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Technology demand and the role of South-South trade in Tanzania's textiles and apparel: Examining linkages with India

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Abstract

Cross-country productivity differentials are primarily determined by technological change, with a particularly worse gap for Sub-Saharan Africa, with large gaps between best practices in more advanced economies. Adopting more efficient and effective technology and production processes and their adaptation is an important pathway for improving productivity in low-income countries (LICs) such as Tanzania. However, there are constraints in access to technology that suggests the need for a better understanding of the nature of technology in any given sector, its demand, and existing linkages that facilitate its adoption. In this paper, we focus on technology exchange between countries in the Global South, as a complement to South-South trading relationships. We examine the demand for technology in Tanzania's textiles and cotton apparel sector and the role of India's technology transfer in two steps. First, we identify existing technology sources and the current demand to meet technology gaps. Second, we examine the extent to which South-South partnerships can contribute towards developing absorptive capacity i.e. "ability to identify, assimilate and exploit knowledge", a key enabling variable for technology transfer, leading to innovation and economic growth, inducing self-learning over time. We provide policy implications for the Tanzanian textiles and apparel sector on utilising existing and potential linkages with foreign Southern firms and the local economy to successfully meet technology gaps.

Keywords: *Cotton; textiles; garments; technology; India; Tanzania*

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1. Introduction

A key reason for cross-country income variations stem from productivity differentials, which are in turn determined by technological change (Mankiw et al., 1992; Romer, 1986). The gap is particularly worse for Sub-Saharan Africa (McMillan et al., 2017), as firms operate far from the production possibilities frontier[5], with large gaps between best practices in more advanced economies. Adopting more efficient and effective technology and production processes and their adaptation is an important pathway for improving productivity in low-income countries (LICs). However, the existing gaps are dynamic, as technologies are always evolving, with new knowledge and the size of the gap is expanding (Stiglitz & Greenwald, 2014). There are also constraints in access to technology, as not all technology is freely available, or homogeneous in nature. Hence, the need for a better understanding of the nature of technology in a given sector, its demand, and existing linkages that facilitate its adoption.

In this paper, we focus on technology exchange between countries in the Global South, as a complement to South-South trading relationships. We examine the demand for technology in *Tanzania's textiles and apparel* sector and the role of India's technology transfer in two steps. First, we identify existing technology sources and the current demand to meet technology gaps. Second, we examine the extent to which South-South partnerships can contribute towards developing *absorptive capacity*, i.e. "ability to identify, assimilate and exploit knowledge", a key enabling variable for technology transfer, leading to innovation and economic growth, thus inducing self-learning over time.

India's intensified trade relations with Africa features as a key component of its model of South-South cooperation based on mutual partnerships. India's trade and investments with the African continent has grown in a major way, building on deep historical ties, especially with East Africa. These ties date back to the colonial times, when the British brought a significant amount of Indians as a source of medium skilled-labour to undertake infrastructure projects (chiefly among them railways); later on this people with Indian origins – and the large majority already nationals of their host countries – set up commercial businesses that still dominate East African economies today. Moreover and also due to historical reasons, India has a large capital goods industry, relatively above the average of developing countries: it exported in 2017 US$ 40.5 billion in capital goods, which represents about 14% of the country's total exports[6]. These features make India a potentially good source of intermediate inputs to East Africa, among them Tanzania has emerged as a key partner, with promising potential in textiles and cotton apparel. Notwithstanding this potential, there is only limited evidence on the existing demand for partnerships towards meeting

[5] The potential firm output given the current state of knowledge, technology and employment of factors of production as well as the best practices of both firms and the economy.
[6] Data extracted from UN Comtrade.

technology gaps towards sustained learning and innovation. Hence, our key research question is: '*How can the Tanzanian textiles and cotton apparel sector utilise existing and potential linkages with foreign Southern firms and the local economy to successfully tap into technology in global value chains (GVCs) towards sustaining growth*?'

The remainder of this paper is structured as follows. Section 2 presents a brief literature review on technology transfer in the context of LICs. We outline a framework and methodology in Section 3. The characteristics of the Tanzanian cotton apparel sector are discussed in section 4. In section 5, we present an analysis of the primary data. Finally, section 6 concludes the paper and lists policy recommendations.

2. Literature Review

This section outlines a brief critical review of the literature on technology in the Global South and the role of absorptive capacities in mediating benefits from adopting new technologies based on existing and potential trading relationships.

2.1. Technology in the Global South

Southern countries not only exchange technologies with more advanced economies, but they also exchange cost-effective and adaptable technologies with other Southern partners (Mohanty et. al., 2019; Saha et. al., 2019). These opportunities have the potential to create strong ties across firms by promoting access to new markets and based off technological and skills complementarities (Horner, 2016).

South-South trade and investment promotion offers an alternative route of exchange of technology and knowledge – diverse from the linear, traditional conceptions of technology transfer, that are often based on the preconception that this type of exchange is (i) top-down, (ii) following the North-South direction. This exchange may comprise simple knowledge transfers with at least some of the following mechanisms: through mutual learning from face-to-face interactions; training of the local workforce undertaken by lead companies; knowledge transfer in a narrow range of tasks; value chain pressure to adopt international standards; learning by hiring of skilled managers from other countries; through joint ventures; firm clustering, such as through sector associations, through imitation or learning through suppliers (within or out of the country).

A more advanced technology relevant for a capital-abundant country may not be conducive to a relatively low-skilled labour-abundant country, with lower rates of capacity utilisation, common in LICs countries. Therefore, technology transfers between Southern countries hold promise as an intermediate pathway. The concept of inclusive innovation, as defined by Heeks et al. (2014), synthesises this idea: *it is the process*

of creation of new production processes, technological inputs, goods and services that fit better the needs and interests of the economies in the Global South.

Moreover, another important aspect of technological upgrading that cannot be ignored is the increasingly leading role of the largest emerging economies (in sum the BRICS) in setting the global agenda. Hanlin and Kaplinksy (2016) undertake three case studies for Tanzania, Kenya and Uganda and find that capital goods imported from the Global South (largely from India and China, with Brazil running behind) to these East African countries are not only cheaper, but also suit better the local needs and conditions of firms operating there, thus turning over higher profits; the longer lifespan and the less frequent breakdowns are compensated by the cheaper acquisition price and the wider availability of spare parts and repair support. Only when access to capital is less of a binding constraint and when production takes place at a larger scale are more advanced capital goods more efficient.

2.2. Role of Capabilities

Theoretically, the main linkage between producing knowledge and reaping the associated economic rewards is to accumulate capabilities. For instance, product, process, marketing and organisational innovations (OSLO manual) are all instrumental to stimulate export growth and assist developing countries to gain market share (Aw et al., 2011). The distribution of these activities is crucial to determine if a country will reap the rewards of linking itself to the GVCs. Sometimes, reaping benefits may only mean furthering already existing capabilities and functions along the same link on the value chain, not only climbing up the GVCs (Gereffi et al., 2005; Giuliani et al., 2005).

Subsequently, the gradual accumulation of capabilities translates into more developed production networks, exporting more and more complex products, quantified by Hausmann et al. (2011) who devised the *economic complexity index* (ECI). The ECI classifies countries by exports diversity and complexity of each exported product. Vergara (2018) corroborates the main idea of the ECI with his finding of a strong positive relationship between technological capabilities and export diversification, both in terms of number of products and number of destination markets. The definition of technological capabilities in our paper is "the skills—*technical, managerial or organizational*—that firms need in order to utilize efficiently the hardware (equipment) and software (information) to accomplish any process of technological change" (Morrison et al., 2008, p. 41) that can be disaggregated as:

- **Investment capabilities**: technical and labour skills necessary to assess the feasibility and profitability of technologies.
- **Production capabilities**: operational skills to assimilate and adapt technology, and process and product innovation.

- **Linkage capabilities**: development of relationships with other firms, with research institutions and with suppliers.

Therefore, the main challenge facing especially LICs such as Tanzania, is as follows: *innovations that push the technological frontier outwards are often unattainable given constrained resource endowments and information gaps, therefore technology and knowledge will need to be co-created with learning brought through economic linkages.* Economic linkages could stem from existing and future trade and investment relationships. However, the question remains on *how to utilise linkages between foreign firms and the local economy to successfully tap into the technology and knowledge in global value chains (GVCs) to sustain growth?* For Tanzania, one particular policy recommendation in Balchin and Calabrese (2019) is to increase its degree of openness in the cotton and textiles value chain, both to foreign direct investments (FDIs) and trade. Export orientation is an important instrument for the country to reap the rewards of economies of scale, which are not available if only the domestic market, or even the regional East African Community (EAC) market, is explored. However, few other studies have convincingly presented evidence on the *demand for concrete technological exchange and/or co-creation and spill over effects of trade and investments* (especially due to lack of control of firm heterogeneity according to Görg and Strobl (2001) and Meyer (2004), or focused on the *complementarity between local and foreign innovation which can lead to co-creation of knowledge and technology* – which we argue as being crucial.

There is a strong body of evidence analysed by Fu et al. (2011), stating the importance of indigenous technological innovation efforts to complement foreign adoption, transfer and diffusion of technological innovations. When these efforts are combined with long-term FDIs that support the development of backward linkages, then the positive effect is magnified. *Transfer and diffusion of foreign knowledge are only effective when they also support local capacity building* (Morrison et al., 2008). Without these pre-conditions to foreign investment, the recipient country will find itself trapped into a vicious cycle of foreign dependence and will not be able to adapt imported models into their local realities.

