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Agriculture-Industry Linkages for Employment and Economic Transformation in Ethiopia

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Solomon Tsehay[1]*, Zewdie Adane[2], and Adem Feto[3]

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[1] College of Development Studies, Addis Ababa University, Addis Ababa, Ethiopia.
[2] Ministry of Planning and Development, Addis Ababa, Ethiopia.
[3] Ethiopian Economics Association, Addis Ababa, Ethiopia.

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EXECUTIVE SUMMARY

Introduction

The quest for structural transformation, sectoral linkages and employment creations are among the most primary development aspirations of Ethiopia. Strengthening linkages between manufacturing and agriculture as well as linkages within manufacturing are the key focuses in designing development plans, policies, and strategies aimed at sustainably improving employment and economic structural transformation. Empirical evidences also show that strong sectoral linkage is one of the most salient sources of economic development because of the fact that the expansion of key sectors will have a significant impact on competitiveness, increasing output, income, or employment domestically (Berliant, 2007). Particularly, in the initial phase of development when agriculture is the main driving sector of the development of the economy, it plays a crucial role in establishing the framework for industrialization (Fei and Ranis 1961, Kuznets 1965). It supplies raw materials and key inputs including labor to industry while it in turn uses important industrial outputs as productivity enhancing farm implements and machineries. These forward and backward interlinkages between the sectors are important elements of the development process.

However, little attempt has been exerted so far to investigate the backward and forward linkages within the economy to understand the extent and potential of linkages between agriculture and manufacturing for structural transformation and sustainable development in Ethiopia. Owing to this this study aimed at investigating the linkage between agriculture and agro-processed activities and further examined the sources of weak intersectoral linkages between agriculture and manufacturing in Ethiopia. It also scrutinized factors behind the weak structural transformation and technical changes that has been observed in the economy over the past decades and propose policy recommendations that help overcome this in the subsequent years of development endeavors.

The study attempted to contribute to the understanding of sectoral linkages between agriculture and industry for designing appropriate long-term policies and strategies to achieve a sustainable development by posing and finding answers to the following three research questions:

- ✓ To what extent do the priority industries (agro-processing) have backward and forward linkages? To what extent are manufacturing sectors linked to the agricultural sectors?
- ✓ How do manufacturing link to existing and emerging formal market outlets in Ethiopia?
- ✓ What are the hindering factors for sectors to have high sectoral linkages within the economy?

The study aimed to assess the nature of the agriculture-industry linkages and the role of the linkages in employment creation and structural transformation through the following specific objectives:

- ✓ to identify factors behind weak structural transformation observed in the Ethiopian economy despite the double-digit growth registered during the last decades;
- ✓ to assess the contribution of agriculture and industry sectors in general, and manufacturing in particular to employment creation and overall economy of the country;
- ✓ to assess the extent of the agriculture-industry linkages in the Ethiopian economy and its role in fostering structural transformation;
- ✓ to review experiences and lessons of other countries which remarkably transformed their economies from a predominantly agrarian economy into industrialized economy; and
- ✓ to review the existing agriculture-industry linkage policy and strategy documents, examine the documents and identify their shortcomings, if any, and propose policy reforms that are necessary for ensuring strong and effective agriculture-industry linkages that will bring the needed structural transformation of the country's economy.

Methodology

Data

Both primary and secondary data were collected using appropriate data collection tools. Secondary data were collected from various sources including national and sectoral plans, policies, strategies, reports, national accounts statistics, and other

relevant documents. Secondary data were collected from sectoral and macroeconomic institutions. The study used two Social Accounting Matrices (SAMs) namely 2005/06 and 2015/16. The two SAMs have been modified to help compare results and to conduct the SAM decomposition analysis. The agricultural activities have been aggregated into cereals, pulses, oil seeds, fruits, vegetable and root crops, enset, cash crops and livestock and fish. The manufacturing activities have been aggregated into agro-processed and non-agro-processed activities. Since the main aim of the study is to look at the linkage between agriculture and manufacturing sectors, the agro-processed activities have been disaggregated into preserve, vegetable oils, dairy, bakery and grain, sugar, other agro-processed, alcohol, beverage and soft drinks, tobacco, textile and apparel and leather. The activity and the commodity account have been merged so that the SAM decomposition analysis can be carried out. In addition, primary data was collected from industries and agri-businesses in Addis Ababa city administration and Hawassa town using Key Informant Interviews (KII) and Focus Group Discussions (FGD). FGD and KII were also held with representatives from selected government policy makers to get comprehensive insights on the agriculture-industry linkages, policy making landscape, and possible policy options.

