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Unlocking the potentials of Micro and Small Enterprises (MSEs) in building local technological capabilities in agro-processing industry

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ABSTRACT

This research was aimed at feeding into the quest for ways that would help advance Africa's effort to industrialize its economy. Empirical evidence suggests transforming the agro-industry and inserting MSEs into value chains is the most feasible strategy. Inspired by arguments against global value chains (GVCs) orientation of Africa's industrialization strategies, this research investigated the link between local production and technological capability in Africa using indicators from various international databases and cross-country quantitative analyses. The research also undertook an in-depth qualitative investigation on Ethiopia's edible oil industry as an important case capable of shedding some light on problems linked to Africa's agro-processing with a special focus on local production system and technological capability. The finding revealed strong positive linkages between local value chains and technological/innovation capabilities in Africa. Structural constraints, underdeveloped supply chains, and poor implementation and coordination of policies have limited Africa's capability to harness potentials inherent in the agro-processing sector.


KEYWORDS

Industrialization; agro-processing; value chain; local production; technological capability; Africa

1. Introduction

Africa constitutes the largest number of the world's least industrialized and less diversified economies. The commodity-intensive African economies are among the least integrated into the Global Value Chains (GVCs) and linkages in Africa's commodity sectors are relatively weak lagging behind other similar countries of Asia and Latin America (Morris and Fessehaie 2014). Agriculture dominates Africa's economy with its average contribution of about 60% to employment and 25% to Gross Domestic Product (GDP) while manufacturing makes only about 10% of GDP (Naudé 2017; AfDB, OECD, and UNDP 2014). Meanwhile, the productivity of Agriculture in African economies remained to be the lowest (Yumkella et al. 2011).

Some sources argue that the most preferred type of structural change for Africa should involve enhancing export-oriented light manufacturing activities and agro-processing

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industries to have wider and more inclusive effects (World Bank 2016). It is inclusive in the sense that Africa's agro-processing sectors constitute micro and small enterprises (MSEs) on which a significant majority of people make their living (World Bank 2013). Therefore, creating forward and backward linkages to the commodity sector, including soft commodities, offers the most viable channel towards achieving sustainable industrialization in Africa (Woldemichael et al. 2017).

Developing the technological capabilities of the critical mass of Africa's MSEs, implies the crucial importance of focusing on enterprises in Agricultural value chains. Designing appropriate MSEs' development strategy (UNECA 2017), developing linkages between the agricultural and industrial sectors and facilitating the growth of job-creating small- and medium-sized enterprises can help establish a strong foundation for a sustained growth Africa aspires (UNIDO, FAO, & ILO 2013; UNECA 2005).

Ethiopia is among countries in Africa with the dominant share of food and beverage industry in their manufacturing value added (UNIDO 2013b). On account of this, the industry makes the core of the country's industrialization strategy with special emphasis given to sectors with high export potential and can make wider use of cheap labour and agricultural inputs. Development of MSEs is also considered pivotal for a twin purpose of hastening industrialization and reducing unemployment and poverty. This is indeed sensible as MSEs can also be instrumental in strengthening linkages between urbanization and industrialization which is yet to be successful in Ethiopia (UNECA 2017).

On the above backdrop, the study was aimed to explore the prospects and challenges facing Africa's industrialization in view of the globalizing manufacturing processes and the development of technological capabilities in the agro-processing sub-sector. Using the mixed research method, the findings of this research reveal the co-evolution of countries' income and technological capability. Besides, local value chain development was found to be associated significantly with innovation/technological capabilities in Africa. This paper can contribute in two major ways. Primarily, it has managed to show the links between local value-chain development (LVCD) and technological capability. Secondly, it has developed a new framework that would help evaluate strategies devised to help agro-processing industry in Ethiopia.

The rest of the paper is organized as follows. Section two discusses empirical evidence and formulates research questions for subsequent investigation. Section three and four, respectively, present the conceptual framework and methodologies applied to investigate the research questions. Stylized facts on the trends of African economies at different levels of development in terms of GVCs and technological capabilities (TCs), as well as the nexus between TCs and LVCD, are discussed in section five. Section six provides discussions on the analysis of Ethiopia's edible oil production system using the LPS framework. The final section presents conclusions and recommendations drawn from both quantitative and qualitative analyses.

2. Global value chains and technological capabilities in Africa: empirical evidence and research questions

With the emergence of Global Value Chains (GVCs) and the associated fragmentation in global production process are believed to benefit developing and emerging economies, especially, in areas of their comparative advantages (OECD 2013). The increasing role

of GVCs-driven production system for improved competitiveness urged low income countries (LICs) with the dual challenges of coping with the related souring competition and developing capabilities to learn new production and business practices towards better competitiveness.

However, there are concerns about the disproportionate patterns of integration and the associated benefits between developing and developed countries (UNCTAD 2013). According to some evidence (Fagerberg, Lundvall, and Srholec 2017), increased GVCs' participation of countries in low income countries (LICs), developing countries, Africa and small (in terms of size) categories make their respective economies to be worse off rather than improving. The nature of GVCs governance which is often controlled by lead firms from developed countries on the one hand and low technological capabilities of local firms on the other have been the prime suspects for the problems linked to GVCs-oriented industrial policies of the above country groups.

Pietrobelli and Staritz (2018) attribute problems with GVCs-oriented intervention to lack of clarity on what this intervention is and what differentiates it from other alternatives. Particularly, lack of common understanding on GVCs-related concepts and on sector- and country-specific dimensions of learning and innovation associated with GVCs, is seen as the major reason (Pietrobelli and Staritz 2018). Problems, related to the policymaking process and absence of country-specific requisite conditions, such as local technological capabilities and linkages across value-chains in Africa, have contributed to the problem (UNCTAD 2013).

The benefits a country would earn from trade and GVCs' participation strongly depends on national capabilities and linkages in national innovation systems (Lee, Szapiro, and Mao 2018; Sampath and Vallejo 2018). GVCs would help developing countries by improving access to information on the global market's requirements in terms of products, processes, technology and standards (Pietrobelli and Rabellotti 2011) which often happens through direct interaction of local firms with foreign clients. However, firms' access to such information is not an end by itself. In other words, firms' access to knowledge should be coupled with proper 'absorptive capacity': the capacity to screen or identify, adapt and use external knowledge for commercial purposes (Cohen and Levinthal 1990). Absorptive capacity is known to be a strong predictor of innovation and knowledge transfer (Zou, Ertug, and George 2018). The level and depth of innovative capabilities, along with the industrial and organizational environment in which firms operate, affects the innovation performance of GVC entering firms in developing countries (Morrison, Pietrobelli, and Rabellotti 2008).

Therefore, the capacities to learn from GVCs are nonpareil not only across countries but also among firms within a country (De Marchi, Giuliani, and Rabellotti 2018) pertaining to differences in the corresponding absorptive capacities. Countries with higher technological capabilities have better absorptive capacities due to the fact that firms in these countries would enjoy conditions that favour better learning, adaptation and development of new technologies. Therefore, proper functioning of the GVCs policy perspectives calls for integrating with analyses of learning efforts at the firm level and of local institutional factors and innovation systems (Pietrobelli and Staritz 2018).

There are some theoretical dispositions (Morrison, Pietrobelli, and Rabellotti 2008; Lema, Rabellotti, and Sampath 2018) on the nexus between value chain and innovation despite the potential differences in conceptualizing and analysing the relationships.

Reviewing GVCs literatures with diverse disciplinary origins, Morrison, Pietrobelli, and Rabellotti (2008) appeared to align with those who defined value chain upgrading as innovation that results in an increased value addition of a product (Morrison, Pietrobelli, and Rabellotti 2008).