But an important caveat is that whereas indigenous technology has a potential large pay-off, it will tend to be biased in the direction of the country's relative factor endowments, which creates limits to structural transformation and upward movements in the GVCs. The reasoning is simple: in an economy with low labour costs relative to capital costs the direction of technological change will be biased towards labour-intensive and capital-saving. The assumption underlying upward movements along the value chain is an increase in complexity of products and a higher capital-to-labour ratio (Hausmann et al., 2011).

Recent evidence suggests that Southern value chains can offer new and emerging opportunities with lower barriers for market entry by concentrating on specific tasks for functional upgrading (increased skill content of activities) or raising the ability to diversify and introduce more advanced goods into less

diversified sectors. In this sense, the relatively similar settings of Tanzania and India could favour an avenue of technology transfer between the two countries. In this contradiction lies the aforementioned special role played by an efficient mix between local and foreign technologies that makes them complements (Fu et al., 2011), which is a crucial research question that this study will attempt to answer for the case of the textile and cotton industries in the India-Tanzania technology transfer.

The main reasoning behind the focus on foreign technological adoption as an effective strategy is as follows: (i). Innovation is costly, which often represents an insurmountable barrier for LICs; (ii). It is inherently risky, as most of the scientific advances do not necessarily, or immediately, translate into technological change. (iii). It is path-dependent, which means that once the world, led by high-income countries, goes down a certain path there is a strong tendency for all subsequent technological change to keep following the same path, e.g. all subsequent research done under genetics. (iv). Moreover, a lack of investments in R&D (research and development) on a certain area might subsequently severely hinder the development of technological capabilities on that same area.

2.3. Role of Absorptive Capacity

Despite the role that foreign technology can play in boosting LICs economies, there is one crucial link: absorptive capacity. According to the definition of Cohen and Levinthal (1990), it is the capacity of firms to identify the value of new knowledge, assimilate it, and transform it into practical technological innovations to implement them in their products and processes, thus pushing the local technological frontier upwards. The accompanying empirical evidence suggests absorptive capacity as a function of firm's prior related knowledge (particularly problem-solving methods and heuristics), enabling the firm to recognise what investment path it should take – playing a strong mediating function.

Foreign technological adoption is often via importing intermediate goods, particularly higher-quality inputs as a key source of R&D spill overs (Acharya and Keller, 2009). Okafor et al. (2017) have found empirical evidence on these spill overs for Ghana, a country with a background similar to Tanzania. It corroborates the positive impact of imported intermediates on firms' productivity, but with a caveat: the effect varies positively with the recipient country or firm's absorptive capacity. It is remarkable that the foreign intermediates' impact on productivity is larger than the impact of export orientation (or intensity) and foreign ownership. Furthermore, Farole and Winkler (2012) corroborate the importance of local absorptive capacity for internalisation of FDI spillovers to domestic firms.

The challenge that is posed to most LICs is for firms to not only move from being second- or even first-tier suppliers, in terms of adherence to quality standards, but also to concentre on more processed products

and higher quality intermediate inputs. Okafor et al. (2017) find four channels via improving absorptive capacity through public policies: learning by-doing (learning from continuous improvements in manufacturing operations), larger investments in human capital, internal/indigenous R&D investment and import of R&D (generally via intermediates import). It is also crucial that governments design coherent policies that focus on inverting the trend of GVCs choosing local producers, given existing absorptive capacities, into a more pro-active model of upgrading (improvements in products and processes) and governance (Morrison et al., 2008).

2.4. India-Tanzania Relationship

The global competitive edge of Indian textile companies constitutes an opportunity for technological transfer with other LICs. Indian firms can facilitate horizontal technology spill overs through import of machinery, adoption of more efficient processes by local firms (demonstration effect), and the shift and adaptation to local contexts of qualified external workforce. This is the path, for example, that Ethiopia is taking vis-à-vis China (Abebe et al., 2018). Thus, the question arising is: do competitive foreign firms create beneficial linkages and exchanges with local firms?

However, if technological change comes just from abroad, only a very limited pool of local firms will develop innovation capacities, effectively creating an 'enclave economy', thus an adequate mix of foreign and local innovation is crucial (Fu et al., 2011). These factors will then condition the strength of intra-firm linkages and the local economy and, thus, leverage the recipient country's successful integration into GVCs (Morrison et al., 2008). The aforementioned authors argue that each value chain has its own specificities in terms of technological transfer and mechanism of learning. How do these work in the textile and cotton apparel industries, in particular in Tanzania? Are Tanzanian firms able to introduce themselves new innovations, including adaptation to local conditions, rather than just replicating processes and products? Specifically, how can the country improve its quality and productivity in textiles and cotton apparel value chain?

South-South cooperation between Indian and Tanzanian firms has the potential to provide effective technology for the textiles and cotton apparel industries that are also affordable and accessible to local needs and demands. India has an old history in these industries, back before the colonial times, however its early stages development relied heavily on a protectionist import substitution state-led model that arguably only succeeded because of the large and relatively affluent domestic market (Balchin and Calabrese, 2019). The state-supported Indian export push was a consequence of this early success, rather than a cause, and it is difficult to foretell the Tanzanian future in the same direction. The Bangladeshi case is a good balance that has been stricken: second generation indigenous firms learned from their foreign predecessors and developed the local capacities

(Balchin and Calabrese, 2019).

In the following sections, we set out a framework and methodology to closely examine the nature of technology demand and linkages, with the aim of drawing a set of targeted policy implications.

3. Framework & Methodology

Based on our review of the literature and existing evidence, we set out four key hypotheses to be examined using secondary and primary data from our survey. We do not examine South-South technology transfer as a preferred alternative to North-South but examine the demand and its role in Tanzania.

3.1. Framework

We examine four key hypotheses as set out below:

- H1: *Imported intermediates can have a positive effect on firms' productivity, but the effect varies with absorptive capacity.*
- H2: *Transfer of foreign knowledge is effective when there is sufficient demand for technology and corresponding support for local capacity building.*
- H3: *South-South cooperation for trade has the potential to provide effective technology for the Tanzanian textile and cotton apparel sector that are also affordable and accessible to local needs and demands.*
- H4: *South-South technology transfers with India comprise simple technology exchanges that are context-specific, meeting key gaps of knowledge.*

3.2. Methodology

This paper adopts a mixed methods approach, combining quantitative data from primary and secondary sources with qualitative semi-structured interviews. We use a mix of secondary and primary data for analysis. The secondary data is a representative sample of Tanzanian firms operating in the manufacture of textiles (ISIC classification: Division 13) and wearing apparel (ISIC classification: Division 14) extracted from the 2015 and 2016 rounds of the *Annual Survey of Industrial Production* (ASIP). The two samples analysed are made up of 63 (2015) and 60 firms (2016) respectively. The ASIP is a nationally representative survey carried out by the Tanzanian National Bureau of Statistics (NBS), which is periodically complemented by the Census of Industrial Production (CIP).

The primary data of this paper derives from a carefully structured survey with a target sample of 30 firms which, due to the limited size of the textiles and cotton apparel industry in Tanzania, is quite close to the

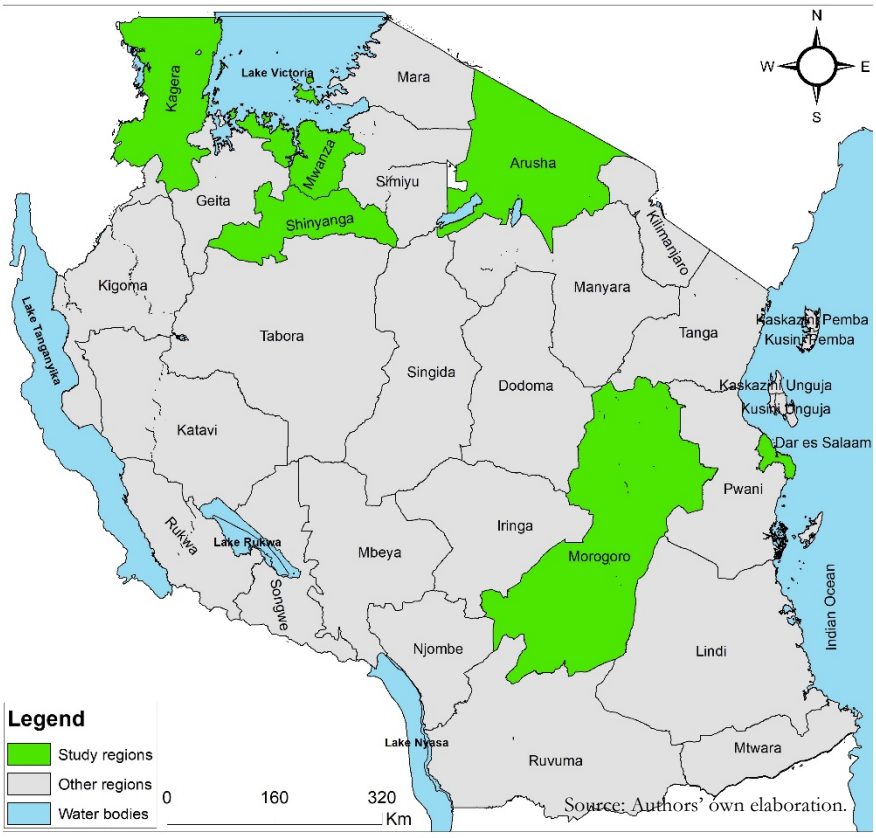
universe. The surveys yielded a sample of 20 firms that responded to a structured set of questions – the interviews lasted one hour each and firm responses were collected using tablets. The geographical distribution of firms across Tanzania regions is illustrated in Figure 1.