Method of analysis

To gauge the level of linkage in the form of forward and backward linkages among sectors, a SAM multiplier analysis and Hirschman index have been used. In addition, a SAM decomposition and a decomposition of structural change analysis have been deployed to sort out the key sources of the forward and backward linkages between agricultural and agro-processing activities and to examine the extent to which technical change occurred in the main agro-processed activities. In addition, qualitative analysis was specifically conducted to investigate the reasons of weak linkages after the levels of the strengths of the linkages have been identified by the SAM multiplier. The critical review and synthesis of existing national planning, policy, and strategy documents particularly helped to identify the key gaps in national development programmes regarding intersectoral linkages. A desk review was made on major national documents include the National Industrial Development Strategy, Agricultural Development Led Industrialization (ADLI), the Sustainable Development and Poverty Reduction Program (SDPRP), Plan of Action for Sustainable Development to End Poverty (PASDEP), the first and second Growth and Transformation Plans (GTP I and GTP II), the Homegrown Economic Reform, and the Ten-Year Development Plan. Thus, the study also conducted a policy gap

analysis by examining how the issue of sectoral linkages have been depicted in recent national development plans, policies, and strategies.

Results and Discussion

Forward and backward linkage

The results from the quantitative analysis in general shows that there is weak linkage between agriculture and agro-processing in Ethiopia. Particularly, agro-processing activities have weak linkages with agricultural activities. The linkage has been found to be very weak especially in the fruits and vegetables subsector although several other subsector activities have also exhibited weak intersectoral linkages with other sectors. On the contrary, cereals and livestock sectors have strong forward and backward linkage showing that the agro-processing are concentrating on flour processing bakery business. The results further revealed that all key agricultural activities have strong backward linkages. However, except cereals and livestock, all agricultural activities have weak forward linkages which entail that there is no strong agro-processing that intensively use domestically produced agricultural outputs as intermediate inputs. Some agro-processing activities notably bakery/grain mill, vegetable oil, dairy and alcohol have higher backward linkages while the rest of agro-processing activities have weak forward and backward linkages. The study further signified that the agricultural sector creates more demand for labor than the agro-processing activities.

The analysis has shown that the status of the backward and forward linkages of activities did not significantly change for the decade under study. This could be partly because the production pattern of activities did not technically alter between 2005/06 and 2015/16. There is no as such a difference between the technical coefficients of 2005/06 and 2015/16 SAM on the share of factors of production and input intensity of activities. This shows that there has not been any significant change in the mode of production and the level of integration among activities in the economy.

SAM decomposition analysis and sectoral linkages

SAM decomposition analysis have depicted that the closed loop effect is the strongest form of all linkages entailing that the consumption effect is stronger than the within effect which is linked to the forward and backward linkages of activities. The closed-loop effects of cereals and other agricultural crops creates more spillover

effects and linkages with the agro-processing manufacturing activities. The change in demand of cereals or any of the agricultural activities by households or any agent induces more production. Feedback effect that goes from industries' factor payments to households' income will stimulate production activities through demand effects. Because of this, the change in the final demand is the salient driver of the change in economy-wide gross output. This is because much of the commodities produced are consumed as final demands by households and government than used as intermediate inputs by activities. This limits the spillover effect created through forward and backward linkages.

Welfare and employment effects of sectoral linkages

The impact of an expansion of agro-processing and agricultural activities on the welfare of households partly depends on its effect on income. The effect of an increase in the production activities on income of households partly depends on the share of labor and capital in the values of goods and services. The results revealed that all agricultural activities; namely pulses, oilseeds, fruits and vegetables, cash crops, Enset, and livestock induce higher impact on household's income compared to manufacturing activities. However, from the agro-processing activities, edible oils, dairy, bakery and grain mill, sugar, and alcohol ensure higher income gain compared to other manufacturing activities. On the other hand, the impact of the expansion of activities on creating employment opportunity apparently depends on the effect of the expansion of activities on labor. The analysis shows that agricultural activities induce more demand for labor than manufacturing activities. From all activities of the agro-processing, bakery and grain mills, dairy, and vegetable oil and other agro-processing activities induce more demand for labor than other activities. The result revealed that other agro-processing activities do not create more employment opportunities. This is because they either intensively use intermediate inputs or capital in their production systems.