In the cases of Korea and Brazil, Lee, Szapiro, and Mao (2018) found a strong link between level of development and GVCs integration as a function of local innovation systems. Based on this, they proposed an ‘in-out-in’ GVCs strategy whereby latecomer countries at early stage of industrialization have to make active participation with the aim of learning basic production skills and techniques from global frontiers. However, Countries at middle-income level should delink from GVCs and focus on local value chain development and reintegrate back after attaining high level of competitiveness (Lee, Szapiro, and Mao 2018).

In the case of Africa, Yumkella et al. (2011) indicated that the ‘buyer-driven’ nature of agro-food chains in Africa allowed oversee lead firms to govern value chains in their own interest (Yumkella et al. 2011). This and the evidence regarding the negative effects of countries’ GVC integration on LICs in general and Africa in particular (Andreoni 2019; Fagerberg, Lundvall, and Srholec 2017) casted doubt on GVC-oriented industrial policy prescriptions. However, there are differences among countries owing to variation in local contexts. Countries in northern and southern Africa have made better progress in their GVCs participation and agro-processing value chain compared to other SSA countries (UNIDO 2013b).

Andreoni (2019) raises two main reasons for the ineffectiveness of GVC-oriented interventions in spurring structural transformation in Africa. First, Africa’s engagement in GVCs constitutes mainly backward linkages to resource-based sectors. Creating and capturing value in these specific types of sectoral value chains is farfetched for local African companies as it involves mastering production technologies that are important for value addition. Second, the forward linkages in which farmers supply their product to processors also limit farmers from further value-adding activities. A strategy that does not enhance local firms’ GVCs integration at higher value-added stage is unable to create cumulative process of inter-sectoral learning and hence economic transformation (Andreoni 2019). Thus, the major differences seem to relate with variation in the countries’ level of income in general and the extent of local value chain developments in particular. On this ground, the following questions are to be answered.

- Q1: Are there evidences on variations in GVCs participation and technological capability among African countries at different income levels?
- Q2: How important is value chain development for building technological capability in Africa?

The above discussions suggest the importance of applying policies tailored to specific countries’ contexts to successfully embark on sustainable industrialization. Strengthening national/local innovation systems and firm-level technological capabilities can increase firms’ upgrading potential along the value chains (Low and Tijaja 2014). Therefore, the evolving reality is in favour of getting inward-looking strategies correct before taking on GVCs-oriented prescriptions in order to effectively kick-start sustainable industrialization in Africa.

In this regard, developing the technological capabilities of the agro-processing industry entails the most promising prospect for Africa's industrialization (Morris and Fessehaie 2014). According to Woldemichael et al. (2017), agro-processing has higher multiplier effects in terms of job creation and value addition pertaining to its forward and backward linkages. It can stimulate businesses across a range of ancillary services and supporting activities in the secondary and tertiary sectors outside the domains of its direct input suppliers and product buyers. Das Nair and Landani (2020) noted that innovation and adoption of technologies have significant contributions in upgrading the agro-processing value chains in Africa. Technologies assisted the inclusion of small and microenterprises (SMEs) into local, regional or global value chains in a number of ways, including through improving the quality and quantity of products, lowering costs, improving access to finance, enhancing transparency and traceability, fostering resilience to climate change and developing capabilities to meet retail and export standards (Das Nair and Landani 2020).

The fact that the vast majority of informal enterprises and MSEs in Africa are directly or indirectly linked to the agro-processing sector, enhancing the sectors' technological capability offers better opportunities to realize the social dimension of sustainable industrialization (Sampath 2016). Besides, measures taken in building technological capabilities along the value-chain will have positive effect on sustainability in terms of both growth and environmental dimensions of sustainability following technology upgrading that enables more efficient use of safe energy and natural resources (UNIDO 2016).

On this backdrop, Ethiopia's edible oil sub-sector was investigated owing to its poorly established production system. Despite the underlying potentials, Ethiopia has remained to rely on import (above 80%) for its domestic consumption of edible oils (UNIDO 2013a). The government had to take active involvement in its import and distribution due to ever-increasing shortage of edible oil. Problems linked to shortage of raw material supply, skills deficiency, lack of modern equipment and technologies, and unfriendly government rules and bureaucracy (Wijnands et al. 2011) have remained to be among the key challenges facing local oil producers. This suggests the need for revisiting structural and systemic constraints underpinning the edible oil value chain in Ethiopia and hence seeking answer to the following question.

- Q3: Why has Ethiopia's edible oil industry been unable to respond to the increasing domestic demand and how can MSEs benefit from the available potentials along the value chains?

3. From GVCs to local production systems: the conceptual framework

It has been shown that GVCs-oriented strategies benefit only countries and firms with adequate local production and innovation capabilities. In the case of Africa's agro-processing MSEs, it is difficult to enter the local value chain, leave alone GVCs. The need for compliance with standards on quality and food safety imposed by both legal and private supermarkets creates barriers to MSEs, participation in the local food systems (Das Nair and Landani 2020). Specific to the edible oil SMEs in Ethiopia, strong market competition, in terms of both price and quality, with imported products causes

additional problems. This justifies the need to focus on building local production system and technological capability. The relationship between local production system and innovation/technological capability can be seen in terms of the early notion of communalities between production and knowledge systems (Bell and Albu 1999) and the recent development that links learning in production with innovation process (Chang and Andreoni 2020).

With respect to the first, Bell and Albu (1999) defined production system as constituting product designs, materials, machines, labour inputs and transaction linkages involved in the production of goods. In a cluster context, the knowledge system is shown to encompass flows of knowledge from outside the cluster and between firms (and other institutions) within the system; stocks of knowledge and organizational systems involved in generating and managing changes in the products, processes or organization of production giving rise to what is called 'technological capabilities'. Within technological capabilities are bundles of complementary skills and knowledge along with the organizational structures in which they are embedded capable of facilitating particular activities in the production system (Bell and Albu 1999). In view of the functional categories of technological capabilities (investment, production and linkage capabilities) and characterization of innovativeness as a continuum of activities from simple production to complex activities, involving modification or development of new products, process and distribution (Lall 1992), every activities in a production system constitute innovation (Low and Tijaja 2014; Bell and Albu 1999).

Similarly, Chang and Andreoni (2020) learning in production system makes the centerpiece of innovation processes and hence linked to building innovation capabilities. The authors noted that learning in production is triggered by three technology-pull and two market-pull mechanisms. The opportunity to adopt similar technical and organizational solutions to production problems across different products, firms and sectors constitutes the first technology-pull mechanism of learning in production. The second supply-side mechanism corresponds to the need to solve 'scale bottlenecks' in production associated with indivisibilities giving rise to organizational innovations both within an industry and throughout the whole value chain in which the industry is embedded. The third technology-pull mechanism relates to changes in the existing production processes and structures that may trigger changes in complementary products and processes and technologies within and across firms. With respect to market-pull mechanisms, learning in production is motivated by changes in the quantity and quality (or composition) of demand (Chang and Andreoni 2020).

The visual summary of the conceptual basis for shifting from GVCs to local production system is given in Figure 1. The figure shows local production system in terms of a bi-directional arrow linking linkages and local value chain to depict the potential linkages created due to developing local value chain. Every activities along the linkages are believed to involve some form of innovation. If effective management of knowledge flow within a firm, across a sector, and across dissimilar sectors is in place, it would result in the accumulation of stock of knowledge (or Technological/innovation capabilities). These capabilities are essential for developing local manufacturing capabilities, thereby laying ground for sustainable industrialization and hence possibility to enter GVCs at higher value-added activities. Dashed arrows in the Figure 1 are used to indicate indirect connections outside of the current study's empirical coverage.