The survey was divided into six key sections:

- Firm characteristics;
- Main activity and resourcing;
- Labor;
- Technology/knowledge adoption;
- Linkages;
- Networks.

Using information from our survey, we are able to bring depth to the secondary data analysis and examine the nature of domestic and foreign linkages with India, and also bring attention to the key barriers and demand for meeting technology gaps in the Tanzanian textiles and cotton apparel sector over the last three years.

Figure 1: Regions of Tanzania covered by the survey of the textiles and apparel sector



Source: Authors' own elaboration.

4. Textiles and apparel in Tanzania

Growth of the textiles and cotton apparel sector remains a key policy priority in Tanzania, as highlighted by the last National Five-Year Development Plan (FYDP II) (Balchin and Calabrese, 2019). Tanzanian textiles and apparel, however, lies on the lower end of the global technology gap, as the productivity differential is increasing with respect to other economies at similar stages of development.[7] Despite numerous interventions by the Government in the last decade (e.g. the establishment in 2009 of the Textile Sector Development Unit), this sector faces constraints in terms of capacity, product variety and value chain integration (ITC, 2015).

The sluggishness that has characterised the firms operating in the textiles and cotton apparel sector are symptomatic of a lack of *absorptive capacity*, which appears to be severely hindering technology adoption and hence productivity. A likely factor explaining the low absorptive capacity is the lack of human capital, and especially the low share of skilled workers (Eaton and Kortum, 1995).

To assess the sector's absorptive capacity, we begin by examining the data available from secondary sources, in terms of key technological capabilities and the role that South-South cooperation can play in developing those capabilities. This section presents the key firm characteristics in terms of labour, technology, linkages and the local network, and will set the scene for the analysis using our primary data.

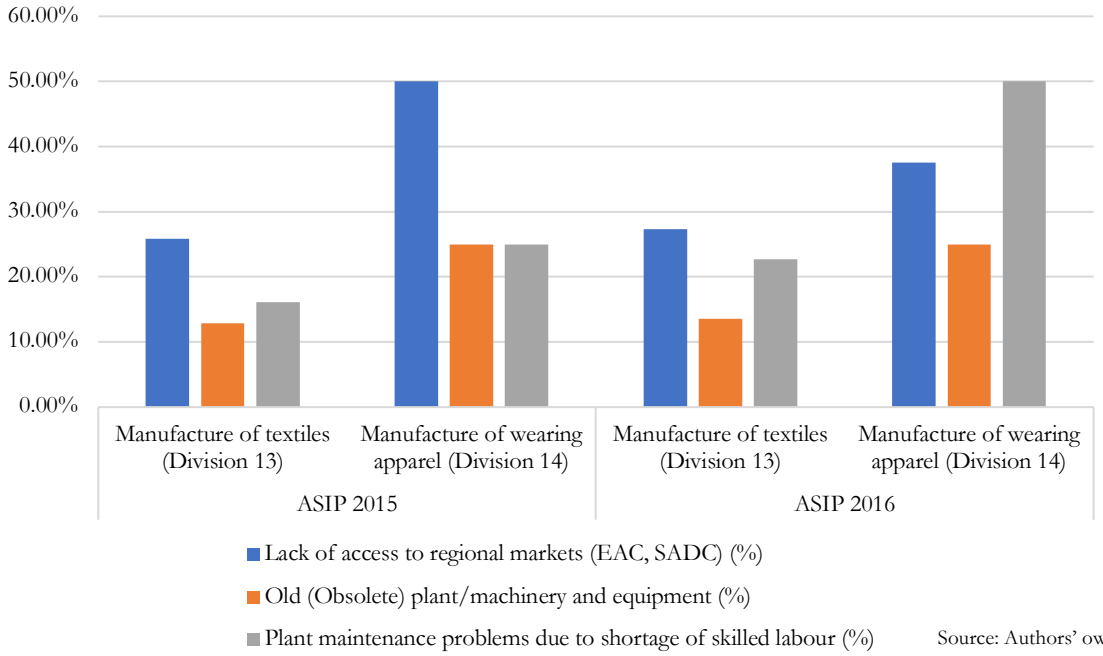
According to evidence from the ASIP rounds, Tanzanian firms in the textiles and cotton apparel industries are primarily owned by nationals (*Appendix Table A*), and only a very small proportion (16% on average) have foreign ownership. Around 69% of the businesses operating in the textiles sector employ less than 100 workers, whereas the percentage increases to 84% when we move to those in the apparel production. The former sector appears also to be characterized by a significant proportion (around 20%) of sizeable firms, employing between 100 and 499 workers. If we look at the average number of regular employees, which ranges from 178 to 264 workers, it is clear that both sectors are marked by a skewed distribution of firm size, with a handful of large companies with a massive labour force. Operatives (skilled and non-skilled) form the bulk of the employees (65-78%) and, on average, more than half of the staff have completed secondary education.

It is interesting to see that, in both rounds of the survey, the lack of access to regional markets has been highlighted by a substantial proportion of firms (on average around 35%) as a major reason for capacity under-utilization (*Figure 2*). Lack of access to international markets (not depicted below) is considered to be of importance for capacity under-utilization only by about 13-18% of the firms – indicating perhaps a

[7] As an example, in 2013 Tanzanian exports of Cotton-to-Clothing goods (e.g. yarn, fabric, apparel, home textiles & carpets) were valued at US$ 247.7 million, which is significantly less than the US$ 377 million exported by Kenya (ITC, 2015).

lack of information on accessing markets further away. Moreover, exporting firms mentioned tariffs (on average 57% of them) and customs and administrative entry procedures (53%) among the three main obstacles to expanding towards international markets. This last finding seems to suggest the potential for policy interventions – esp. the importance of non-tariff measures that could ease the perceived barriers.

Figure 2: Reasons for Capacity under-utilization in Tanzanian textiles and apparel sector



Source: Authors' own elaboration.

In addition, inadequate equipment and plant maintenance problems due to shortage of skilled labour also appear to play a significant role in the sluggish growth of the sectors. These latter factors in particular might be suggestive of a lack of production capabilities, which are crucial conditions for the effective adoption and implementation of new processes and products. The ASIP rounds of survey did not find compelling evidence that points *lack of access to international markets* as a highly important factor for under-utilisation of installed capacity – the highest figure is not larger than 19% of respondent firms.

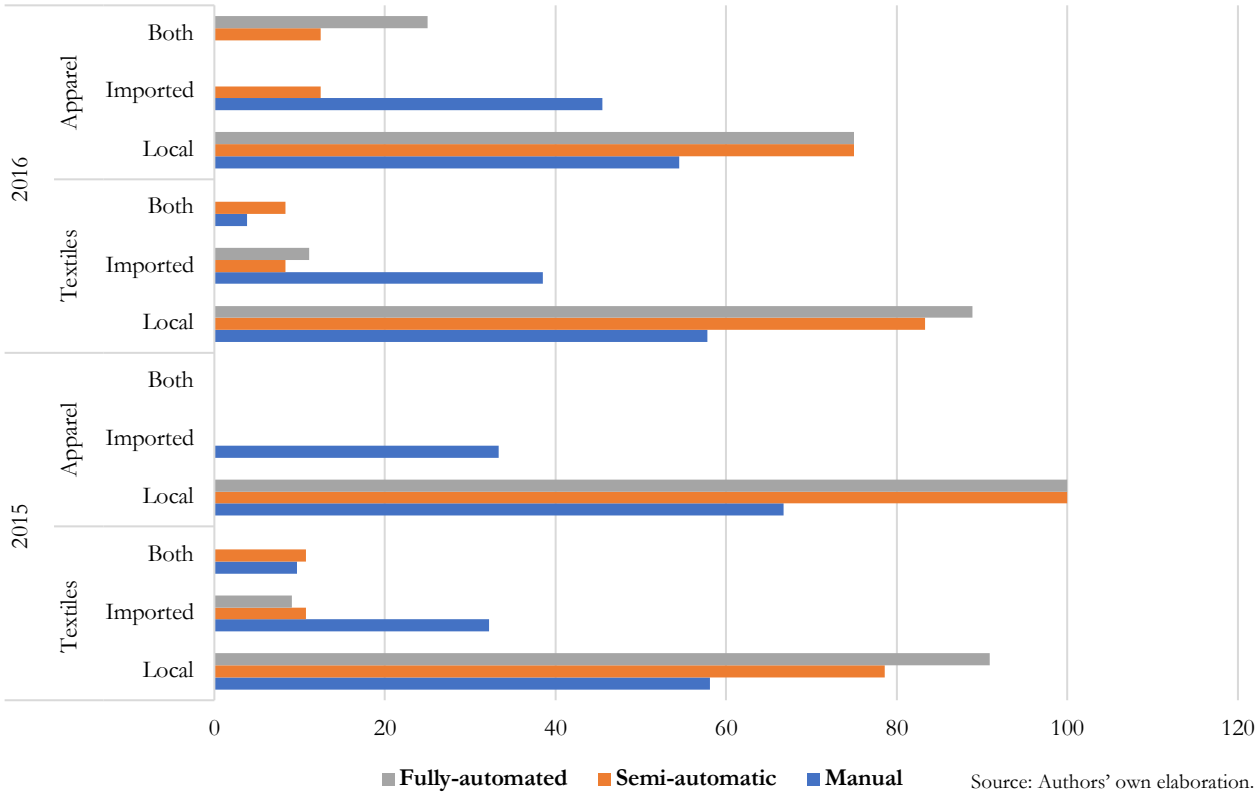
4.1. Technology and Knowledge Adoption

To evaluate the absorptive capacity of the industry, we begin with a better understanding of the local technological frontier and the prior knowledge available to these firms. With respect to the types of technologies being adopted (

Appendix Table B), we observe that firms mainly operate with manual and semi-automatic machineries. However, what is interesting is that a substantial proportion of manual technologies are being imported (35-39%). Disaggregating into textiles and apparel (*Figure 3*), we find that in textiles, about 90% fully automated machines were locally sourced in both 2015 and 2016. The main sources of machineries are

countries from the Global South, especially China and India. This seems to reflect a specific feature of developing South-South cooperation: characterized by the exchange of technologies that are more suited to the local context and capabilities (Hanlin and Kaplinksy, 2016).

