarcity on the apparel export industry by encouraging textile investments in the country, including those by vertically-integrated firms, and locating textile firms within the industrial parks in order to increase the amount of inputs that can be sourced locally (see Box 5).

Box 5: Moving together? Evidence of "follow sourcing"

While the case of the Dalang sweater cluster (see subsection 4.2) demonstrated the collective action challenge for a whole cluster to relocate, there is quite a lot of empirical evidence of follow sourcing in some of Ethiopia's industrial parks, that is, of large lead investors pulling their suppliers along.

The Hawassa Industrial Park is a case in point. It is a clothing industry cluster dominated by PVH, which owns brands and outsources manufacturing ("branded manufacturer"). PVH's investment in a joint venture factory in Hawassa was the first time in 25 years that the company engaged in manufacturing. In addition, as a global buyer, PVH pushes its first-tier assemblers and input suppliers to co-locate in Ethiopia. As a result, around half of Hawassa Industrial Park is effectively a cluster around PVH. More specifically, PVH convinced JP Textile (a subsidiary of Wuxi, a Chinese firm that already supplied fabric) to establish a woven textile mill. In total, PVH brought 13 of its existing suppliers to see Hawassa, and 9 of them set up factories in Hawassa, including Sri Lankan, Indian, Chinese and Indonesian firms making men and women's underwear, bras, jeans, men's dress shirts, and casual shirts for its brands such as Arrow, Calvin Klein and Warner. Furthermore, PVH convinced two international input supplier firms producing labels and shirt interlinings to set up operations in Hawassa, and supported a local entrepreneur to set up a firm in Hawassa to supply packaging inputs tailored to PVH products. Thus far, network externalities are limited except for the production of men's formal shirts, where fabric and accessories are used that are produced in the park. Rather, the Hawassa industrial park example is one of a lead firm (global buyer) pulling its suppliers to a new location.

A similar story emerges from Adama Industrial Park. Here, the Chinese company Antex chose Ethiopia as its first-ever SSA investment location and took over 10 out of the park's 19 sheds (7 for clothing, 2 for textiles and 1 to produce foaming for bras). The Antex Group produces swimwear, underwear and fashion knitwear for Calzedonia and Walmart and its Adama factory will produce for Calzedonia, which also has its own factory in Mekelle outside the industrial park. While one of Calzedonia's Italian fabric producers (Carvico) is building a textile mill in Kombolcha industrial park, the former also encouraged Antex to invest in Ethiopia and promised to support this investment with orders. Currently, Antex is still importing fabric from Carvico's mill in China; however, it intends to switch sourcing to the latter's mill within Ethiopia once it is operational.

Such co-location may become a game changer if trade disputes between China and the United States continue and Western lead firms adapt their sourcing strategies to become less dependent on Chinese sources.

Source: Authors

Despite the government's policy of promoting industrial parks, crucial issues remain regarding infrastructure provision, including the high costs and inefficiencies of transport, logistics, and customs as well as the unreliability of electricity, water and telecom supply. The Ethiopian government has pursued far-reaching public investments to address these issues but challenges remain (Staritz et al., 2016). In particular, Ethiopia being a landlocked country, imports and exports have to go through the port of Djibouti, which makes the Ethiopia-Djibouti trade corridor crucial for export competitiveness. In our interviews, many firms stated that the high transport and logistics costs effectively eliminate the country's wage advantage. In April 2019, the government negotiated an investment agreement with the State Grid Corporation of China to invest in Ethiopia's electricity transmission and distribution networks in order to secure power for the railway and the industrial parks.[47] In general, it would seem that the government invested in too many industrial parks without making sure that it had the resources to successfully implement all of them, and now it is struggling to find the financial resources to finish and the human resources to manage them.

5.4 The case of Madagascar

5.4.1 Development of clothing exports and foreign investments

Madagascar's export clothing sector started with the establishment of the export-processing zone (EPZ) in 1989, as part of the structural adjustment reforms pushed by the World Bank. The idea behind the EPZ was to increase foreign exchange and create jobs, and the incentive package was modelled on the Mauritian EPZ, in other words, there was not a physical industrial park but rather individual firms were given EPZ status regardless of their location. The policy was successful, and by 2001, Madagascar had 213 firms with EPZ status, with clothing firms accounting for the majority. EPZ firms contributed 42 per cent of the country's exports and 10 cent of GDP (Fukunishi & Ramiarison, 2012). The initial sector development in the 1990s was driven by FDI from France, followed by Mauritian investors (Cling, Razafindrakoto, & Roubaud, 2005) and later by a first generation of Asian investors drawn to Madagascar to take advantage of its duty-free access to the US market under AGOA. However, with the MFA phase-out and also caused by political crises, most Asian investors left and the sector has been sustained and has recently grown based on European (largely French), Mauritian and increasingly local investors (Morris & Staritz, 2014).