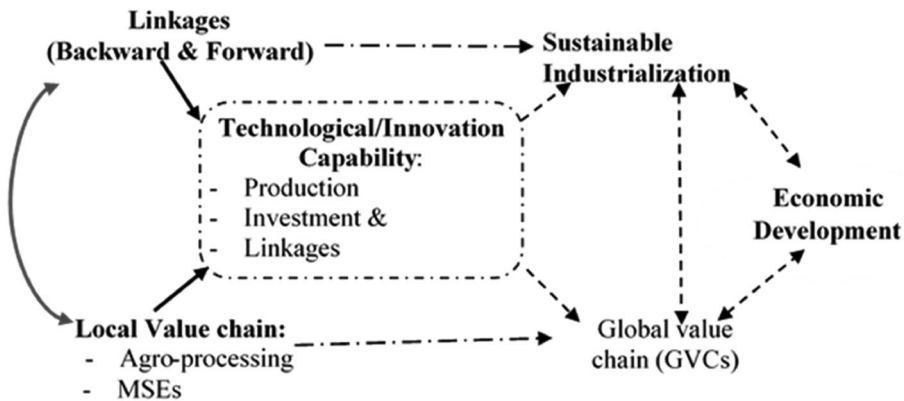


Figure 1. The conceptual framework Source: Author's articulation.

However, it is important to understand the complexities and the dynamic process involved in setting conditions for the development of innovation capabilities (Andreoni and Chang 2019). Complexities relate to the need for coordinating different institutions and policy instruments with each of them targeting directly one specific policy domain, while indirectly impacting several other policy domains. Each policy domain characterises a relatively similar set of instruments or institutions aiming at one part of the industrial system. The dynamic process refers to the need for adjusting package of interactive measures over time by policy makers aimed at maintaining institutional complementarities and policy alignment (Andreoni and Chang 2019).

On this ground, Andreoni (2019) proposed Hirschman's 'Generalized Linkage Approach to Local production System development (LPS)' as an alternative framework to guide Africa's industrial policy. Problems linked to Africa's dismal status in GVCs and its economies' dependence on natural resource-based sectors make the basis for using LPS. Because, the LPS framework was driven by assumptions behind the high potential 'linkage effects' involved in investment projects made in agricultural and extractive industries. The strong forward and backward linkages emanating from such investments are believed to accelerate economic transformation (Hirschman 2013). Three types of linkages that were introduced by Hirschman in his original work are production, consumption and fiscal linkages.

According to Andreoni (2019), production linkages are representations of structural interdependencies associated with input–output relations of a country. Consumption linkages are those created following increased income from domestic production of staples and exports originally spent on imported goods. However, subsequent increases in consumption demand eventually induce substitution of imported goods by domestic products. Andreoni (2019) described fiscal linkage as a 'second-order effect' of staples production in underdeveloped countries whereby a state can tap into income generated from staples production and used for productive investments.

Developing on the original concept, Andreoni (2019) modified the LPS framework in a way it captures different types of linkages with their different hierarchical forms, different linkage effects with a focus on those related to learning dynamics, and the

relationship between political economy factors and linkages effects. The LPS framework stands on two fundamental thoughts.

- (1) It can deliver quality of growth through incremental and cumulative process of enhancing value addition and linkages development. Integrations into regional and global value chains would, respectively, follow after developing strong linkages among local firms, as depicted in Figure 2
- (2) Developing LPS necessarily involves shifting incentives from importers and rent-seekers to productive entrepreneurs while disciplining rents allocation and reducing rents chains and power concentration.

Most importantly, Andreoni (2019) introduced technological linkages as the fourth and another important set of interdependencies worth considering in the LPS framework as it captures direct and indirect transfer of technological capabilities from both within and across sectoral value chains. The hierarchical form constitutes ‘vertical linkages’ representing various players (system integrator, multi-tiers suppliers) hierarchically linked to each other along sectoral value chains and ‘horizontal linkages’ involving players operating at the same stage of the sectoral value chain or across diverse sectors in the LPS (Andreoni 2019). In the schematic representation of the LPS (Figure 2), small blocks at the bottom of the graph show local MSEs linked horizontally among each other and vertically to first-tier local medium firms which, in turn, are connected with transnational lead companies (TNC).

Technological linkages are emphasized to have the strongest potential in inducing learning and diversification dynamics, improvements in process efficiency and scaling-up, as well as product quality, standards and functionalities. Production and consumption linkages have also been well acknowledged to entail learning within and across value chains. Technological linkages among different manufacturing processes involve

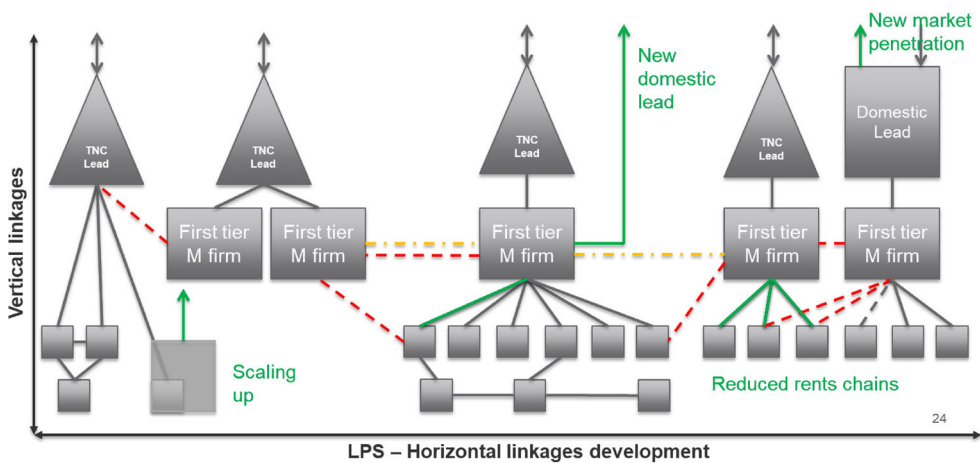


Figure 2. Generalized linkage approach to local production system development. Source: Andreoni (2019).

Note: Production Vertical Linkages (solid line); Production Horizontal Linkages (dashed line); Technological Horizontal Linkages (dash-dot line).

diverse techniques, productive knowledge and production technologies defining what Andreoni (2018) calls ‘capability domains’ depicting similarities and complementarities across processes. Specific to the agro-food sector, Chang and Andreoni (2020) noted that contemporary capability building practices go beyond the traditional food processing capabilities. It requires developing other complementary sets of capabilities in mechanics and control systems for packaging, on ICT capabilities for food tracking and, on the capabilities in advanced materials for smart packaging.

According to Andreoni (2019), linkages effects in general, and building technological capabilities in particular, are subject to enablers and constraints linked to political economy forces and dynamics. Power relations in both the public and private sectors have important implications for rent allocation among the players and hence on the effectiveness of public institutions in implementing policies. The right hand-side of the figure shows cases in which political settlement leads to reduced rents chains and enhances the capabilities of local firms to assume a leadership position in value chains and to become competitive in global markets.

4. Data and methodology

Investigation of the three research questions involved a mixed research method using both quantitative and qualitative data. Quantitative data constitute selected aggregate indicators for African countries in relation to the first two research questions (Q1 and Q2), while qualitative data were used to answer the third question (Q3). The qualitative data were collected from actors along Ethiopia’s edible oil manufacturing value chain with specific focus on Adama cluster, one of the two potential clusters in Ethiopia (UNIDO 2013a).

The quantitative data were drawn from different sources, including World Economic Forum’s (WEF) Global development Indicators (GCI), World Integrated Trade Solution (WITS), UNCTAD-EORA GVCs databases. The data were chosen on account of constituting the major variables of interest for this study. However, it is good to note the potential limitations in using these data in relation to aggregations at the country and group levels. Besides, the fact that GCI data were collected through enterprises’ executive attitude survey warrants care in driving specific implications due to the potential limitation linked to its nationwide representativeness. Nevertheless, no other data with the required traits were available for the country-level analysis.