Figure 3: Sources of Machinery in Tanzanian Textiles and Apparel



Source: Authors' own elaboration.

In terms of proxies for capabilities (*Appendix Table C*), we see that around 50% of the firms offer on the job training to their employees. However, managerial, professional, semi-professional and clerical staff appear to be relatively less targeted compared to skilled operatives. The lack of a trained administrative cadre might impair the ability to successfully assess the potential opportunities offered by new technologies, with adverse consequences on the innovative and absorptive capacity of these firms (H1). Hence, while imported intermediates can have a positive effect on firms' productivity, the effect varies with absorptive capacity as in hypothesis 2. Examining the R&D activities of firms (*Appendix Table D*), we find that the main research and development activities being performed are as follows:

Manufacture of textiles:

- Product standards quality improvement;
- Machines software re-programming.

Manufacture of wearing apparel:

- Maintenance, repair and operations (MRO);
- Technology commercialization & market development.

Firms do R&D related predominantly to product quality improvement and MRO items, but only few firms have their own R&D laboratory and the share of personnel devoted to this task is still quite low, ranging from 0-8% of the total number of regular employees. This can be a long run constraint, as low levels of R&D investment may cause an extremely high dependence on imported intermediates, potentially slowing down the establishment of its own local innovation network, which is crucial to upgrade in the value chain for key products. There is evidence in the literature about the importance of developing countries producing inputs and other intermediate products, instead of solely focusing on exporting final products, usually with low processing (Stiglitz & Greenwald, 2015; Hausmann & Hidalgo, 2011). Of course, this needs to be balanced against the short- and medium-term demand of local industries for high quality inputs in order to achieve an internationally competitive productivity level. Nevertheless, looking closer, we notice that more than 45% of the businesses do have investment plans and a substantial fraction of these investments (around 46%) are targeted to technology upgrading, which suggests that there is certainly a demand for technological change in these sectors. However, this demand might not be adequately supported by the existing structure of R&D linkages, both in terms of private and public partnerships.

4.2. Existing Linkages – domestic and foreign

Next, we examine firm linkages (Appendix Table E) – the pattern that emerges from our secondary data shows clear opportunities for improvement. The share of businesses that have collaborations with public technology intermediaries (the Tanzania Bureau of Standards and the Small Industries Development Organization predominantly) does not seem particularly high (21-36%). This appears to be due to the lack of awareness of the services provided (62-68%), a gap that can be easily targeted by policy interventions. Public institutions mainly provide training for employees and support on the process and operational side. On the other hand, R&D partnerships with private organizations are mostly based on product development, a key component of technological change, but this appears to be extremely low (<10%). Thus, it is clear that firms operating in this industry would also benefit from incentives enhancing R&D cooperation with private partners.

Moving to a different channel, we also examine the exchange of foreign intermediate and capital goods (*Appendix Table F*). We notice that, when focusing on the manufacture of textiles, the average share of imported capital goods and raw materials is not particularly high (around 20 and 24%, respectively), but the main sources of these inputs are again partners from the Global South, especially India and China. Thus, these already existing channels present potential to further develop collaborations towards meeting

other technology and knowledge gaps. Exploring trade linkages, we observe that very few firms interviewed are exporting or export large shares of their output. Export shares are low for both textiles and apparel (around 16 and 7%, respectively), and according to the ASIP 2015 and 2016, for those firms which export more than 50% of their total output, a considerable share is from firms that can be considered large for the Tanzanian economy, i.e. more than 100 workers[8]. These are strong signals of relatively lower competitiveness in the global markets, with broader consequences for the domestic economy: lower productivity.

Literature suggests differences in the characteristics of firms that export from those that do not-specifically, exporters tend to be larger and more productive (Greenaway, et al, 2005). However, empirical evidence also suggests here is some consensus that exporters are more productive before they start exporting, and learning from exporting is quite limited (Melitz, 2003). Spray (2018) has evidence for Uganda – an East African country that has an economy similar to Tanzania – that exporting firms tend to have higher productivity and generate more well-paid jobs. This is not surprising as exporting may enable learning-by-doing such that firms must earn foreign customer demand, overcome the bureaucratic procedures required for exporting, and learn what their competitors are selling to the international markets, to outperform them. In our context, a major constraint to exporting (specifically in terms of meeting potential demand in the short run), at least in terms of access to regional markets, appears to be supply capacity, especially for the manufacturing of textiles.

Main barriers to regional markets:

- Inadequate supply capacity;
- Customs and administrative entry procedures;
- Limited promotion;
- Inability to meet delivery time.

This highlights the need for a productivity boost to support an export-led development strategy for textiles. Notwithstanding the crucial role played by exports, it is important to emphasize that not all types of exporting necessarily leads to economy-wide productivity increase (Stiglitz and Greenwald, 2014). The main reason being the dependence on the technology intensity of the product or service exported; what are the forward and backward linkages to the domestic economy; and what are the learning spillovers that a firm exposed to international trade can bring back to the domestic economy? Thus, to assess the spillover

[8] More specifically, in the ASIP 2015, for those firms for which exports constitute more than 50% of total sales, 100% of them had more than 500 employees in division 14 (although this is just one firm) and around 57% have more than 100 workers in division 13. In the ASIP 2016, for the same type of exporters, 100% of them had more than 500 employees in division 14 (again only 1 firm) and 50% have more than 100 workers in division 13.

potential of exporting, and more generally technology and knowledge adoption at the local level, it is necessary to understand the dynamics of the interactions between domestic firms, mapping the connections that characterize the textiles and cotton apparel industries in Tanzania. Unfortunately, there is not much that we can infer from our secondary dataset about the local network structure of this sector (*Appendix Table G*). We only observe a moderate affiliation to industry associations (42%), with the main organization of membership being the Confederation of Tanzania Industries (around 70%). The primary data collected for this study allows us to further investigate the existing relationships between the textiles and cotton apparel firms in the national context, shedding more light on the types and intensity of interactions between these economic agents.

5. Examining Technology demand and South-South linkages

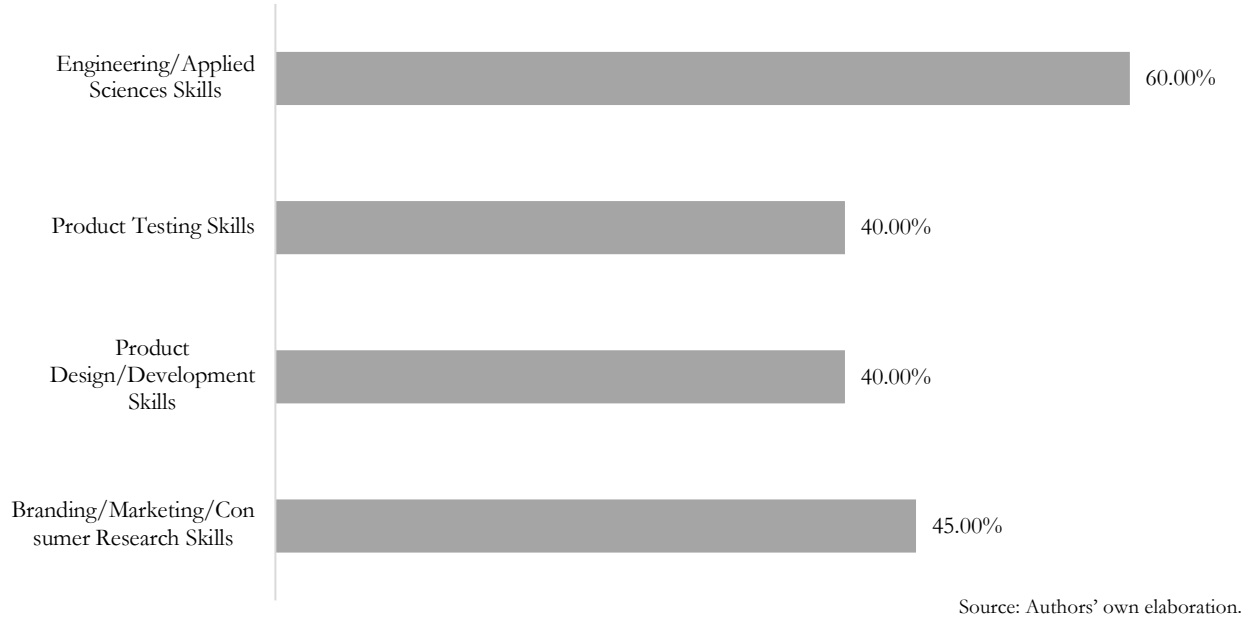
In this section, we examine technology demand and South-South linkages in Tanzania's textiles and cotton apparel industry using the primary data collected with the structured survey. We begin by drawing a comparison of our sample with that of the ASIP survey to check for external validity of our primary data. Firms in our sample are broadly comparable in terms of employment size (*Appendix Table H*) to those in the ASIP survey. 55% of our sample of firms employed less than 100 workers and 20% of them employed between 100 and 499 workers in 2018-2019. These proportions are comparable with the ASIP figures, with the exception that our firms are characterized by a higher proportion of large firms, employing more than 500 workers (25%, in 2018-2019), as also highlighted by the average number of permanent, full-time employees (494). This is to be expected, since periodic surveys conducted by national statistical offices tend to encompass larger samples.