After a rapid increase in exports during the 1990s and several setbacks in the first decade of this century (caused by the MFA phase-out, the global financial crisis and the loss of AGOA preferences due to a political crisis), the clothing sector began to rebound in 2011 as EU exports expanded and new markets were sought, especially in South Africa. Also fuelled by the country's reinstatement as a member of AGOA, by 2017 Madagascar had become the largest clothing exporter in SSA, just overtaking Mauritius. This strong growth performance was driven by Mauritian firms relocating their clothing production to Madagascar as well as by local firms.

47 For more information, see http://www.globalconstructionreview.com/news/china-agrees-invest-18bn-ethiopias-power-grid/.

By 2019, there were 74 clothing and textile firms producing for export either directly or indirectly through subcontracting (see Table 9). Of these, 31 were locally-owned. Mauritian firms constituted the majority of foreign firms accounting for 18 firms, followed by China and France with 6 firms each. The leading role of Mauritian investors was driven initially by large Mauritian clothing firms (owned by French and Chinese settlers) relocating production of basic products in search of cheap labour as the clothing industry in Mauritius moved into higher value products (Abdoolla, 2013; Ancharaz & Kasseeah, 2012). More recently – and with greater political stability in Madagascar – these Mauritian groups have become interested in moving more functions, and even fabric production, to Madagascar.

Table 9: Number of export firms in Madagascar's textile and clothing sector

Nationality of investor	Integrated (textile & clothing)	Clothing	Subcontracting	TOTAL
TOTAL	4	52	18	74
Local Malagasy	1	19	11	31
Foreign	3	33	7	43
- Mauritius	1	13	4	18
- China	--	4	2	6
- France	--	6	--	6
- USA	1	2	--	3
- Hong Kong (SAR)	--	2	--	2
- South Korea	--	2	--	2
- Others	1	4	1	6

Source: Data collected by the authors. We had to compile our own list of clothing exporting firms, as the list from the Economic Development Board was not up-to-date and the list provided by the Madagascar Export Processing Companies and Partners Association (GEFP) was incomplete. We contacted all firms on the government and industry lists and used a snowballing technique with existing firms to locate operational firms not listed. Thus, our list is a close approximation but may itself not be complete.

As a result of the historical development of the sector, several different types of buyers source from Madagascar. French buyers came to Madagascar from Mauritius, looking for new suppliers and actively encouraged new local clothing firms to enter specific product categories such as children's clothes. Mauritian firms also invested in factories producing for the same buyers that they had in Mauritius and tended to be concentrated in particular categories of products: knitted sweaters, knit and woven shirts, lingerie and children's clothes. Local firms were able to enter the global clothing GVC by producing specialised products for specific French buyers with whom they developed stable buyer-supplier relations. Thus, local firms tended to produce for intermediate French buyers such as Jacadi, Orchestra, Nautica, Petit Bateau, Etam and Princesse Tam-Tam but also other European buyers such as Massimo Dutti and Pierre Cardin as well as specially designed collections for boutique retailers.

The large local firms and Mauritian firms tend to produce more mainstream products for larger European and US buyers such as Zara, M&S, JCrew, GAP, Eddie Bauer, Levis as well as South African buyers such as Woolworths using fabric produced in Madagascar or Mauritius. The Asian firms (coming from Hong Kong (SAR), South Korea, Pakistan and

Chinese Taipeh) almost entirely produce for US buyers such as Jordache, JCPenny and Walmart. The types of buyers and products are inherently linked, with Asian firms producing basic products for large US buyers; Mauritian firms producing intermediate products for a range of big brands from the European Union, the United States and South Africa; and local firms producing niche and high-value products for medium-sized European (predominantly French) brands, retailers and boutiques (Whitfield & Staritz, 2018).

Linkages between Mauritius and Hong Kong (SAR) led Hong Kong-based firms to invest in Madagascar, due to rising labour costs and labour shortages in Mauritius in the 1990s. However, most of these first generation Asian investors have gone now due to political instability in the 2000s and the subsequent loss of trade preferences to the US market under AGOA (Morris & Staritz, 2014). The second generation Asian investors, which have focused so strongly on Ethiopia (see subsection 5.3.1), only play a marginal role in Madagascar. This also applies to investors from China. French colonial linkages in Madagascar gave rise to clothing firms in Madagascar owned by European/French-diaspora as well as Indian-origin Malagasy that have French citizenship or strong connections to France for historical reasons. The European and the European-diaspora (local) firms in Mauritius and Madagascar are locally embedded with significant decision-making taking place in the host country. They have also been responsible for the emergence of a number of local firms in Madagascar.

Among the 43 foreign firms (see Table 9), by far the largest share originates from the regional investor Mauritius (42 per cent). Chinese investment (14 per cent) ranks second, together with French investment. All of the Chinese firms are active in clothing, that is, there are no Chinese textile or integrated firms. Most of these Chinese clothing firms only started operations very recently, between 2016 and 2018, after the reinstatement of AGOA status in 2015. Of the 6 Chinese firms, 2 firms produce jeans, one each produces knit sportswear and medical uniforms, while there are 2 firms producing knitted pullovers on a subcontracting basis for Mauritian and European-diaspora firms. The medical uniform and sportswear firms produce synthetic products of low unit value for the US and thus benefit highly from the AGOA duty-free access that production in Madagascar provides. While delivery time is considered a challenge, the combination of low wages and preferential market access outweighs this disadvantage and has determined the decision to invest in Madagascar. There are also two Hong Kong firms: one producing high-value cashmere sweaters, and one producing woven trousers. Both of these firms stayed in Madagascar despite the loss of AGOA and survived by switching to the EU market.