The data were analysed using descriptive tools, such as graphs and figures, depicting country- and group-based indicators for African countries as well as using regression analysis. Regression was applied to estimate the links between value chain and technological/innovation capabilities based on indicators compiled under the 9th, 10th and 12th pillars of the GCI (WEF 2017). Estimation was made using data spanning over 2000–2017 for 38 African countries with data on indicators of interest.

The selected variables include Innovation (INN) and Technological readiness (TECHR) as dependent variables, while Institutions (INSTIT), Quantity of local suppliers (LS_QUAN), Quality of local suppliers (LS_QUAL), State of cluster development (CLUSTER) and Value chain breadth (VCB) were treated as the independent variables (see Table A1 in Appendixes for detailed definitions). Given the potential multicollinearity problem by using all the four variables (LS_QUAN, LS_QUAL, CLUSTER and VCB)

related to local production system, only VCB was selected for the analysis using a step-wise examination. The first step was to conduct a preliminary correlation analysis among the variables (Table A2). According to the analysis, variables related to local production system - VCB, CLUSTER, LS_QUAN and LS_QUAL- have strongly significant pair-wise correlation. Besides, VCB has significantly high partial correlation with the remaining three variables as expected and can encompass the other indicators.

The relationship between technological capability and value chain was estimated using fixed effect (FE) and two-step system generalized method of moment (SYSGMM) techniques. The definition of technological capabilities will include investment, production, innovation and linkage capabilities (Lall 1992) and meant to be represented by INN and TECHR as alternative indicators. The equations used to generate the results are given by (1) where the subscripts 'i' and 't' identify country and year, respectively; β s are constants to be estimated, while ε is the error term.

$$\text{INN}_{it}/\text{TECHR}_{it} = \beta_0 + \beta_1 \text{INSTIT}_{it} + \beta_2 \text{VCB}_{it} + \varepsilon_{it} \quad (1)$$

Qualitative data were collected from 16 edible oil manufacturing enterprises operating in selected Ethiopian cities: Adama, Dukem and Addis Ababa; 10 oilseeds and edible oil retailers in Adama city; and 6 local government officials. Interviewees were selected through purposive and convenience sampling. Interviews were made with manufacturing enterprises of varying sizes including micro, small and large. One FGD was also conducted with the founding members of 'Right' edible oil Share Company which was under establishment to erect a large refinery plant in Adama city. Key informants (KIs), constituting local administration officials, edible oil and oilseed retailers, were asked questions of limited focus and relevance to each. Local officials were asked questions regarding their relationships with enterprises in view of their roles in implementing sectoral policies. Oilseeds and oil retailers were asked questions in relation to prices and supply of goods as well as their customers' behaviour. The analysis of the data was guided by the generalized local production systems approach (LPS) framework (Andreoni 2019) in view of building local technological capabilities and insertion of MSEs into more value adding activities.

Therefore, the overall empirical analysis contains two layers: quantitative cross-country analysis and country-specific sector-level qualitative analysis. The purpose of the first layer was establishing evidence on heterogeneities of African countries first in terms of their GVCs statuses in relation to their respective income levels and technological capabilities. Second, it was aimed at examining the links between local value chain and innovation/technological capabilities in African context. The second layer of the analysis was meant to unravel problems underlying the production capabilities of Africa's agro-processing industry given evidence on the need for building the industry's local value chain towards sustainable industrialization and developing capabilities required to benefit from GVCs.

5. Technological capability and local production system: stylized facts

Heterogeneities among African countries can be seen in terms of the extent of integration into GVCs, competitiveness and their income levels. Low income countries' GVCs (Figure 3) have remained below countries at medium and high income levels over the

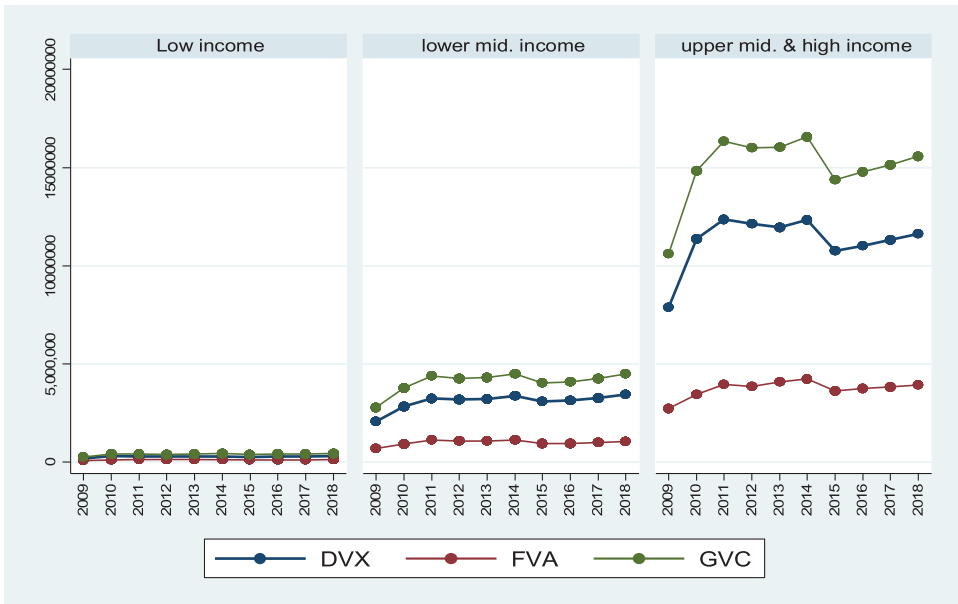


Figure 3. The trends of African countries statuses in GVCs by their income levels. Source: UNCTAD; based on data from the UNCTAD-EORA GVC database.

last 3 decades. There have been marginal improvements over the recent decade as shown by increased GVCs largely driven by Domestic value added to export (DVX) –the forward (or downstream) integration component of GVCs. The contribution of upstream integration or foreign value added to export (FVA) is not only very low; its growth has also been modest over the recent years.

The statuses of African countries at different income levels reveal the strength of symmetry between countries' income levels and levels of GVCs participation (Figure 3). The GVCs' participation of African LICs over 2009–2018 has remained to be close to zero. The FVA component of lower middle income countries (LMICs) has been far higher than the total GVCs participation of LICs reflecting the former's relatively better position. Similarly, the average GVCs participation of upper middle and higher income countries (UMHICs) exceeded that of LMICs by over three fold. The FVA of UMHICs only amounted to the total GVCs of LMICs (about 4 million USD).

In terms of Global competitiveness index (GCI), Least Developed countries (LDCs) in general and countries in sub-Saharan African (SSA), in particular, had the lowest scores in 10 of the 12 pillars of GCI in 2018. Among the bottom 20 countries of the globe, 17 were from SSA with the region's median of 45.2 which is less than halfway to the frontier nation (WEF 2018). However, there are differences in performances among countries in the region. The gap between the region's best performer, Mauritius (63.7, 49th) and the least performer, Chad (35.5, 140th) is at point (WEF 2018). This indicates existence of a positive correlation between countries' GCI scores and their respective levels of development. Similarly, the fact that countries at higher level of income appeared to have higher scores in terms of the specific indicator of technological capability (Figure 4) reveals

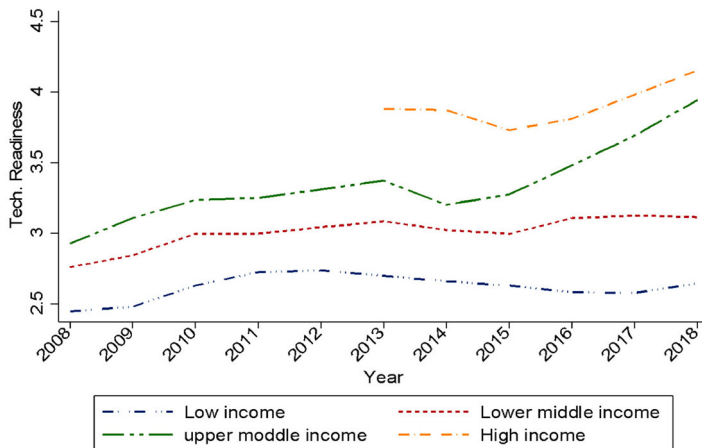


Figure 4. The trends of African countries' technological capability (TECHR) by income levels. Source: World Economic Forum; based on GCI database.

symmetry also between technological capability of countries (TECHR) and their respective levels of income.