The characteristics of the labour force in our sample are also comparable with the ASIP data. About 77% of the full-time, permanent workers are engaged in production (a figure close to the share of operatives in the ASIP rounds) and around 61% of full-time employees completed secondary education. In terms of ownership, businesses operating in this sector are predominantly national. In our sample, only 20% of the firms have a non-Tanzanian largest owner (mostly from China). The firms are mainly involved in the production of clothing and accessories for end consumers (around 74%). However, the firms report a rather low capacity utilization (on average, around 56%) which, in the absence of a crisis of insufficient aggregate demand, constitutes a strong signal that firms in these sectors are underperforming and they are not exploiting their full productive capacity.

Examining the characteristics of the labour force in the Tanzanian sample (*Figure 4*), it is interesting to note that on average, over the past 5 years, about 40-60% of the firms have hired workers with skills that are crucial for developing technological capabilities (e.g. branding, product design and testing,

engineering). These skills have also been actively outsourced, especially true for individuals with branding, marketing or consumer research skills, with 44% contracted from outside the business. The demand for skilled works *suggests a strong demand for technological change* (H2) that we explore further in the next section.

Figure 4: % Firms that Employed Individuals with key characteristics of (Past 5 years)



Source: Authors' own elaboration.

5.1. Technology & Knowledge - Innovations

We now extend the analysis to uncover the features of the innovation-related activities undertaken by these firms, shedding more light on the absorptive capacity of the sector. We find that a rather high share of firms provided formal training to their permanent employees (around 90%) in the past 5 years (*Appendix Table I*). However, as previously highlighted in the ASIP rounds, non-production workers (e.g. administrative staff) are disproportionately less targeted than the production ones (59% compared with 89%). This might represent an important constraint, which could hinder the improvement of relevant technological capabilities within the industry, as the training of managerial staff is crucial to identify the benefits of investment opportunities in new technologies and thus the development of the business' absorptive capacity.

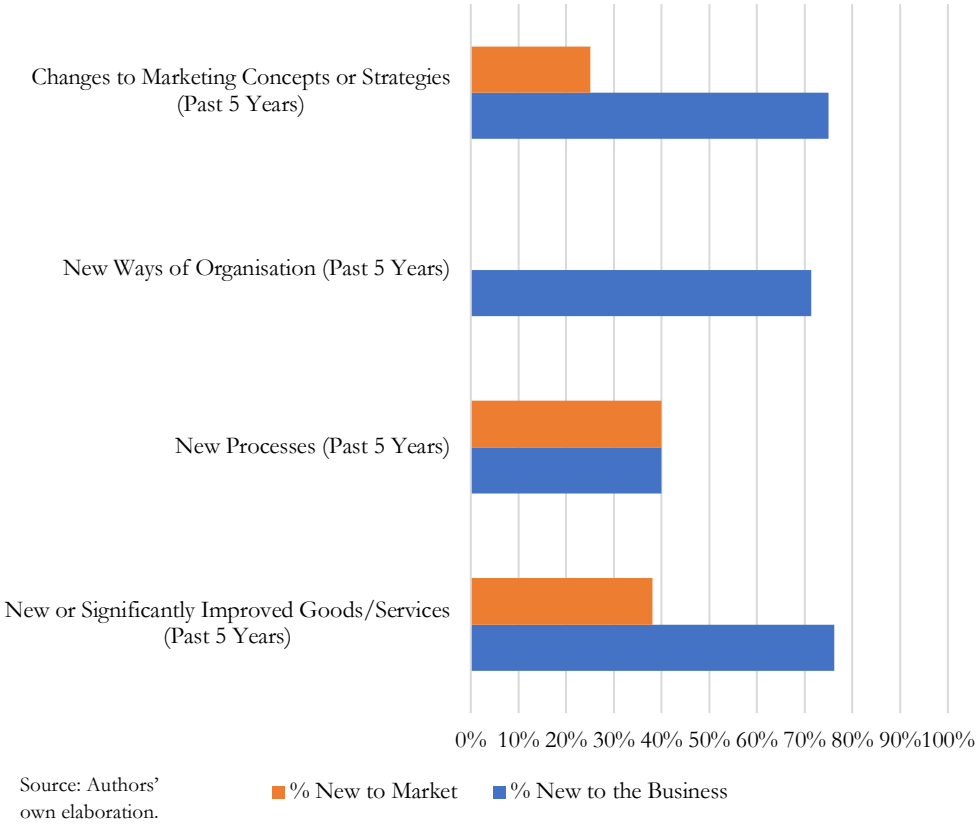
Our first hypothesis that that transfer of foreign knowledge is effective when there is sufficient demand for technology and corresponding support for local capacity building – an affirmation as a further signal of demand for technological change (H2). We observe that a *substantial fraction of companies are currently investing in new forms of knowledge or technology* (65%), the main type of investment being the purchase of new

capital equipment (73%). In terms of innovation-related activities undertaken in the past 5 years, the leading ones are:

- Training for introduction of innovations (50%);
- Learning by doing (45%);
- Internal research and development (40%).

In addition, on average, around 59% of the firms investing in those activities are planning to increase the allocated budget in the near future. When we look at the actual types of innovations introduced by the companies, we notice that these are predominantly new or improved products (50%), which are usually developed within the business (82%) and new forms of organizations (35%), mainly new methods of organizing work responsibilities (83%). It is interesting to observe that for both these two types of innovations, and for all types (*Figure 5*), these tend to be new for the business (76% for products, 71% for ways of organization), but only a rather small fraction of them tends to be new for the market (38% for products, 0% for ways of organization).

Figure 5: Types of Innovations by Tanzanian Textiles & Apparel firms (past 5 years)



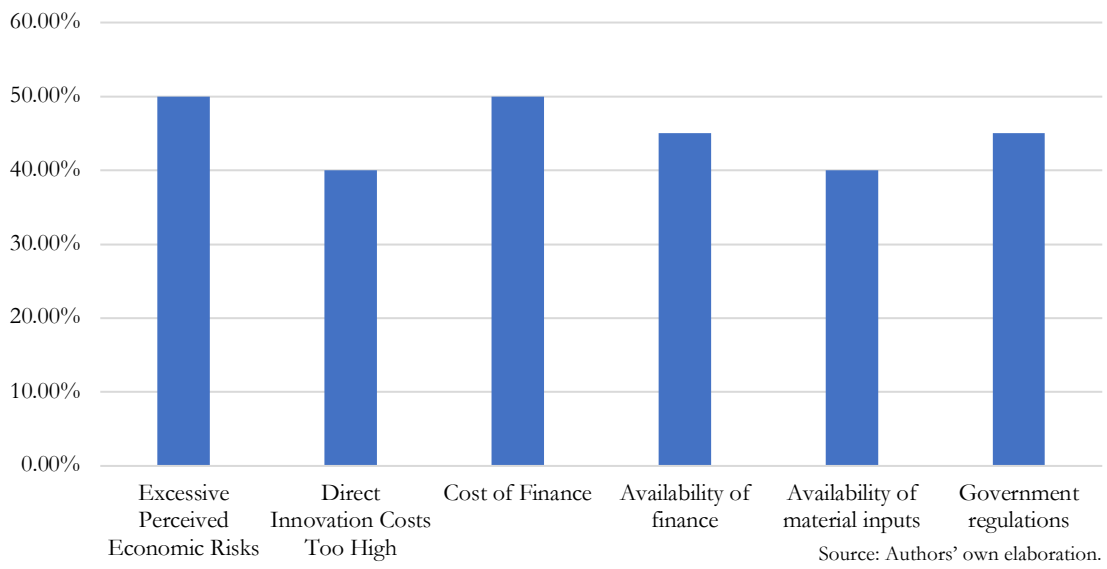
Source: Authors' own elaboration.

The pattern of adopting technologies in the market suggests that firms are adopting forms of knowledge already available in the market, a strategy that can be symptomatic of difficulties in developing own innovation systems. This is to be expected, given the character of low-income of Tanzania's economy. To further explore this issue, we investigate the main drivers and constraints of innovation activities in this industry.

5.2. Factors explaining innovations in Tanzanian textiles

To gain more insights into the factors shaping the absorptive capacity and demand for technological change in the textiles and cotton apparel sector, it is crucial to analyse the main drivers and constraints to innovation activities that firms are facing. Looking at the past 3 years (*Appendix Table J*), the major barriers perceived by firms appear to be (*Figure 6*): Excessive economic risks (50%); costs of finance (50%); and government regulations (45%).

Figure 6: Major barriers to Innovation in Tanzanian Textiles



Source: Authors' own elaboration.

Hence, the central government can play a pivotal role in addressing these concerns. As a matter of fact, often developing countries lack appropriate formal bodies, formal rules and regulations, and also lack of enforcement, if those are formally present, that provide a stable and conducive environment in which innovation can thrive (North, 2009). Conducive innovation systems and modern institutional and governance structures are necessary to set the right conditions that incentivise investments in innovation activities.