There is one Chinese-origin Malagasy company producing cashmere pullovers which originates from linkages with Hong Kong (SAR) and the larger Chinese diaspora community in Madagascar. Its technology is based entirely on manual knitting, which is a highly labour-intensive process. At the same time, several locally-owned and Mauritian clothing firms in Madagascar produce knitted pullovers, as a legacy of Hong Kong investment first in Mauritius and then in Madagascar (Whitfield & Staritz, 2018). One of the Chinese sub-contracting firms, established in 2010, produces knitted pullovers for the largest locally-owned and the largest Mauritian-owned pullover companies and uses a mix of hand-flat and automated knitting technology.

There is a general paucity of information on Chinese firms operating in Madagascar, which makes it difficult to compare their profiles to other foreign clothing firms. Apparently,

Chinese firms operate on a CMT basis, which is similar to other foreign firms. Lead times are too long in Madagascar to produce fashion items for big brands, which adjust their outsourcing frequently so that suppliers have to live from order to order. The key challenge for firms in Madagascar is thus to find the suitable products, such as work wear and sportswear, that are more stable and have long run orders, or products that are highly labour-intensive, such as hand-flat knitted pullovers, where the country can capitalise on its cheap but high-quality labour force.

Foreign firms in Madagascar vary greatly in terms of their equipment. While some use the latest sewing machine models by Juki, others use out-dated equipment that has been moved from existing factories to Madagascar. There are no firms that we know of that are based on automated production lines. Partial automation can be found in most of the knitted pullover companies, which have invested in automated knitting machines and computer-assisted design. Also, some Mauritian firms have automated fabric-laying machines. In general, however, the degree of automation is still rather low and reflects a continued preference for labour-intensive manufacturing.

5.4.2 Determinants of competitiveness

Wages and productivity

For Madagascar, the government's clothing sector promotion documents state that the average cost of labour, all charges included, is USD 100, while the minimum monthly wage in 2019 was about USD 54. Firms report that the base wage in the clothing sector is indeed equal to the minimum wage. Some Mauritian firms that used to operate in Antananarivo complained about increasing labour costs, which led them to move their factories to Antsirabe where costs are lower. Labour is very skilled and abundant, and labour turnover is low at 3 per cent. Overall labour productivity is considered to be 15-20 per cent higher than in other SSA countries, according to a 2019 consultant report commissioned by the Malagasy government.

Labour productivity in Madagascar is considered high by clothing firm owners and some firms use production systems that require polyvalent workers. However, firms complain that the country lacks good middle-level managers and training programmes or institutes for training middle managers. Furthermore, labour productivity varies according to the product. Firms that produce the same types of products on repeat orders have reached 70 per cent of world-class productivity levels. Firms that specialise in products with a high element of labour-intensive manual work report lower productivity but higher unit values.

Industrial zones and supply chains

Madagascar has a modest supply chain within the country, as many Mauritian input suppliers moved to Madagascar and several international supplier companies have factories there. The supply chain includes packaging (cartons, hangers, polyethylene bags), accessories (sewing threads, buttons, and so on), freight forwarders, and shipping line representatives. However, the country lacks significant fabric production. There is one locally-owned vertically-integrated factory producing woven fabric which sells to other firms, and two foreign vertically-integrated factories established by Mauritian

investors In general, however, Mauritian firms have kept their capital- and energy-intensive fabric mills in Mauritius and export fabric to their clothing assembly factories in Madagascar. With electricity supply being unreliable and water conditions unsuitable in Antananarivo, the Mauritian government had gone to great lengths to keep the textile sector going in Mauritius. This approach seems to be changing now, with the Mauritian government's investment in the Moramanga Textile City in Madagascar.

In Madagascar, unlike in Ethiopia and many other countries, EPZ benefits are not linked to being located in a geographical zone but to individual company status. EPZ status is granted to single firms as long as they export a minimum share of 95 per cent of their production. However, fiscal incentives and streamlined legal and administrative procedures may not always be upheld in practice. On paper, Madagascar has a generous tax regime for export-oriented companies with 100 per cent exemption from customs tax, VAT (value added tax) and corporate taxes for the first five years, followed by 10 per cent corporate tax (instead of 20 per cent) and exemptions from customs tax and VAT on imports of all inputs. However, in practice, companies are charged the 20 per cent VAT on imported inputs and are then reimbursed, which in recent years, according to companies has taking more than a year. Given that most companies import their fabrics – even if only from Mauritius – this amounts to a large pre-financed expense.