The above facts reveal that successful GVCs integration of a country is linked to its industrial and technological capabilities. There appears to be a consensus on the importance of developing basic industrial capabilities and local value chain for a country to reap positive return from GVCs participation (OECD 2013; AfDB, OECD, and UNDP 2014; Lee, Szapiro, and Mao 2018; Andreoni 2019). Therefore, the success or failure of GVCs-oriented industrial policy of a country hinges on its capability to harness opportunities underlying areas of potential comparative advantages (OECD 2013). It also requires understanding own trade profiles and industrial capabilities and evaluating realistic development paths that can help pursue better strategic positioning (UNCTAD 2013).

Likewise, it is important to understand differences between African countries in terms of their GVCs integration and its effect. For instance, south Africa achieved a status comparable to Asian performers (OECD 2013) and GVCs participation and firm-level performance indicators were found to have strong positive correlations in North African countries (Del Prete, Giovannetti, and Marvasi 2015). These differences are linked to differences in their local production and technological capabilities. However, the relationship has yet to be verified through rigorous empirical analysis in Africa.

In order to address this gap, equation (1) was applied to generate results reported in Table 1 using both FE and SYSGMM estimates. Result from the latter is considered as the main basis of interpretation and conclusiveness due to its statistical rigour. Despite differences in the estimation and statistical rigour, both FE and SYSGMM techniques generated close estimates.

The null of adequacy of instruments (or over identifying restriction) has failed to reject by both Arellano and Bond's AR (1) and Hansen tests confirming the robustness of the SYSGMM's result. Corresponding to innovation capability (left column), institutional quality (INSTIT) has strongly significant effect at less than 1% of significance level with the effect ranging between 0.30 (SYSGMM) and 0.43 (FE). It indicates that a

Table 1. The links between innovation and technological capabilities with value-chain.

Variables	Innovation capability		Technological readiness	
	FE Coef.(RSE)	SYSGMM Coef.(FSCSE)	FE Coef.(RSE)	SYSGMM Coef.(FSCSE)
INSTIT	0.434*** (0.043)	0.300*** (0.072)	0.120** (0.058)	0.077 (0.146)
VCB	0.315*** (0.040)	0.341*** (0.043)	0.227*** (0.059)	0.194** (0.079)
_cons	0.401*** (0.141)	0.676** (0.294)	1.845*** (0.210)	1.976*** (0.470)
	sigma_u = 0.223	AR (1): Pr >z= 0.468	sigma_u = 0.369	AR (1): Pr>z = -0.712
	sigma_e = 0.122	AR (2): Pr >z= 0.000	sigma_e = 0.151	AR (2): Pr>z = 0.018
	rho = 0.771	Hansen test: Pr>chi ² (20) = 0.828	rho = 0.856	Hansen test: Pr>chi ² (20) = 0.455
No. of obs	383	383	383	383

Note: *** and ** show statistical significances at 1% and 5% levels. RSE = Robust standard errors, FSCSE = Windmeijer finite-sample corrected Standard Errors for two-step estimation of System GMM. Year dummies were included in all estimations including FE.

unit improvement in institutional quality indicator results in 0.30–0.43 increase in innovative capability. However, INSTIT has failed to show similar effect on technological readiness. The result turned to be significant at 5% level only in the case of FE.

The coefficient estimates, corresponding to the major variable of interest (VCB), indicate strongly significant (1%level) positive effect of value chain development on both innovation and technological capabilities. Given all other factors constant, the innovation capability of a country with one unit extra value of VCB is expected to improve by about 0.34. In other words, a 10% improvement in VCB is associated with a 3.4% increase in innovation capability, *ceteris paribus*. In spite of the equally strong statistical significance, VCB appeared to have lower economic effect on technological readiness than innovation capability.

Similarly, one more unit of VCB increase technological readiness by 0.19. Alternatively, with all else kept constant, a 10% increase in VCB generates about 2% gain in technological readiness. An important note with regard to all the results is that, interpretations have to be understood with the utmost care in view of the potential limitations inherent in the GCI database with respect to the measurements and computations of the indicators. Nevertheless, the finding provides a convincing empirical basis for the importance of local value chain development for enhancing technological capabilities in African.

6. Local production of edible oil in Ethiopia

Local production of edible oil in Ethiopia constitutes input suppliers, farmers, traders, brokers, processors and retailers involved in the value chains, as it is shown in Figure 5. The first includes agricultural input suppliers such as cooperative unions, private traders and agricultural research institutes. Oilseeds produced by farmers make their ways to local and foreign markets through a chain of traders and brokers. Edible oil


Figure 5. The edible oil value chain. Source: Author's construction.

processors compete with oilseeds exporters and retailers along the supply chain. Oil-manufacturing enterprises both formal and informal millers with their sizes ranging from micro to large firms endowed with advanced processing capabilities. They distribute edible oils of different qualities to end-users either through own distribution outlets or through other retail traders. The big market challenge for the local products is the strong competition they face with imported oils via formal and informal ways.

Specific to the Adama cluster, a large number of formal and informal edible oil-processing enterprises are believed to exist owing to Adama city's locational advantages and presence of a large number of livestock rearing businesses. Among these are the 16 enterprises interviewed for the current research. According to the definition (Table A3) by Ethiopia's Ministry of Urban Development and Housing (MoUDH 2016) and the Council of Ministers' Regulation No. 373/2016 (FDRE 2016), these enterprises constitute eight micro (50%), six (38%) small, one (6%) is medium, and one (6%) large-level categories and the majority of them (75%) were registered as sole proprietors. The reason for the very existence of about 80 per cent of interviewed enterprises was entrepreneurs' job creation motives and oil processing is their major occupation.

Economic rents linked to forward and lateral diversifications constitute the major motives for half of the entrepreneurs who had background experiences in oilseeds trading and brokering. The lateral diversification motives relate to the increasing demand for seedcakes, mainly from urban livestock rearing businesses. Four enterprises started oil processing through acquisition of plants, three of which were state-owned enterprises (SoEs), while one was foreigner owned. The takeover of the three SoEs followed government's privatization policy, while the other was due to owner's repatriation.

In contrast to Ethiopia's pledge to encourage manufacturing businesses, especially MSEs, more than 55% of interviewed enterprises reported to have faced difficulties with access to finance, while over 60% of them have no premises of their own to operate. Own premises are believed to have the advantage of reducing operating cost and offering better flexibility in terms of ease of operation and expansion as compared to operating in rented facilities. Part of MSEs-related problems emanated from the policy design and perceptions that excludes voluntarily established businesses from the government support packages. The only MSE with government-backed cooperative form was found to be offered government-built shade. However, it could not benefit from the credit element of the benefit packages mainly due to founders' faith-oriented aversion of the associated interest. Having said this much on enterprises' background, let us turn to the analysis of linkages in production along the LPS framework.

6.1. Production linkages

Ethiopia's potential in oilseeds production has attracted the attentions of development actors since long time ago. Efforts have been underway by the government and donors to resolve supply side problems through improving agricultural productivity and the supply chains. The Government of Ethiopia (GoE) promised to support agro-processing MSEs in both downstream and upstream activities, establish linkages with medium and large enterprises (MLEs) through facilitating formal buyer-supplier contracts (MoUDH 2016). Cognizant to the fundamental problems of sustainable oilseeds supply, GoE vowed to make special support to 'out growers' schemes that can reduce transaction cost and

improve benefits to all actors along the value chains. Similarly, donors-supported project has been targeted towards developing edible oils value chains involving GoE and NGOs, notably UNIDO, FAO and ILO.