Decomposition and technical change

The study further illuminated that there is significant change in production volume of various activities in the economy between 2005/06 and 2015/16. However, the change was owing to massive increase in final demand than technical changes. The decomposition analysis has shown that the change in production of activities has been caused more by the change in consumption rather than technical changes. There is no significant change occurred in the nature of the production

function of different agro-processed activities in the economy in ten years' time. The change in economy-wide gross output is predominantly due to the change in the final demand, with changes in technology only contributing a very infinitesimal amount. Although, final demand is the main driver of change in economy-wide gross output, results vary across activities. Several activities rely solely on final demand effects while their technology effects associated with backward linkages to the other activities have become less intense. Pulses, oilseed, livestock, vegetable oil, grain and bakery, and agro-processing exhibit positive technology effects, although for all these activities final demand remains the main source. The limited role of technical change indicates that there was no significant structural transformation in the economy over the ten years between 2005/6 and 2015/16.

Reason of weak linkages: qualitative assessment

The qualitative analysis in general depicted that there have not been concrete steps and efforts in policy design for promoting systemic and sustainable linkages between the agricultural and manufacturing activities. The focus group discussions as well as the key informant interviews also revealed that there is input shortage both in terms of quality and quantity entailing the fact that the agricultural and the industrial sectors were not well linked to each other to induce targeted economic structural transformation. Apart from this, the previous development plans, policies, and strategies were not designed in a way that can sustainably and effectively promote the linkages between the agricultural and industrial sectors although there were intentions to do so as indicated by some policy and strategy documents.

The focus group discussion and key informant interviews with experts has shown that Ethiopia's planning processes did not give much emphasis to effectively link the agricultural sector with the agro-processing subsector during plan preparation. Coordination among sectors to match the demand and supply of respective priority activities in the agricultural and manufacturing activities during plan preparation was not exercised except the recently endorsed ten years development plan. Lack of adequate quality raw materials along the value chains of various agro-processing activities in the domestic economy is one of the salient causes of weak linkages between agriculture and agro-processing. The problem will remain an uphill to achieve sustainable development.

The agro-processing focus group discussants explained the massive potentials for agro-processing if effective linkage between agriculture, the agro-processing and the market linkage is aided by sound policies and effective incentives

that promote the right investment decisions along the value chains of each agro-processing. However, participants generally indicated that there are a lot of hurdles that hinder and disrupt the linkages. Even though the reasons varies across sectors, the main challenges that have been commonly indicated by the participants include poor quality of raw materials domestically along the value chains, policy and institutional problems which don't give much attentions to sectoral linkages and investment alignments, incidences of high prevalence of illegal trade particularly in the livestock sector, challenges to access financial services to operate at optimal scale, inadequate provisions of strategic raw materials, lack of access to reliable markets, and poor logistic services.

The agro-processing focus group discussants indicated consideration of the below corrective actions:

- For the government to conduct a comprehensive and detailed diagnostic assessment along the value chain and carefully look at the potentials of each subsector as well as complementarities that could serve as a basis for developing strong and sustainable intersectoral linkages;
- For all actors along the value chain to effectively contribute their shares to ensure improved competitiveness of the subsectors;
- For policies and strategies be designed to give special privileges and incentives to local manufacturers at least for a defined short period of time to protect them against unfair competition from foreign firms;
- For the government to work decisively to solve administrative and bureaucratic bottlenecks that hinders investments and development;
- For the government to revise the existing investment policy and incentive structures to support the development of the subsectors and to possibly enhance the use of domestic inputs and encourage intersectoral linkages

Conclusion and Policy Implications

Results from this study confirmed the presence of weak linkages between agriculture and agro-processing activities and within agro-processing activities themselves. The linkage has been found to be very weak especially in the fruits and vegetables activities although several other activities have also exhibited weak intersectoral

linkages. Cereals have strong forward linkage showing that the agro-processing concentrates in flour processing and bakery business.

The weak intersectoral linkages between agriculture and industry implies that there is a long way for inducing effective structural transformation and decent jobs if Ethiopia continues to do things the same way. The major problem regarding weak linkages is more resulting from the structure of the economy and weak implementation of the plans, policies and strategies rather than the existence of such documents. It will remain an uphill to achieve sustainable development without building high quality value chains and linkages within and between agriculture and manufacturing, fostering economic structural transformation, and ensuring a vibrant business environment for the private sector to flourish.