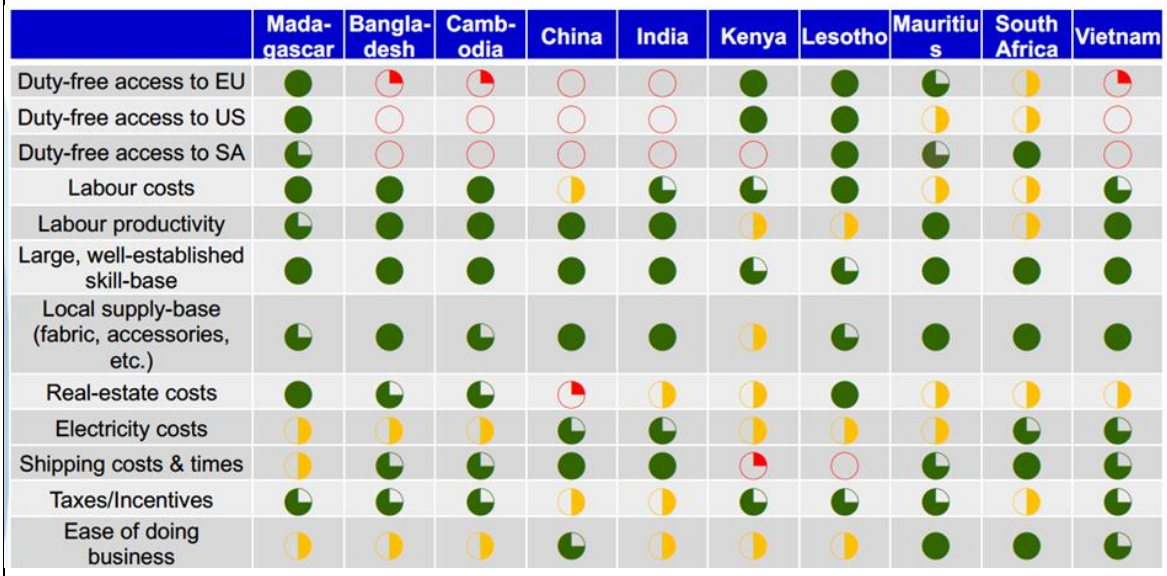
All the main clothing manufacturing areas in and around Antananarivo and Antsirabe are located within 200 km of a port, which compares favourably with the transport conditions in most other SSA countries. Container operations at the main port at Toamasina (Tamatave) have been privatised, more than doubling throughput and halving handling times, while a new extension to the port is under construction. The frequency and competitiveness of international sea-freight to and from Madagascar is increasing. Imports have risen faster than exports, creating significant spare capacities for outbound shipments. While logistics and lead times need to improve further, at USD 1,000-1,400 per 40 foot container, international shipping costs compare favourably to Kenya and Lesotho, but are more expensive than in Mauritius, South Africa, and Asian clothing countries, as indicated in Figure 5. It takes 3-5 days to clear ports. Firms with repeat orders have high inventory carrying costs, as they maintain 3-4 months of imported materials. The lead time in Madagascar is estimated at 4-5 months. Firms producing small volumes of high-value niche products ship by air.

According to Madagascar government documents, the electricity cost is USD 0.09 per kWh (please note: USD 0.16 according to Table 4), and water costs USD 0.37/m^3, which is lower than in other SSA countries but higher than in most Asian countries. The power sector has been liberalised; more than 10 independent power generation projects are under evaluation or development and installed capacity has doubled since 2002. The telecommunications sector has also seen greater competition, which is driving down costs, and there are three new under-sea cables, further expanding capacity and reducing costs, which are nonetheless still high relative to Asian countries.

There are no government-owned industrial parks or zones in Madagascar, only private-owned industrial areas. Government investment promotion documents cite the lease price in industrial areas as USD 1.7/m^2 per month, but in interviews all firms complained that leases in the private-owned industrial zones were more expensive. As a result, several firms have left these zones to build their own factory, but that entails higher risks as it

represents a sunk cost, in other words, if firms leave during a political crisis, they cannot sell their factory. Several new Chinese investors took over existing factories in industrial areas that were not being used.

Figure 5: Madagascar cost structure compared to Asian and SSA competitors (2016)



Note: Comparisons were prepared by an external consultant based on a Harvey-ball method of ranking each country's relative performance for each criterion from very attractive (a full green Harvey-ball) to very unattractive (an empty red Harvey-ball).

Source: Economic Development Board of Madagascar power point presentation, May 2016; all rights reserved, used with permission

5.4.3 The role of industrial policy

Unlike in Ethiopia, the Malagasy government has not pursued a strategic industrial policy targeting the clothing export sector, with the exception of a few measures to facilitate exporting in the context of the EPZ law. The Economic Development Board of Madagascar, created in 2006, has the mandate to promote investments, facilitate administrative processes for setting up EPZ firms and provide visas to expatriate workers. However, the only policy measures that were stated by firms as helpful were the EPZ regulations and exchange-rate policies that support exporting.