However, problems with developing downstream activities have yet to be resolved mainly due to the shortage of oilseeds supply. All but one of the interviewed firms had any form of formal contract-based oilseeds procurement. Consequently, productions are mostly irregular with some enterprises indicating to operate 4 months a year because of the dearth of oilseeds and the associated increase in prices from time to time. Microenterprises, generally, face stronger challenges in raw material procurement even when available owing to severe shortage of operating capital.

On the other hand, the demand for oilseeds has kept growing from both domestic and foreign buyers. Domestic edible oil manufacturers expressed the extent of difficulties they have been through to sustain their businesses. Enterprises perceived that oilseeds production has declined as farmers tend to use their lands for better rewarding crops. Besides, the increasing demand from foreign buyers and the government's tendency to favour exporters over local manufacturers appeared to have worsened oilseeds shortage as exporters pay higher prices for good quality oilseeds.

Constraints in oilseed supply have fuelled speculative behaviours among actors in the value chains. This includes hoarding and underground trading of oilseeds by some processors to amass speculative margins associated with windfall prices. The average speculative margins (in percent) associated with reselling linseed, rapeseed, Niger seed and groundnuts were estimated to be 17, 19, 22 and 57, respectively. Speculations are more common and involve higher returns when imported oils, especially palm oils, are in adequate supply. Supply constraint appeared to have granted more power to brokers in the supply chains as processors seemed to have been convinced on their importance.

On the other hand, enterprises with brands and bottling capabilities are less likely to engage in speculation as compared to those without similar capabilities. They have better resilience to high competition from imported products in relation to improved product quality and more established distribution networks. Nevertheless, almost all manufacturing enterprises have remained to produce below their potential. In fact, there exist differences among enterprises in terms of their capacity utilization and production efficiency depending on differences in their sizes, technology and experiences. The average capacity utilization of enterprises was about 42 per cent, while their average extraction efficiency amounted to 24 litres per quintal of oilseeds. The average quantity of oils extracted per

Table 2. Oilseeds types with prices^a and outputs produced per quintal.

Oilseed type	Average price of oilseeds per quintal (USD) (A)	Average quantity of oil extracted per quintal (Litres) (B)	Average price of oil per litre (USD) (C)	Value of oil extracted from a quintal of oilseed (USD) (D)	Difference (D-A)
Linseed	94.50	28.50	1.93	54.87	-39.63
Rapeseed	82.60	26.50	2.14	56.58	-26.02
Niger seed	78.75	32.50	2.52	81.90	3.15
Sunflower	60.20	26.00	1.93	50.05	-10.15
Cottonseed	44.10	11.00	1.23	13.48	-30.62
Groundnut	77.88	32.50	2.21	71.67	-6.21
Soybean	45.50	13.00	2.10	27.30	-18.20

Source: Own construction from interviews.

^aPrice data were collected in April 2019 and the exchange rate used was 1 USD = 28.57 ETB.

quintal of selected oilseeds types (Table 2, column B) ranged between 11 litres (for cottonseeds) and 32.5 litres (for Niger seed and groundnut).

In Table 2, average purchase prices of different oilseeds per quintal (A), the average price of a litre of edible oils (C), the estimated average revenue of edible oils extracted from a quintal of oilseeds (computed by multiplying columns C and B), and differences in the value of oils produced from one quintal of oilseeds and the average prices of a quintal of raw seeds (D-A) are displayed. The differences indicate losses involved with edible oil processing in the absence of any production costs and any extra revenue from the associated by-products. These differences ranged between 6 USD and 39.63 USD corresponding to using groundnuts and linseeds as raw materials. The only exception with positive difference (3.15 USD) is in cases where Niger seeds is use as raw materials to produce oil. The good thing is that, seedcakes produced as a by-product of processing a quintal of oilseeds can be sold from 40 to 50 USD.

In view of the LPS framework, only few enterprises had some linages with Addis-Modjo Edible Oil Complex S.Co., the only operational candidate firm to be seen as domestic lead in LPS framework. The local production linkage with this potential lead has been limited only to enterprises that extract crude oil from cottonseeds forced by the necessity for the crude to undergo further processing to be palatable.

Creating horizontal linkages among oilseeds growers was acknowledged to have been supported by both governmental and NGOs as a means of ensuring sustainable supply of oilseeds to processors (UNIDO, FAO, and ILO 2013). Unlike successes achieved in other staple crops production, government's effort in supporting farmers' cooperatives in terms of agricultural technology and market linkages has not been successful in the case of oilseeds growers and creation of linkages with edible oil manufacturers. From NGOs side, FAO was involved in supporting oilseeds farmers in terms of providing skills development and yield augmenting technologies including high yielding varieties and related inputs. However, it has not been successful even with respect to farmers in the pilot project. Interviewees indicated that farmers were not willing to continue after the termination of FAO's project in relation to insufficient return from oilseeds as compared to growing other crops.

In order to validate the above claims, average annual returns obtained from one hectare of linseed and groundnut have been estimated and compared with those of wheat and garlic production based on total production and producers price data obtained from FAOSTAT database. According to these estimations the average yearly returns of growing linseed and groundnut each on one hectare of land were 753 USD and 1214 USD, respectively. On the other hand, returns from growing wheat and garlic on similar size of lands appeared to have generated about 863 USD and 11307 USD, respectively. This shows that growing wheat is more beneficial than growing linseed, while it turned to be less beneficial than groundnut. However, returns from growing garlic are 15 times and more than 9 times higher than returns from growing linseed and groundnuts, respectively.

Similarly, horizontal linkages among oil-manufacturing enterprises have yet to be established. The formation of 'Right' edible oil-manufacturing Share Company by 48 founding members, with the help of UNIDO, deserves appreciation as a good basis for creating horizontal linkages among enterprises operating in Adama cluster (UNIDO, FAO, and ILO 2013). The factory under installation is expected to improve the

technological capabilities of MSEs in the cluster through fostering learning and product upgrading. However, there should be adequate incentives and system to link-up non-member enterprises so that they would benefit from the associated learning.

In addition to this, a system that promotes efficient allocation of rents among enterprises is important to exploit benefits related to horizontal linkage. Among important policy measures enterprises wanted to be taken are curtailing the palm oil import (56 percent), putting fair taxation system in place and ensuring sustainable power supply (20 percent). Supporting oilseed-producing farmers, creating linkages with oilseeds-producing cooperatives, facilitating import of better technology, granting land for expansion and waste disposal were also among the problems identified to deserve policy actions.

6.2. Consumption linkages

Locally produced oils' contribution to domestic consumption is not only negligible (below 20%), they are also less competitive than those imported in terms of both price and quality. Illegally imported edible oils caused a formidable challenge to local producers in these regards. The price-wise disadvantage emanates from high production cost attributed mainly to high oilseeds prices driven by the supply–demand imbalances. Consequently, the counter balance in the supply and demand for edible oil has persisted over the last two decades turning it to a good with high social and political concerns. Government-backed import and distribution of palm oil has been the most viable short-term solution until recently. However, the solution has been marred with other sorts of policy malaises related to governance and industrialization.

From the governance point of view, government's control over palm oil distribution has created a fertile ground for corrupt bureaucrats and rent-seeking private businesses or 'Rents chains' which Andreoni (2019) defines as 'value capture opportunities politically or institutionally determined beyond the power distribution linking companies along the value chains'. From the industrialization perspective, government-backed palm oil importing had destructive impact on local producers as consumers would shift towards imported products whose prices are about one-third of locally produced counterparts. Supply constraints and cost-driven high prices rendered locally manufactured edible oils unaffordable to the majority low-income Ethiopians. Demand for local oils happened to reach its pick only at times when national or local stocks run out of the imported palm oil.