Moving to the most salient factors that guide a firm's decision to innovate (*Table 1*), we observe that these are mainly based on product quality enhancement (60%), increased productive capacity (65%) and

concerns regarding health and safety regulations (70%), which are likely to be related to compliance with mandatory standards. In terms of sources of information for innovation activities, we see that the leading channels are within the same business or enterprise group (70%). However, a nontrivial fraction of companies stressed the role played by partners from the private sector (50%), which highlights the relevance of these actors as medium for knowledge exchange.

Table 1: Factors for firm's decision to innovate and sources of innovation

Most Important Factors in Firms' Decision to Innovate in the Past 3 Years	*Most Important Sources of Information for Firms' Innovation Activities in the Past 3 Years (Rated as "High")*
• Improving Quality of Goods or Services • Improving Capacity for Producing Goods or Services • Reducing Costs per Unit Produced or Provided • Improving Health and Safety • Reducing Environmental Impacts • Replacing Outdated Products or Processes	• Within your Business or Enterprise Group • Suppliers of Equipment, Materials, Services or Software • Clients or Customers from the Private Sector • Clients or Customers from the Public Sector • Consultants, Commercial Labs or Private R&D Institutes • Conferences, Trade Fairs or Exhibitions

Indeed, a broader set of connections has been mentioned as one of the key types of support firm's demand (60%), together with availability of skilled workers (80%) and training (75%). These last two factors appear to be a clear signal of a lack of production capabilities: those operative skills that are crucial to the effective implementation of new technologies and processes in the industry. In addition, the need for a stronger network calls for a deeper analysis of the dynamics of interactions between companies at the local level, which we will address in the next section.

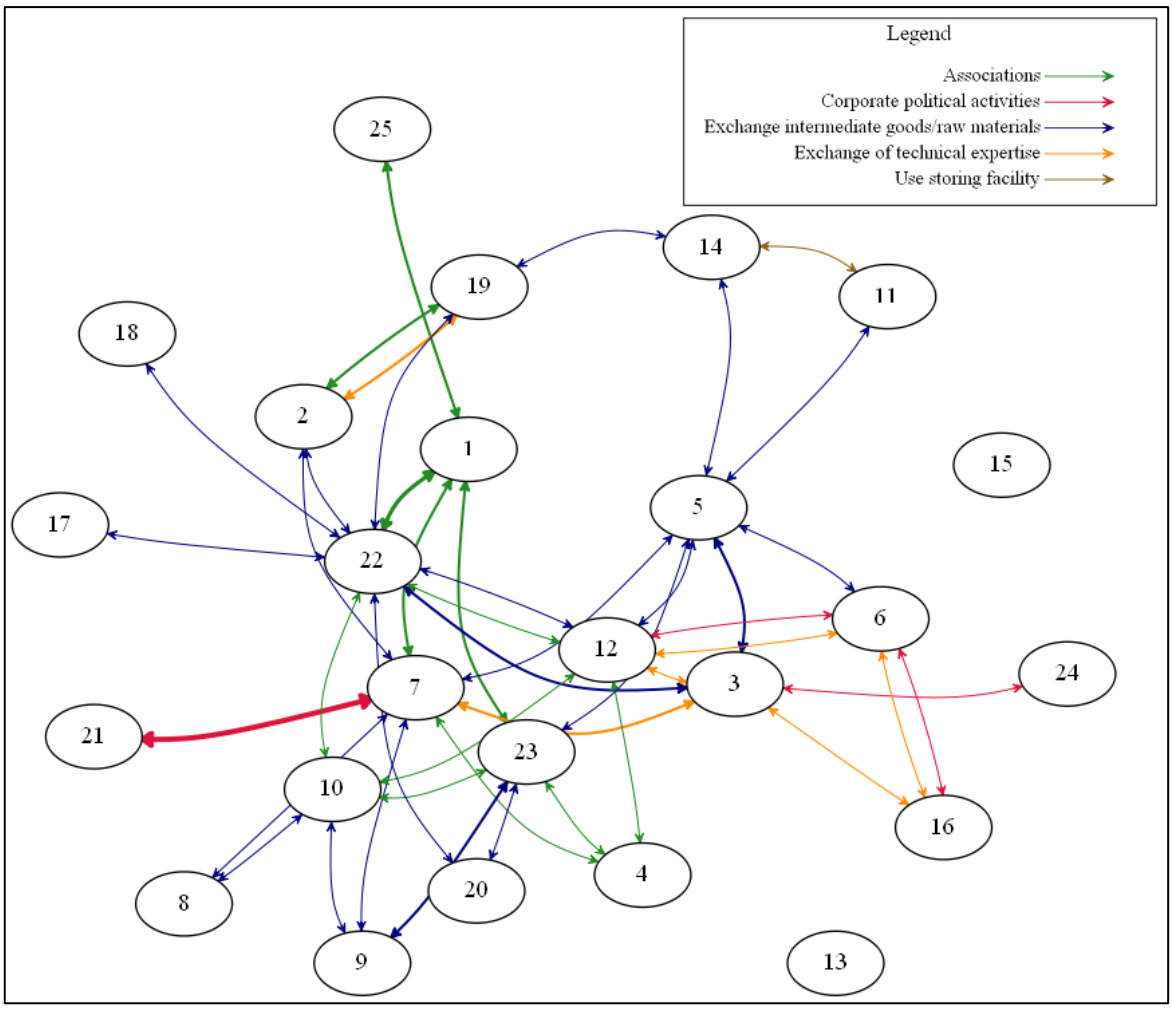
5.3. Linkages- Local Networks & Foreign

The novel data from our survey allows us to explore the pattern of connections that firms operating in these sectors share, gaining insights into the linkage capabilities that these companies have developed within the domestic economy. *Figure 7* shows the local network structure for the Tanzanian textiles and apparel sector based on firm responses in our sample. Each node denotes a firm and each edge a link, where a different colour stands for a different type of interaction. The width of the edge represents the intensity of the interaction, captured by its frequency, ranging from less than once a month to a weekly basis. From the network, it appears evident that the large majority of interactions are based on the exchange of intermediate goods or raw materials (49%), followed by connections made through associations (27%) and exchange of technical expertise (13%). However, these interactions are quite different in their frequency. If exchanges of intermediates occur predominantly less than once a month (86%), 41% of the contacts made through associations occur on a monthly basis or more frequently. In addition, the network seems to exhibit two major hubs (company 22 and 12), however they appear to be quite different in their nature. The types of connections shared by company 22 are mainly related to the

exchange of intermediates, whereas company 12 shows a more diverse set of interactions with the other firms, including also corporate political activities and exchange of technical expertise.

From the network analysis, it is clear that the exchange of intermediate goods or raw materials represents the prevalent channel of interaction between companies at the local level. If this is indeed the case, it is crucial to get a better understanding of the broader linkages that these firms share outside the country. Trade can actually play a pivotal role in innovations and technological change: imports of intermediate and capital goods, embodying foreign knowledge and expertise, might further propagate in the domestic domain through the network presented below.

Figure 7: Network of local linkages between Tanzanian textile and apparel firms



Source: Authors' own elaboration.

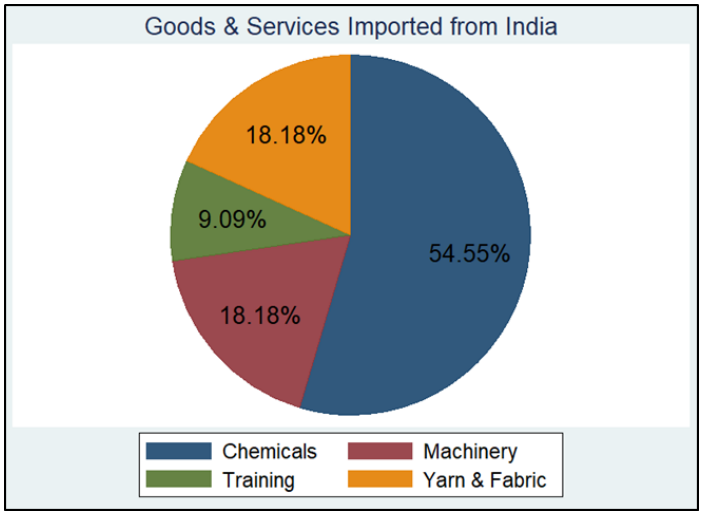
As in the data from the ASIP rounds, the export performance of firms in our sample is quite poor (*Appendix Table K*). The main reference market for firms' products is either local or national (75%) and national sales, on average, account for 68% of the total sales. For those that predominantly export, the leading trade partner appears to be the US (60%). Material inputs exhibit the same pattern, coming largely

from the domestic market (79%). However, it is interesting to notice that, for those companies that have some foreign supplies, the main countries of origin are partners from the Global South, namely India (67%) and China (67%). In addition, for these firms, the share of material inputs imported from those two countries is quite relevant (on average around 28%). Hence, this confirms hypothesis 3 on the potential for South-South partnerships.

Moving to capital goods, we see that in 2018-2019 the majority of companies in our sample purchased either new machineries (55%) or equipment (80%), which were largely imported (91% and 63%, respectively). When we look at the leading trade partners, we find that, for both machineries and equipment, the major sources are again India (30%) and China (50%). As for the ASIP rounds, we have found evidence that there are already existing South-South partnerships that could be further developed, promoting the exchange of capital goods between these countries, as these technologies appear to be more affordable and accessible and thus likely to meet the needs of the textiles and cotton apparel industries in the Tanzanian context. In addition, the knowledge embodied in these technologies can further spread in the domestic economy through the local network between firms and the exchange of intermediate goods. Focusing on our main trade partner of interest, India, we can take a closer look to the actual products exchanged. *Figure 8* shows the basket of goods and services imported from India by our Tanzanian sample firms, *affirming hypothesis 4 that South-South technology transfers comprise simple technology and knowledge exchanges that are context-specific.*

- Intermediate chemical products represent the largest share (55%) and they are mainly related to the dyeing process,
- Primary type of training provided by Indian partners concerns the printing procedures.
- In terms of capital goods, the key technologies imported are paper bag and weaving machines, for which on average Tsh. 261 million were spent.