Moreover, the government has not invested significantly in vocational and technical training for the clothing and textile sector or any other deliberate measure to upgrade these industries. However, the gap in skilled and experienced managers has been filled by the redeployment of Mauritian production managers set free by the decline and delocalisation of the sector in Mauritius. In general, firms interviewed by the authors bemoaned the government's lack of interest in the industry. In addition, political instability and regular changes in the positions and responsibilities of ministers were identified as further factors creating a challenging and unsatisfactory policy environment for export-oriented clothing production.

In 2017, however, the Economic Development Board of Madagascar announced its Textile City project at the Africa Origin trade fair. The Textile City was to be located on a future

highway connecting Antananarivo (the capital) and Toamasina (the biggest port), and to be a totally integrated zone able to accommodate more than 100 factories in a new city that would offer all logistic and government services as well as residential and commercial infrastructure. The idea of the Textile City actually originated from a group of Mauritian investors in Madagascar and was proposed through the Madagascar Export Processing Zone Association. The water in Antananarivo is not suitable for dyeing and the infrastructure is poor, with the effect that only very few investments in textile industries have been undertaken. The Textile City had been envisioned as a dedicated solution aimed at reducing lead times and costs.

Given the high political volatility in the country and insecurity about tenure in office, combined with limited government revenue, the government has not actually made any progress in implementing the Textile City. Then, in March 2019, the Mauritian government announced that it had been granted land in Madagascar to build an industrial park called Moramanga Textile City, which was to be run as a joint venture between the two governments.[48] Most likely, this reflects a recognition by the Mauritian government that it cannot maintain an clothing industry on the Mauritian island with rising wages and over 50 per cent of workers imported and thus of the need to invest in securing the future of relocated Mauritian clothing manufacturers in Madagascar with generated profits to be repatriated to Mauritius.

5.5 Prospects for Chinese FDI in a comparative perspective

The preceding subsections have shown that in particular Ethiopia and to a lesser extent Madagascar have succeeded in attracting Chinese investors to their export-oriented clothing sector. In a stylised perspective, Ethiopia has been able to capitalise on a proactive industrial strategy with heavy investments in industrial parks and strategic targeting of buyers and investors, whereas Madagascar is a case of investments driven by regional dynamics and established European investors. Trade preferences to the US and the EU market have played a crucial role for both countries. What then are the prospects for future FDI inflows from China and their development impact in both cases?

5.5.1 Ethiopia

In Ethiopia, large-scale Chinese investments are clearly increasing; however, they are not yet fully operational and thus cannot be assessed in terms of their impact. What is noticeable though is a trend for Chinese investments to go beyond just labour-intensive clothing assembly. Investments into textile and integrated factories are significant, which is distinct from FDI coming from other countries. These textile-related investments will change the supply chain in Ethiopia by providing yarn made from Ethiopian cotton and access to export quality fabric for use in clothing export production, including high-value fabrics such as linen and wool. The localisation of the supply chain within Ethiopia will also benefit locally-

48 For more information, see the following websites: http://www.govmu.org/English/News/Pages/Textile-Malagasy-and-Mauritian-Industry-Ministers-discuss-new-avenues-of-cooperation.aspx; https://www.theafricaceoforum.com/en/projets/special-economic-zone-industrial-zone-at-the-moramanga- textile-city-in-madagascar/.

owned clothing firms that do not have relations with fabric suppliers in China or India. Previously, this disadvantage was a major reason for many local firms collapsing or exiting the clothing export market (Staritz & Whitfield, 2019). The gradual localisation of input-sourcing will also decrease lead times, making firms based in Ethiopia more competitive, and able to produce on a FOB basis.

The textiles investments reveal a longer-term business strategy of Chinese firms and can generate significant development impact in terms of their linkages potential, particularly for integrating local firms into supply chains thus increasing domestic value addition. It may also lead to important skill development as these Chinese firms train workers in China, and through expats in Ethiopia, in higher-level textile manufacturing skills.[49]

It is likely that Chinese investment in Ethiopia's clothing and textile sectors will continue to increase in the near future. Despite heavy investments into digital upgrading at home (see subsection 4.2), Chinese firms are actively seeking new production sites. Compared to Southeast Asian countries with increasing labour costs and a high prevalence of labour strikes, SSA is seen as the last frontier of abundant low-cost labour. In this broader scenario, Ethiopia is regarded as the most promising location, in large part due to the infrastructure of the industrial parks and the government's consistent policy commitment.[50]

Ironically, the biggest threat to this rosy picture is Ethiopian politics itself. Ethiopia is currently undergoing political and economic reforms under its new Prime Minister Abiy Ahmed who has pledged economic reforms to liberalise the economy as well as political reforms allowing the return of political opposition parties that had previously been classified as terrorist organisations. This newfound political freedom is akin to taking the lid off a boiling pot. There have been increased instances of violence in both rural areas and in Addis Ababa, as different ethnic groups clashed with each other. The latest example is the mobilisation of people in the Sidamo area to request their own region, with Hawassa as the capital. This has led to major protests in Hawassa, which caused the industrial park to shut down repeatedly for several days. Global buyers are now worried and are looking to source more from factories located in other parts of the country. The political future is more uncertain in Ethiopia than it has been in a long time.[51]

This comes at a time when many new investments are still in limbo. Many of the foreign firms that signed agreements for sheds in the existing industrial parks are still in the process

49 It is noteworthy that non-Chinese investors are also moving upstream in the direction of higher levels of vertical integration. This applies to firms from UAE (Velocity) and Bangladesh (DBL), with both planning to establish private industrial parks in Mekelle.