Depending on their production and technological capabilities, firms distribute products of different quality to consumers through retailers, supermarkets and consumers' cooperatives. Microprocessors that do not have packaging facility sell directly to consumers and retailers in urban areas and those coming from rural areas. There are also cases whereby the same intermediary operate in both upstream and downstream stages of the oilseeds value chains. The upstream activity includes collecting oilseeds from farmers or other rural traders and supplying to processors at higher prices. The downstream activity involves buying unrefined or partially refined oils from processors in barrels and supplying to rural consumers either directly or through other retailers.

Enterprises with packing and better refining technologies enjoy higher market opportunities ranging from small retailers, supermarkets, hotels, restaurants, universities, hospitals and public outlets such as 'Efruit': a state-owned retail enterprise and cooperative shops. This entails benefits underlying the oil industry's linkage with the service sector.

All processors have consumption linkages with livestock rearing farmers as they supply seedcakes as animal feeds either directly or indirectly through traders. It was found that oil manufacturers are recovering some of their production costs by selling seedcakes (by-product) with the exception of those using rapeseed since its seedcake is not readily palatable for livestock.

6.3. Technological linkages

Ethiopia's Micro and Small Enterprises Development strategy underlined the crucial importance of supporting MSEs in all respects including providing working premises, finance, consultancy, training, capacity building, raw material supply, marketing, improving product quality and hence help them obtain quality standards accreditation certificates for their products (MoUDH 2016). Similarly, Ethiopia's TVET policy put TVET institutions at the core of operationalizing efforts towards developing the micro and small enterprise (MSE) sector through providing technical support to start-up businesses, serving as centres for technology transfer that would help increase productivity, improve the quality of products and services and facilitate creation of new business (MoE 2008). The GoE also promised to facilitate local production of appropriate technologies; help MSEs access better technologies, machinery and Equipment; promote imitation of appropriate technology; provide incentives to innovative enterprises, offer maintenance services, make research-based technology and standardization support (MoUDH 2016).

Enterprises appreciated provisions that allows duty-free import of machines, equipment and parts for manufacturers. This involves import of technologies embedded in the machines and equipment that would help improve productivity and product quality. However, only few enterprises managed to benefit from the provision by importing modern machines directly, while the majority had to buy from other importers due to capacity constraint. Most of the processing machines happened to be of Chinese origin due to price-wise advantages. However, there are wide resentments among enterprises about the frequent breakage of Chinese machines and their parts due not only to associated extra expenses but also difficulties to find spare parts.

Only five enterprises have better technologies to process and pack their products. Most MSEs (60%) follow less hygienic traditional processes and hence produce crude oils with impurities. About 40% of enterprises had reported to use soda and bleaching earth for product colouring. Enterprises have different levels of awareness on manufacturing processes and product quality. No government institutions intervened to offer supports to curb skills gap in this regard. Non-governmental organizations (NGOs), especially UNIDO, had some support on this. UNIDO had trained some of the founding members of 'Right' Share Company about edible oil qualities during the multi-stakeholders edible oil value chain development pilot project (UNIDO 2013a).

Regarding quality and standards setting services, Ethiopia's quality and standards authorities appeared to be lenient when it comes to MSEs. Consequently, processors sell products of unproven quality as far as consumers are willing to buy. Prevalence of consumers' tendency to associate unrefined oils with good has rendered quality upgrading useless. On the other hand, local authorities appeared to exert more pressure on enterprise with better quality checking and refining capabilities under the pretext of quality control. From political economy perspective, this can be associated with rent-

seeking tendency or a signal of inappropriate government- enterprise relationships. The bottom-line is that lack of market and policy incentives has weakened product upgrading and hence technological linkages.

6.4. Fiscal linkages

In Hirschman's original concept, fiscal linkage refers to government's capability to collect tax from resource-based investments with the aim of re-investing on development projects for the benefits of the public (Hirschman 2013). For instance, the taxes Ethiopian government collect from activities along edible oil value chains can fall within this. However, there are contradictory issues when it comes to the government's practical strategy around production and distribution of edible oils. On the one hand, the government wants to develop local manufacturing which is expected to contribute to the government revenue; on the other hand, the government has been sacrificing its revenue by importing palm oil free of duty to satisfy the growing demand for edible oil. Prevalence of underground businesses in terms of both production and distribution of edible oil also makes it difficult for the government to effectively collect taxes.

The majority of interviewed enterprises found government's taxation system to be unfair. For instance, they complained about the value added tax (VAT) obligation imposed on oil and its (seedcakes) while excluding flour manufacturers from such obligations over and above the benefits they enjoy in terms of access to duty-free imported wheat. Authorizing duty-free importing of palm oil on the one hand, and levying import duty of 30%-40% on crude oils on the other, was also deemed unacceptable. Generally speaking, adequate ground has yet to be established for the government to extract revenue out of the edible oil manufacturing.

6.5. Linkages and technological capability

Based on the conceptual ground discussed in section 3, the schematic view of how production, consumption, fiscal and technological linkages contribute to technical capability is given in Figure 6. At the left-end of the figure are downward pointing blocks representing actors in the edible oil value chains (also depicted in Figure 5).

The right-hand side shows key institutions providing support towards technological capability building and linkage developments along the value chains. Farmers' cooperatives are included as they play key role in supplying farmers with yield augmenting inputs. Moreover, they are believed to be among the potential actors in creating direct linkage between oilseeds farmers and edible oil processors, thereby reducing high transaction costs involved in the upstream section of the value chains. Therefore, cooperatives can be one of the potential horizontal linkage platforms in both the upstream and downstream activities. Linkages are depicted in oval shapes (middle part) and through dashed lines linking blocks as noted beneath the figure. The bottom blocks show major governmental and non-governmental players that have stakes in the edible oil value chains.

The linkages depicted in Figure 6 have yet to be established in Ethiopia's edible oil manufacturing value chain in relation to the limitations discussed earlier. The key government supportive structures have remained to be ineffective in solving the major bottlenecks. Raw materials supply, in particular, has worsened due to problems in the

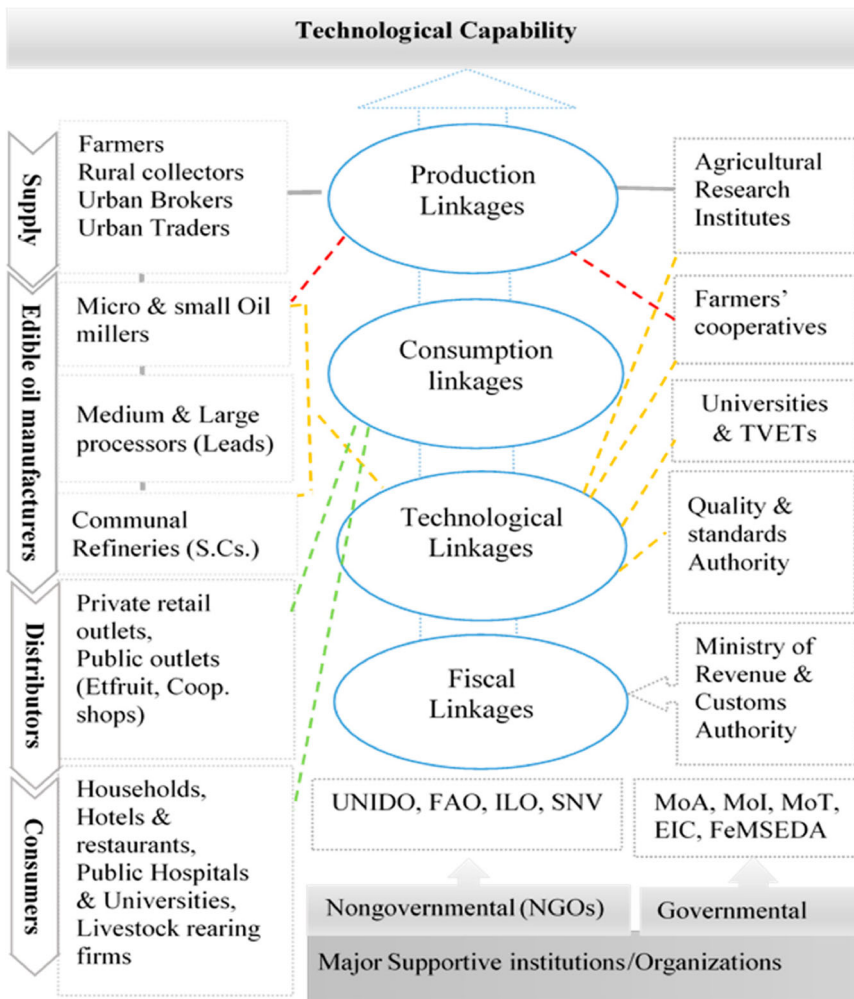


Figure 6. Technological capability Building in Edible oil industry.