The study recommends that policy making should focus on improving implementation capacity to transform agriculture and promote systemic linkages between agriculture and manufacturing to sustainably improve the economy's overall productive capacity. Particular attention should be given to the fruits and vegetable subsector where the forward linkages are extremely weak. Thus, policy makers and national planners should give more attention to improve linkages between the agriculture and the agro-processing activities by improving national implementation capacity, removing the binding constraints that hinder strong intersectoral linkages, undertaking technological or technical upgrading, and fixing the looseness on the value chains of each agro-processing activities.

1. Introduction

1.1. Background

There has been strong consensus among scholars of development economics that the industrial sector, particularly manufacturing, possesses relatively a much bigger potential than other sectors in terms of sustainably absorbing large amounts of labor force and achieving successful economic structural transformation. This mainly emanates from the sector's benefit from technological improvements, its high capacity to exhibit prolonged periods of increasing returns to scale, and its high potential for inducing the development of other sectors through its strong backward and forward linkages (Newman et al., 2016). As a result, manufacturing has historically received a disproportionately favorable policy and financial support in many countries in different epochs.

It is evident that structural transformation cannot be achieved without strong linkages between agriculture and manufacturing particularly at the early stages of the development process. Cognizant to this, economic development theories have given considerable attention to sectoral linkages since the 1950s. For instance, Lewis (1954) considered agriculture as less productive compared to manufacturing. He then suggested that the agricultural labor should be reallocated to the most productive manufacturing sector. According to Lewis, the role of agriculture was mainly to supply labor to manufacturing sector, which expands continually through adopting productivity enhancing technologies. In a definitive form, the essence of sectoral linkage was introduced by proponents of unbalanced growth model, which believed that manufacturing sector with higher forward and backward linkages should be promoted to induce growth and development (Hirschman, 1958)[1].

The development process of many countries clearly shows that at the earlier phase, countries tend to produce commodities which intensively use agricultural outputs as intermediate input and also heavily rely on labour-intensive techniques. For instance, from recent experiences in South-East Asian (SEA), South Korea gave prime focus on the development of agro-processing industries such as textile and garment, food, and beverage at the early stages of industrialization in the 1970s (UNIDO, 2017). This development pathway helped South Korea and other SEA countries to achieve sustainable growth, and structural transformation. For instance,

[1] This theory explicitly recognizes the linkage between agriculture and the manufacturing as a source of sustainable economic development.

from 1950 to 1990, industrial employment soared from 7 percent to 26.9 percent in South Korea, from 12 percent to 32 percent in Taiwan and from 19 percent to 29.5 percent in Singapore (UNCTAD, 1996). This entails that, effective sectoral linkages could serve as a steppingstone for achieving successful structural transformation in Ethiopia wherein agriculture still contributes 32.5 percent of the Gross Domestic Product (GDP) while manufacturing contributes only 6.8 percent of the total GDP (PDC, 2021). Thus, strengthening linkages between manufacturing and other sectors particularly agriculture as well as linkages within manufacturing are the key focuses in designing development plans, policies, and strategies aimed at sustainably improving employment creation and economic structural transformation.

1.2. Statement of the problem

Ethiopia has introduced a series of economic development policies and strategies since the formulation of its First Five-Year development plan (1957-63) to transform the economy and improve the lives and livelihoods of its citizens (Welteji, 2018). These development policies and strategies have promoted some selected sectors in their respective implementation periods. For instance, in the mid-1960s, the imperial government anchored its economic development strategy on the development of sectors such as agro-processing, mining, and power generation with the ultimate objective of propping up the domestic manufacturing capacity. This enabled the manufacturing sector to grow at an annual average rate of 16 percent, and thus the sector's share in the total GDP reached 13 percent in 1967 from 9 percent in 1963 (UNDP, 2017). By contrast, agricultural sector development did not get enough emphasis by then. Agriculture was mainly meant to supply raw materials for the industrial sector besides the usual role of supplying the food required for household consumption.

The economic development pathway of Ethiopia was adhering to the 'industry first' approach in the 1950s and 1960s. Unfortunately, the industrial growth could not be sustained with the same pace after Ethiopia joined the socialist block in 1974. The shift in the political ideology has been accompanied by reforms that encouraged public ownership of private enterprises and thus the booming private sector left way for communal ownership. This adversely affected the status of the overall economy while industry sector growth drastically decelerated with negative growth rate averaging -1.4 percent per annum over the seventeen-years (1973/74 to 1990/91) of the Dergue period.