50 At the same time, firms are struggling to train workers who have never worked in a factory before, or even with a sewing machine, that is, they start with a very low productivity. While foreign firms seem to expect such challenges in a country with an incipient industrial working class, they did not expect wages to increase so quickly, especially in Mekelle, and to have problems recruiting labor. While productivity will surely rise in Ethiopia over the next couple of years, the question is how fast wages will rise, squeezing foreign firms between rising production costs and global buyers that demand low prices.

51 The country will hold national elections in 2020. The last election was in May 2015, in which the EPRDF (Ethiopian People's Revolutionary Democratic Front) coalition regional parties won all 547 parliamentary seats, sparking calls of foul play from opposition groups. In the now much more open political environment, the strength of other regional parties is growing so that it is unclear if EPRDF can hang on to power or what would happen if they lost the election.

of setting up, and most of the ones in Adama industrial park have not even started setting up due to delays with electricity and water infrastructure. In Adama, simple assembly production has started, but assembly requiring steam and textile production has to await the construction of a pipe to bring water from the Awash River to the industrial park, which may not be completed until mid- or late 2020. The other parks use water from boreholes, but the water in Adama is too deep and unsuitable due to hard minerals, making it costly to extract and use. There are a few smaller industrial parks in Jimma, Bahir Dar and Debre Berhane, where the government has built only basic infrastructure, but they do not have a clear list of investors yet. At the moment, the Ethiopian Investment Commission and the Industrial Parks Development Corporation are overwhelmed with resolving issues related to the five large industrial parks. These issues include infrastructure within the parks and utilities flowing to them, as well as broader urban planning issues such as housing, food and transport access and prices (which affect the purchasing power of workers' wages and thus wage costs). The government also faces difficulties in terms of insufficient financial and human resources to manage these parks.

While Ethiopia continues to be hyped as the new sourcing location, these issues and the growing political problems in Hawassa have dimmed its prospects. Global buyers and new investors are waiting to see how quickly the industrial park issues can be resolved and how the political events will play out. Economic and political reforms take time. If they succeed, it is very likely that Ethiopia will be the biggest clothing exporter in SSA in five years from now as the currently planned investments come to fruition. In this scenario, Chinese FDI inflows will play a dominant role given the growing push factors in China and also the sheer size of its clothing and textile sectors.

5.5.2 Madagascar

In Madagascar, where FDI is dominated by regional Mauritian and partly embedded European, especially French investments, the development impact of the rather small-scale Chinese FDI is more limited. In general, most Asian and particularly large first generation transnational producers that concentrated on the US market have left Madagascar and have not come back with the political situation still being risky. A few smaller Chinese clothing firms came to the country in the wake of its renewed AGOA eligibility despite the political risks. They focus on synthetic products with a low unit value, and thus benefit immensely from duty-free access under AGOA. However, these Chinese investments are still modest and do not yet show signs of a larger trend.

In contrast to Ethiopia, right now Madagascar appears to be politically more stable. However, political dynamics in Madagascar have not fundamentally changed, in that political elites are viciously fighting over access to the state and the natural resource sectors with a view to exploiting economic opportunities and rents. However, this struggle will not necessarily boil over into further coups d'état and renewed national violence. At the same time, the intense political infighting naturally diverts attention away from economic development. The ruling political elites have not really taken interest in the country's clothing export sector.

Against this backdrop, we do not expect large Chinese FDI flows and relocations of factories to Madagascar in the near future. Limited, AGOA-induced investments may continue,

particularly in low-value synthetic products where Chinese companies see potential to benefit from cheap but skilled workers who can start with reasonable productivity levels. The clothing sector in Madagascar has only been growing in recent years again because Mauritian investment has been relocating to Madagascar at an increasing rate but it is likely that this transition will become complete over the next five years. If the Mauritian-driven Textile City should prove a success, it could spur more investment – also from other countries, including China. At the same time, large locally-owned firms in Madagascar as well as Mauritian firms are also looking at Ethiopia as a potential future investment location in parallel to, or in replacement of, their Madagascar investments.

6 Conclusions and outlook

Industry-led development paths, in particularly those based on light manufacturing exports, such as clothing, footwear or electronics assembly, have historically played an important role in latecomer development. As pioneering firms evolved into broader clusters of exporters, they enabled agrarian countries to build up basic manufacturing capabilities and created massive employment for unskilled workers, thereby driving productivity growth and spreading its benefits to previously marginalised low-income groups.