Figure 8: Tanzanian Imports from India – primary data



Source: Authors' own elaboration

6. Conclusions and Policy Recommendations

Examining the demand for technology in Tanzania's textiles and apparel sector and the role of India's technology transfer, we conclude with a series of key policy messages that can be useful to direct the future of Tanzania's industrial policy as well as direct further South-South cooperation and investment programmes:

- The types of innovations introduced by the firms are predominantly new or improved products developed within the business or new methods of organizing work responsibilities, and are *new for the business, but rarely new for the market*.
- The main research and development activities performed by textile firms are *product standards quality improvement and machines software re-programming*; while apparel firms do maintenance, repair and operations (MRO); and technology commercialization & market development.
- Tanzanian textiles and apparel sector firms mainly operate with manual and semi-automatic machineries, and is *importing substantial manual technologies from the Global South*, especially China and India.
- The major barriers perceived by firms are the *excessive economic risks, the costs of finance, and government regulations*. The central authority can play a pivotal role in addressing these concerns.
- Firm's decision to innovate are mainly based on *product quality enhancement, increased productive capacity* (and concerns regarding health and safety regulations, which are likely to be related to compliance with mandatory standards.
- Leading channels of information for innovation are *within the same business or enterprise group*, however, a fraction of companies stressed the role played by partners from the private sector.
- Exchange of *intermediate goods or raw materials represents the prevalent channel of interaction* between companies at the local level.

- Main *barriers to regional markets include*: Inadequate supply capacity; customs and administrative entry procedures; limited promotion; and inability to meet delivery time.
- Export shares are low for both textiles and apparel, a *signal of relatively lower competitiveness* in the global markets, with broader consequences for the domestic market.
- The average share of imported capital goods and raw materials is not particularly high for textiles, but the main *sources of these inputs are India and China*, presenting the potential to further develop collaborations towards meeting other technology and knowledge gaps, including with other developing countries.

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Appendix

I. Secondary data tables (ASIP)

Appendix Table A: Firm characteristics from ASIP Surveys – 2015, 2016

		ASIP 2015		ASIP 2016	
		Manufacture of textiles (Division 13)	*Manufacture of wearing apparel (Division 14)*	*Manufacture of textiles (Division 13)*	*Manufacture of wearing apparel (Division 14)*
Observations		50	13	42	18
Origin of Ownership	National	70.0%	84.6%	73.8%	83.3%
	Foreign	18.0%	15.4%	21.4%	11.1%
	Joint	12.0%	0.0%	4.8%	5.6%
Employment Size (%)	10-19	42.0%	61.5%	42.9%	66.7%
	20-49	14.0%	23.1%	14.3%	11.1%
	50-99	12.0%	0.0%	11.9%	5.6%
	100-499	20.0%	7.7%	21.4%	5.6%
	500+	12.0%	7.7%	9.5%	11.1%
Average Number of *Regular Employees*	Tanzanian	256	211	174	185
	Foreign	8	2	4	3
% Employees					
Managerial, professional, semi-professional and clerical staff (%)		16.5%	18.8%	11.9%	18.4%
Operatives -skilled (%)		42.9%	39.5%	44.3%	47.6%
Operatives -non skilled (%)		31.3%	25.2%	33.8%	21.5%
Employees that have completed secondary education (%)		58.4%	53.6%	52.4%	51.0%
Reasons for under-utilization of capacity (rated as "High")					
Lack of access to regional markets (EAC, SADC) (%)		25.8%	50.0%	27.3%	37.5%
Old (Obsolete) plant/machinery and equipment (%)		12.9%	25.0%	13.6%	25.0%
Plant maintenance problems due to shortage of skilled labour (%)		16.1%	25.0%	22.7%	50.0%

Appendix Table B: Innovation from ASIP surveys

		ASIP 2015					ASIP 2016					
		Manufacture of textiles (Division 13)			*Manufacture of wearing apparel (Division 14)*		*Manufacture of textiles (Division 13)*			*Manufacture of wearing apparel (Division 14)*		
Current Plant *Technology Status* (Average %)	Manual	43.9%			57.1%		43.8%			50.1%		
	Semi-automatic	42.8%			24.5%		43.0%			31.0%		
	Fully-automated	13.3%			18.4%		13.2%			18.9%		
Current Plant *Technology Status: Source* (%)*	Manual	58.1% (L)	32.2% (I)	9.7% (B)	66.7% (L)	33.3% (I)	57.8% (L)	38.5% (I)	3.8% (B)	54.5% (L)	45.5% (I)	0.0% (B)
	Semi-automatic	78.6% (L)	10.7% (I)	10.7% (B)	100.0% (L)	0.0% (I)	83.3% (L)	8.3% (I)	8.3% (B)	75.0% (L)	12.5% (I)	12.5% (B)
	Fully-automated	90.9% (L)	9.1% (I)	0.0% (B)	100.0% (L)	0.0% (I)	88.9% (L)	11.1% (I)	0.0% (B)	75.0% (L)	0.0% (I)	25.0% (B)
Country of origin main machinery and other equipment (%)	Manual	China (46.0%), India (8.0%)			China (33.3%), India (16.7%)		China (41.7%), DPRK (8.3%)			China (47.1%), UK (5.9%)		
	Semi-automatic	China (30.8%), India (23.1%)			China (42.9%), India (14.3%)		China (42.4%), DPRK (18.2%)			China (25.0%), Japan (25.0%)		
	Fully-automated	China (28.6%), India (28.6%)			China (25.0%), Germany (25.0%)		China (38.5%), India (23.1%)			Germany (40.0%), US (20.0%)		

*: L: Local, I: Imported, B: Both.

Appendix Table C: Training for employees – ASIP data

	ASIP 2015		ASIP 2016	
	Manufacture of textiles (Division 13)	*Manufacture of wearing apparel (Division 14)*	*Manufacture of textiles (Division 13)*	*Manufacture of wearing apparel (Division 14)*
On the job training to employees (%)	56.0%	53.8%	52.4%	38.9%
Training's target:				
Managerial, professional, semi-professional and clerical staff (%)	35.7%	57.1%	45.4%	28.6%
Operatives -skilled (%)	78.6%	71.4%	72.7%	57.1%

Appendix Table D: R&D Capacities of firms – ASIP

	ASIP 2015		ASIP 2016	
	Manufacture of textiles (Division 13)	*Manufacture of wearing apparel (Division 14)*	*Manufacture of textiles (Division 13)*	*Manufacture of wearing apparel (Division 14)*
Laboratory for research and development (%)	16.0%	0.0%	16.7%	11.1%
Average number of *employees focused* on R&D activities	11	0	14	12
Main research and development *activities* performed (%)	Product standards quality improvement (24.0%), Machines software re-programming (22.0 %)	Maintenance, repair and operations (MRO) (30.8%), Technology commercialization & market development (15.4%)	Product standards quality improvement (23.8%), Machines software re-programming (23.8 %)	Maintenance, repair and operations (MRO) (27.8%), Technology system development (16.7%)
Any investment plan (%)	50.0%	46.1%	42.9%	44.4%
Target of planned investment: Technology upgrading	48.0%	50.0%	50.0%	37.5%

Appendix Table E: Technology Linkages – ASIP data

	ASIP 2015		ASIP 2016	
	Manufacture of textiles (Division 13)	*Manufacture of wearing apparel (Division 14)*	*Manufacture of textiles (Division 13)*	*Manufacture of wearing apparel (Division 14)*
Collaboration with public technology intermediaries (%)	36.0%	30.8%*	35.7%	11.1%*
Main public partners (%)	Tanzania Bureau of Standards (61.1%), Weights and Measurement Agency (61.1%)	Small Business Development Organisation (50.0%), Weights and Measurement Agency (25.0%)	Tanzania Bureau of Standards (66.7%), Weights and Measurement Agency (66.7%)	Weights and Measurement Agency (50.0%), Small Business Development Organisation (50.0%)
Main types of cooperation (%)	Process and Operational improvements (66.7%), Product quality improvement (61.1%)	Training for employees (25.0%)	Process and Operational improvements (73.3%), Product quality improvement (66.7%)	Training for employees (50.0%)
Main reasons for no cooperation (%)	Lack of awareness of the institution/services	Presence of most competitive	Lack of awareness of the institution/services	Lack of awareness of the institution/services offered

	offered (62.5%), No need for the provided services in the reference period (50.0%)	private providers of the same services (66.7%), No need for the provided services in the reference period (66.7%)	offered (74.1%), No need for the provided services in the reference period (40.7%)	(62.5%), Presence of most competitive private providers of the same service (50.0%)
Collaboration with private companies in R&D activities (%)*	8.0%	15.4%	7.1%	5.6%
Main types of cooperation (%)*	New products development (75.0%), New products commercialization and marketing (75.0%)	New products development (50.0%)	Product components development (100.0%), New products commercialization and marketing (100.0%)	Product components development (100.0%), Sourcing/purchasing activities (100.0%)

*: Small sample.