Note: The dashed lines show different types of linkages (Production Vertical Linkages, Production Horizontal Linkages, Technological Horizontal Linkages, and consumption vertical linkages).

upstream activities. Besides, contradictions in policy and poor policy implementation and coordination capabilities have contributed to the dismal performance of the edible oil industry with the underlying implications for political settlement-related problems (Andreoni 2019).

Therefore, solving fundamental constraints in edible oil value chain requires inspecting and fixing problems inherent in all linkages including those with supportive institutions. According to the LPS framework, fixing constraints in production linkages means ensuring sustainability of local production which means more jobs and increased income. It will also enable consumption and fiscal linkages to occur which means increased local investment and substitution of imports. Solving problems with technological linkages will help improve efficiencies and linkages across various sectors in terms of productions and distributions involving MSEs. The cumulative effect of strengthening all linkages can lay foundations for sustainable industrialization.

7. Conclusion and recommendations

7.1. Conclusion

This study showed the trends and structure of Africa's position in GVCs and the need to pursue strategies of building linkages within local value chains as a precondition to enter GVCs. The links between technological capability and value chains as well as heterogeneities among countries at different levels of development suggested difficulties underlying industrial policy in Africa. It has been confirmed that strengthening local value chain development in a country can significantly improve its technological/innovation capabilities. Corroborating this with evidence in the literature suggests that effective development of the technological capabilities of Africa's agro-processing would help accelerate progress towards achieving its goal of sustainable industrialization.

On this ground, an in-depth analysis was made on Ethiopia's edible oil industry to trace the potential bottlenecks in local production and related policies with focus on uncovering ways of inserting MSEs and building local technological capabilities. The finding shows that Ethiopia's edible oil manufacturing sub-sector has remained to be under-developed despite the propitious potentials in terms of raw materials availability and market. The increasing importance of oilseeds export in Ethiopia's export basket on the one hand and the supply constrained and poorly developed domestic edible oil manufacturing can be seen as a sign of the product 'lock-in' effect of GVCs participation on the other hand. Inconsistencies between the government's pressing need of syphoning foreign currency from oilseeds export on the one hand and the ambitions to substitute imported oils by local products on the other, is a key policy concern worth addressing. Banning duty-free and illegally imported edible oil has also been among the major desiderata for the local manufacturers. Problems associated with the increasing entry of illegally imported oils also caused challenges to local production.

Generally, with all these basic problems, it is difficult to build the technological capability of MSEs in general and that of edible oil industry in particular. However, there is good prospect for this beleaguered industry if the policy formulation and implementation duties are properly executed. The following recommendations are forwarded to help support efforts towards developing local production capabilities of the edible oil-manufacturing industry.

7.2. Recommendations

- It is useful that the government begins with a short-term strategy that would help utilize oilseeds being produced at the current capacity which includes active support in supplying oilseeds and shortening the supply chains.
- Revising policy directions in favour of local industrial capability development. It is particularly crucial for the government to pursue strategies that discourage oilseed exports while incentivizing increased and sustainable supply to local manufacturers through designing strategies like out growers' scheme that benefits all actors.
- Reducing the effect of illegally imported oils requires concerted efforts to boost both the quantity and quality of local products and lowering the production cost; apart

from strict legal control. This can be better implemented through public private partnership initiatives.

- Increasing the productivity of oilseeds in all potential farming areas is critical for developing local manufacturing capabilities of edible oil. Among important measures are providing targeted extension services by the government agents, subsidized input supply, involving government research and technology centres and linking producers with manufacturers with adequate economic incentives.
- Setting and reinforcing quality standards for edible oils and supporting enterprises towards achieving the standard is crucial for building technological capabilities and enhancing value chains upgrading.
- Building the institutional capability of local government requires practical measures beyond the long existing political rhetoric. In addition to correcting problematic rules and regulations, instilling effective check and balance; upholding accountability; improving the knowledge and capacities of local bureaucrats in terms of policy awareness and implementation, technical knowhow and customer services are important
- The government should establish systems that rewards better performing public servants based on objective performances in terms of policy implementation capacity. For instance, linking the public servant's annual work objectives and job targets with that of MSEs' annual production goals and evaluating performance accordingly would help improve the situation.
- Supporting medium and large enterprises with better technological capabilities and linking them with MSEs based on mutual beneficitation along the value chains would reduce transaction costs and trigger collective learning.

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Appendices

Table A1. Definition of variables.

Name	Variable description
INN	<i>Innovation</i> : Indicator of innovation capability computed from seven sub-indicators (Capacity for innovation, Quality of scientific research institutions, company spending on R&D, University-industry collaboration in R&D, Government procurement of advanced technology products, Availability of scientists and engineers and PCT patents applications/million pop). Values Range from 1 to 7: 1 = poor; ... 7 = high
TECHR	<i>Technological readiness</i> : It is used as a measure of a country's absorptive capacity as it is composed of seven sub-indices (Availability of latest technologies, Firm-level technology absorption, FDI and technology transfer, Internet users % pop, Fixed-broadband Internet subscriptions/100 pop, Internet bandwidth kb/s/user and Mobile-broadband subscriptions/00 pop) which show availability and access to technology as well as the requisite capabilities to learn the technology both at the firm and institution levels. Values Ranges from 1 to 7: 1 = poor; 7 = Best
VCB	<i>Value chain breadth</i> : Measures a country's value chain development. Values Range from 1 to 7: 1 = narrow; ... 7 = broad
INSTIT	<i>Institutions</i> : A composite indicator of a country's institutional quality computed from 21 sub-indicators. Values Range from 1 to 7
CLUSTER	<i>State of cluster development</i> : measures how widespread are well-developed and deep clusters are in a country Values Range from 1 to 7
LS_QUAL	<i>Quality of local suppliers</i> : Measures the extent of the quality of local suppliers in a country. Values Range from 1 to 7: 1 = low; ... 7 = high
LS_QUAN	<i>Quantity of local suppliers</i> : Measures how numerous are local suppliers in a country. Values Range from 1 to 7: 1 = few; ... 7 = many

Table A2. Pair-wise and partial correlations.

Pair-wise correlation	VCB	CLUSTER	LS_QUAL	LS_QUAN	Partial correlation of VCB with	
					Variable	Partial corr.
VCB	1				LS_QUAL	0.235***
CLUSTER	0.661***	1			LS_QUAN	0.120**
LS_QUAL	0.580***	0.533***	1		CLUSTER	0.513***
LS_QUAN	0.448***	0.357***	0.657***	1		

Note: ** and *** represent 5% and 1% levels of significance, respectively.

Table A3. Definition of enterprise size categories.

Size of enterprise	Head count staff	Total asset ETB
Micro enterprise	≤5	≤ 100,000
Small enterprise	6–30	101,000–1,500,000
Medium	31–100	1,500,001–20,000,000
Large	>100	>20,000,000