This traditional route to economic and social development has been pursued by a large number of developing countries, most successfully those in East and Southeast Asia. This changed, however, when China emerged as the global export hub for light manufactures. China offered low wages, good infrastructure, political stability and economies of scale and scope. This combination increased productivity rapidly, making China so uniquely competitive that the economic space for other latecomers to successfully export clothing and similar light manufactures narrowed down significantly. In particular, exports from SSA countries have remained marginal. More recently, however, rapidly rising industry wages in China have fuelled hopes in Africa that substantive investments in light manufacturing investments may now flow into the region and provide a springboard for industry-led development.

The research findings presented in this paper focus on emerging trends in the global clothing industry and show that such developments can in fact be observed, albeit starting from a very low level. At the same time, they demonstrate that a whole range of factors – both technological and economic, both global and domestic – challenge the prospects of the incipient clothing export industry in SSA.

First and foremost, technological innovation, that is, rapid digitalisation and the introduction of robotics in manufacturing processes, is about to redefine the future economic landscape and division of labour in the global clothing industry. However, as our field research shows, this process is gradual, not disruptive. We estimate that in light of a considerable gap between the technological feasibility of new robotic technologies (in particular in sewing operations) and their commercial viability, SSA countries are likely to have a time window of 10-15 years to push industrialisation based on clothing exports. Also, technological upgrading in established production locations and relocation to low-wage countries are not mutually exclusive and indeed, are often pursued simultaneously by leading clothing firms. The frequently portrayed dichotomy of relying either on low-wage labour or robots does not reflect the complexity of the real world.

At the same time, our empirical research in China reveals that the country's clothing manufacturers are reluctant to move to SSA, which for many companies remains uncharted territory compared to neighbouring Asian low-cost locations. While full-fledged robotisation of clothing assembly is not yet economically viable, certain product groups and processes can be automated and these potentials are used by Chinese firms at home to reduce their wage bills. In particular, the advantages of agglomeration and proximity in home-grown industrial clusters (that is, collective efficiency) act as a strong deterrent to relocation.

Importantly, digital technological innovation is accompanied by, and indeed enforcing, a trend towards new business models based on shorter fashion cycles, customisation and the reduction of lead times for production. Ultimately, time-to-market becomes more important than wage costs thus favouring nearshoring at least for high-end clothing. This benefits countries that are close to the major consumer markets and can offer efficient logistics; in the case of Europe, countries like Portugal, Turkey or Morocco stand to gain from this trend. However, in principle the emphasis on nearshoring may also favour a country like Ethiopia – as a hub for Africa-Europe flights – over China

Whether or not SSA countries will be able to compete in this emerging global clothing scenario depends on many factors. Essentially, the question is if wage cost advantages will be translated into productivity gains and hence lower unit costs, in particular in comparison with low-cost Asian countries. While Ethiopia stands out as a country combining very low labour costs with a huge domestic labour market, its future success as a clothing exporter hinges on the capability to create and maintain the required transport/logistics, energy and water infrastructure as well as the conducive political environment to attract a critical mass of potent foreign investors and support local firms and domestic supply linkages.

This leads us straight into the role of industrial policy. Several policy dimensions need to be distinguished:

Firstly, the creation of dedicated spaces in terms of industrial parks offering infrastructural services as well as fiscal, financial and trade preferences is relatively easy. In countries lacking proactive industrial policies and/or the necessary financial resources, this can also be achieved with privately operating park developers. In conjunction with low wages and a basic level of political stability, the existence of such industrial parks is often sufficient to attract simple assembly operations and create a modicum of industrial jobs.

Secondly, additional efforts are required to deepen the industrial structure, move into higher value-added activities and create interlinked, locally embedded industrial export clusters. This calls for strategic and targeted investment promotion in which governments, key investors and global buyers have to work hand in hand to build up and strengthen value chains, for instance, co-producing fabrics and clothing in the same park, sourcing domestic cotton or attracting investment into ancillary supporting industries and services. To this end, it is crucial to attract global lead firms that in turn can pull in their key first-tier suppliers and support local firms and inter-firm linkages. Succeeding or failing to attract such "follow sourcing" may indeed be the make or break factor in taking off as a clothing export country. The Ethiopian government is proactively moving in this direction and deliberately works in tandem with global manufacturers and buyers to forge a joint investment drive and portray a consistent image of an attractive rising export location. This public-private investment partnership has been a unique feature in achieving such "follow sourcing" in some (albeit

still limited) cases and in turning Ethiopia into the "hot" new sourcing destination for clothing in Africa.

Thirdly, timing matters. As stated above, about 10-15 years remain to exploit labour cost advantages in the clothing industry years before automation kicks in decisively. African countries need to act quickly to build up infrastructure as well as a reliable, skilled and productive workforce. Also, they need to monitor technology and market trends closely to be able to adapt before the time window closes. Even if automation levels in SSA clothing production are likely to remain partial for some time to come – that is, even if robots will not fully replace labour – new strategies will be needed to keep the industry afloat. One option may be to reduce lead time to gain competitiveness in shorter fashion cycles; another one to shift to original brand manufacturing for the emerging middle classes in a widening African Free Trade Area. Relying on labour-intensive sewing alone will not be a sustainable business model.