Appendix Table F: Exchange of foreign intermediate and capital goods - ASIP

	ASIP 2015		**ASIP 2016**	
	Manufacture of textiles (Division 13)	*Manufacture of wearing apparel (Division 14)*	*Manufacture of textiles (Division 13)*	*Manufacture of wearing apparel (Division 14)*
Average share of imported capital goods (over total purchased) (%)*	21.8%	13.1%	16.9%	15.0%
Main countries of origin (CG) (%)	India (35.0%), China (30.0%)	UK (66.7%)	China (22.2%), India (16.7%)	UK (50.0%)
Average share of imported raw materials and components (over total purchased) (%)*	23.6%	0.0%	24.3%	6.5%
Main countries of origin (RM) (%)	China (30.0%), India (20.0%)	N/A	India (35.7%), China (21.4%)	India (28.6%)
Average share of sales from exported production (over total sales) (%)	14.8%	7.7%	17.0%	5.5%
Main barriers to regional markets (%)**	Inadequate supply capacity (42.9%), Customs and administrative entry procedures (21.4%)	Limited promotion (33.3%), Inadequate supply capacity (33.3%)***	Inadequate supply capacity (60.0%)	Inability to meet delivery time (50.0%), Limited promotion (50.0%)***

*: Missing values are encoded as 0; **: Not Applicable omitted; ***: Small sample.

Appendix Table G: Association membership from ASIP data

	ASIP 2015		**ASIP 2016**	
	Manufacture of textiles (Division 13)	*Manufacture of wearing apparel (Division 14)*	*Manufacture of textiles (Division 13)*	*Manufacture of wearing apparel (Division 14)*
Membership to any association (%)	44.0%	46.1%	40.5%	38.9%
Main associations (%)	Confederation of Tanzania Industries (72.7%), Tanzania Chamber of Commerce, Industry and Agriculture (50.0%)	Confederation of Tanzania Industries (66.7%), Tanzania Chamber of Commerce, Industry and Agriculture (50.0%)	Confederation of Tanzania Industries (70.6%), Association of Tanzania Employers (53.0%)	Confederation of Tanzania Industries (71.4%), Tanzania Chamber of Commerce, Industry and Agriculture (71.4%)

II. Primary data tables

Appendix Table H: Firm characteristics-primary survey

Observations		20	
Main Products & Activity		%	
Main products: Clothing and Accessories for End Consumers (2018-2019)		73.6%	
Main Product as % of Total Sales (2018-2019)*		89.1%	
Main Activity:			
Knitting/Weaving		40%	
Dyeing or Printing		45%	
Sewing		40%	
Capacity			
Capacity Utilization (2018-2019)		56.1%	
Ownership			
Average % of Ownership by Largest Owner		69.7%	
% with Foreign Largest Owner		20.0%	
Foreign Largest Owner: Origin		China (75.0%), Kenya (25.0%)	
Employment		**2017-2018**	**2018-2019**
Employment Size (%)	<19	50.0%	45.0%
	20-49	0.0%	5.0%
	50-99	5.6%	5.0%
	100-499	22.2%	20.0%
	500+	22.2%	25.0%
Average Number of Permanent, Full-Time Workers		347	494
Average % of Permanent, Full-Time categorised as: (2018-2019)			
Production Workers		76.6%	
Non-Production Workers (e.g. Admin., Sales)		23.4%	
Completed Secondary School		61.4%	
% of Firms that Employed Individuals with (Past 5 years) – outsourced in brackets			
Branding/Marketing/Consumer Research Skills		45.0% (44.4%)	
Product Design/Development Skills		40.0% (12.5%)	
Product Testing Skills		40.0% (0.0%)	
Engineering/Applied Sciences Skills		60.0% (33.3%)	

*: Subsample of firms which selected as main product clothing and accessories for end consumers.

Appendix Table I: Knowledge and Technology adoption – firm responses

Formal Training Programs for Permanent, Full-Time Workers (%) (Past 5 Years)	89.5%			
Training Target				
Production Workers (%) (Past 3 Years)	89.1%			
Non-Production Workers (%) (Past 3 Years)	59.1%			
New Technology				
% of Firms which Currently Spend on any New Technology/Knowledge	65.0%			
Main Investment	Purchase of New Capital Equipment (72.9%)			
Main Reason not to Invest in Innovation	Discouraging Business Environment (57.1%)			
Innovation-Related Activities (Past 5 Years)	Training for Introduction of Innovations (50.0%), Learning by Doing (45.0%), Internal Research and Development (40.0%), Acquisition of Advanced Machinery, Equipment and Software for Innovation (35.0%)			
% of *Firms which will Increase the Budget for Innovation-Related Activities* (Next 2 Years)	Acquisition of Advanced Machinery, Equipment and Software for Innovation (85.7%), Training for Introduction of Innovations (70.0%), Learning by Doing (55.5%), Internal Research and Development (50.0%)			
		% Developed by the Business/Enterprise Group	% New to the Business	% New to Market
% of Firms which Introduced New or Significantly Improved Goods/Services (Past 5 Years)	50.0%	81.5%	76.2%	38.1%
% of Firms which Introduced New Processes (Past 5 Years)	25.0%	100.0%	40.0%	40.0%
		Type	% New to the Business	% New to Market
% of Firms which Introduced New Ways of Organisation (Past 5 Years)	35.0%	New Methods of Organizing Work Responsibilities (83.3%), New Business Practices for Organizing Procedures (71.4%), New Methods of Organizing Relationships with Other Organizations (66.7%)	71.4%	0.0%
% of Firms which Introduced Changes to Marketing Concepts or Strategies (Past 5 Years)	21.5%	Creating Brand Awareness (75.0%), Content Marketing (25.0%)	75.0%	25.0%
	New or Significantly Improved Goods/Services	New Processes	New Ways of Organisation	Changes to Marketing Concepts or Strategies
% of Firms with Innovation Activities Still Ongoing (End of June 2019)	35.0%	25.0%	25.0%	20.0%

Appendix Table J: Factors influencing Innovation activities – firm responses

	Excessive Perceived Economic Risks	*Direct Innovation Costs Too High*	*Cost of Finance*	*Availability of finance*	*Availability of material inputs*	*Government regulations*
Factors Constraining Innovation Activities in the Past 3 Years (Importance Rated as "High")	50.0%	40.0%	50.0%	45.0%	40.0%	45.0%
	Improving Quality of Goods or Services	*Improving Capacity for Producing Goods or Services*	*Reducing Costs per Unit Produced or Provided*	*Improving Health and Safety*	*Reducing Environmental Impacts*	*Replacing Outdated Products or Processes*
Most Important Factors in Firms' Decision to Innovate in the Past 3 Years (Rated as "High")	60.0%	65.0%	55.0%	70.0%	60.0%	55.0%
	Within your Business or Enterprise Group	*Suppliers of Equipment, Materials, Services or Software*	*Clients or Customers from the Private Sector*	*Clients or Customers from the Public Sector*	*Consultants, Commercial Labs or Private R&D Institutes*	*Conferences, Trade Fairs or Exhibitions*
Most Important Sources of Information for Firms' Innovation Activities in the Past 3 Years (Rated as "High")	70.0%	35.0%	50.0%	30.0%	25.5%	40.0%
	Finance	*Training*	*Collaboration*	*Stronger Network*	*More Exposure*	*Skilled Workers*
Type of Support Firms would Need for Innovation (Rated as "Very Important")	70.0%	75.0%	35.0%	60.0%	75.0%	80.0%

Appendix Table K: Linkages – primary survey

Main Market of Firms' Main Product (2018-2019)	20.0% Local, 55.0% National, 25.0% International (60.0% USA, 40.0% Canada)				
National Sales as Average % of Total Sales (2018-2019)	67.7%				
Average % of Material Inputs/Supplies of Domestic Origin (2018-2019)	78.6%				
	India		*China*		
Main Countries of Origin if Foreign (%) (2018-2019)	66.7%		66.7%		
Average % of Material Inputs/Supplies of Foreign Origin (2018-2019)*	23.1%		31.9%		
	Customs		*Trade and Regulations*		
Obstacle to the Firm's Current Operations (Rated as "Very Important")	10.0%		20.0%		
	2017-2018		2018-2019		
% of Firms which Purchased Machineries	25.0% (60.0% Imported)		55.0% (91.0% Imported)		
Main Countries of Origin if Imported	China (66.7%), India (33.3%), Taiwan (33.3%)		China (50.0%), India (30.0%), Taiwan (30.0%)		
% of Firms which Purchased Equipment	40.0% (62.5% Imported)		80.0% (62.5% Imported)		
Main Countries of Origin if Imported	China (80.0%), India (20.0%), Taiwan (20.0%)		China (50.0%), India (30.0%)		
% of Firms which Imported Intermediate/Raw Material	15.0%		45.0%		
Main Countries of Origin (Intermediate Goods)	India (100.0%), China (33.3%)		India (66.7%), China (41.7%)		
% of Firms which Purchased Advanced Machinery, Equipment and Software from Outside the Business (Innovation Investment)	40.0%				
Main Countries of Origin	China (50.0%), India (25.0%)				
	Ginning	*Spinning*	*Knitting/Weaving*	*Dyeing or Printing*	*Sewing*
Segment Targeted by Investment in Advanced Machineries	10.0%	15.0%	15.0%	15.0%	15.0%
Main Country of Origin	UAE (50.0%)	China (33.3%)	India (33.3%)	India (33.3%)	China (100.0%)

*: Subsample of firms which imported material inputs/supplies from the relevant country.

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