In addition to industry-specific policies, two broader success factors need to be in place: On the one hand, preferential trade agreements – which so far have been critically important for directing investment flows to low-income countries in both Asia and Africa – need to stay alive to compensate for productivity shortcomings. This applies in particular to EBA and AGOA, the future of which is subject to political uncertainties. On the other hand, political stability remains the main domestic challenge in potential investment locations. As the cases of Ethiopia and Madagascar have shown, foreign buyers and investors respond with great sensitivity to perceived risks of political turmoil and conflict.

In the final analysis, we want to end on a cautiously optimistic note for SSA countries. While the massive relocation of clothing production capacities to Africa is not yet happening, there are clear opportunities to put the continent on the global map of export-oriented light manufacturing. The biggest risk for this scenario is not technological but political.

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Annex

Table A1: List of interviews carried out in China			
	Time	Place	Interviewee
1	5 November 2018	Beijing	Vice Secretary-General, CNTAC
2	12-13 November 2018	Foshan	Group Marketing General Manager, Esquel Group
3			Group R&D General Manager, Esquel Group
4			General Manager, Guangdong Esquel Textile Company, Esquel Group
5			Chief Engineer, Esquel Group
6	17 November 2018	Guilin	General Manger, Esquel Garment Manufacturing Vietnam-Hoa Binh Company
7	27 November 2018	Shanghai	Professor at College of Textile, Donghua University,
8	3 December 2018	Beijing	President, CCCT
9	4 December 2018	Beijing	Chief Representative, Beijing Office, Esquel Group
10	8 January 2019	Dongguan	Associated Director, Dalang Woollen Textile Industry Administrative Committee
11			Supervisor, Dongguan Association of Woollen Textile Industry
12			Deputy General Manager, Dongsheng Company
13			Associated Director, Bureau of Economy and Technology Information, Dalang Town Government
14	11 March 2019	Ningbo	Vice Group General Manager, Shenzhou International Group
15			Chief Engineer, Shenzhou International Group
16	12 March 2019	Ningbo	Secretary to Chairman, Cixing Company
17	13 March 2019	Hangzhou	Senior Operation Advisor, Alibaba Group
Source: Authors			

Table A2: Overview of clothing export-sector cost structures in Ethiopia and Madagascar		
	Ethiopia	**Madagascar**
Tariffs & ROO to United States, European Union and South Africa	Zero tariffs to European Union & United States (plus single ROO), high to South Africa	Zero tariffs to EU, US (plus single ROO) and SA (double ROO)
Wages	No minimum wage. Entry wage is around USD 40, rising to USD 60 after 6 months and with attendance allowance, and up to USD 90 with productivity bonus.	Government reports wage as USD 100 per month (all charges included) in promotional document. Firms report that minimum wage in 2019 was 200,000 Ariary = 54 USD (which is base salary for sewing operator).
Labour regulations	Medium, not consistently applied	Medium, not consistently applied
Skills and training	Low, sector-specific training available	High for sewing operators. Challenge is local middle-level managers. Limited sector-specific training available.
Labour turnover and absenteeism	High in new factories, but falls significantly in factories operating for 2-3 years.	Low
Fiscal incentives	Yes, strong	Yes, weak
Bureaucratic procedures	Yes	Yes, weak
Electricity	Low costs: USD 0.04/kWh, Reliability issues.	High costs: USD 0.10-14/ kWh. Reliability issues.
Water	Low costs: USD 0.07/ m^3 up to 0.50 depending on consumption, but reliability issues in industrial parks, especially Mekelle and Adama.	USD 0.37/m^3
Land and factory sheds	In Hawassa IP, Mekelle IP, Kombolcha IP: USD 2/ m^2 per month for 4 years than increasing up to USD 3/ m^2 for 11 years and more. In Adama IP and Dire Dawa IP: USD 2.75/ m^2 per month up to USD 4/ m^2 at 11 years	USD 1.7/m^2 per month, according to government. Firms find shed leases expensive. Difficult to get land and build a factory.
Transport and logistics	High costs, long due to logistics and customs, but improvements.	High costs of international transport: USD 1,000-1,400 per 40 foot container.
Lead times	13 weeks (3 months), but will improve with policy changes and government investments.	High (4-5 months), but moderately improving. 35-40 days to ship to the US.
Telecommunication and internet	High costs & low reliability	Medium costs.
Access to inputs (costs and quality)	Limited but improving due to new FDI in IP.	Very limited, only one textile mill (woven).
Productivity	Very low but varying related to lengths of operation.	Medium, varying related to types of products.
Access to finance and interest rates	Subsidised investment & expansion loans, problems with working capital & FX access.	Very difficult access to loans & high costs, particular problem for local firms with no foreign access.
Exchange rate	Volatility but generally depreciating.	Volatility but generally depreciating
Source: Authors		

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