Ethiopia reverted to the market led economic system after the downfall of the socialist Dergue regime in 1991. Consequently, various reforms[2] have been initiated to speed up the transition into a market based economic system partly supported by the structural adjustment program spearheaded by the World Bank (WB) and the International Monetary Fund (IMF). Ethiopia also introduced the Sustainable Development and Poverty Reduction Program (SDPRP) and the Plan for Accelerated and Sustained Development to End Poverty (PASDEP), which were used as guiding strategic frameworks during 2002/03-2004/05 and 2005/06-2009/10, respectively. The country has also introduced Agricultural Development Led Industrialization (ADLI) strategy in 1993, and this has continued to be the overarching strategy on Ethiopia's development efforts complementing the initiatives under the SDPRP and PASDEP until the first Growth and Transformation Plan (GTP) was put in place in 2010. The main aim of the ADLI strategy was to achieve initial industrialization through robust agricultural growth and creating strong linkages between agriculture and industry.

In general, Ethiopia's development orientation in recent decades has been to bring about structural transformation primarily through industrialization. During ADLI, the attempt was to transform the economy by first developing agriculture, as it was considered as the best engine for propelling the socio-economic development due to its purported potential for creating the basis for industrialization and generating the necessary surplus for the expansion of other sectors. By prioritizing agriculture and creating initial stimulus for the sustainable growth of the industry the economic policy has been aimed to raise productivity in both agriculture and industry through appropriate linkages between sectors and other interventions. The key focuses to close the input-output linkages and enhance productivity in the overall economy were through commercialization and market-oriented production in agriculture and through export orientation and labor intensiveness in industry.

Following long years of implementing SDPRP, PASDEP, and ADLI and recognizing their failures to deliver the intended goals in sustainably developing agriculture, let alone transforming the general economic structure, Ethiopia designed and implemented two successive growth and transformation plans (GTP I and GTP II) to induce a comprehensive economic structural change. Again, the GTP I (2010/11-2014/15) and GTP II (2015/16-2019/20) also gave peculiar attention to industrialization. Priority industries, namely textile and apparel, leather and leather

[2] Such as devaluation, liberalization, and privatization.

products, sugar, metal and engineering, chemical products, paper products, pharmaceutical products, and agro-processing industries have been prioritized (MoFED, 2010). The argument was that industries can help diversify exports, increase foreign exchange earnings, promote linkage with the agricultural sector, create employment for the abundant labor force, and ensure rapid technology transfer.

Although Ethiopia has shown progress in selected indicators of economic development, the process of transition from agriculture to sectors with better productivity and increasing returns to scale has been sluggish. The manufacturing subsector which is conventionally known for its higher productivity and increasing returns to scale has not been performing well in Ethiopia. For instance, the share of the manufacturing subsector in GDP has remained low at less than 6.8 percent, and its share in merchandize export earning stood at less than 13 percent by the end of 2019/20 (PDC, 2021). This signifies that the manufacturing subsector is extremely feeble, and the desired change has been far from being achieved. In addition to this, the Ethiopian manufacturing subsector is characterized by less degree of sophistication and integration both within itself and with other sectors. As a result, the subsector is dominated by light industries and showed a tardy transformation over several decades. Besides, the average capacity utilization remained persistently low partly due to high reliance on imported inputs, weak forward and backward linkages, frequent energy outage, and inadequate supply of skilled labor (PDC, 2021).

The low intersectoral linkages within the domestic economy and the lack of substantial improvement in both agriculture and industry over the past decades can also be looked at from the extent the country substituted imports of agro-processed products. Much of agro processed products in big supermarkets in Ethiopia have been imported (GAIN, 2016) signifying mainly very low level of import substitution and sluggish structural transformation despite the implementation of various industrial development plans and strategies including the growth and transformation plan.

It is evident that sound policy making often requires detailed assessment using micro and macro frameworks to closely examine the degree of sectoral linkages to reap larger economic benefits in the long-term. Among these, the link between agriculture and industry dominates the debates very often; and Ethiopia's urge for economic structural transformation revolved around this very fact for the past several decades. The issue of economic structural transformation has also been

considered by the former Planning and Development Commission as one of the ten strategic pillars in the ten-years development plan (PDC, 2021).

Although empirical studies on Ethiopia highlighted that the linkage between the agriculture and the manufacturing sectors and the market has not been strong, evidence have shown that strong sectoral linkage is one of the most salient sources of economic development (Berliant, 2007). This is because the expansion of key sectors will have a significant impact on competitiveness, increasing output, income, or employment domestically. Particularly, in the initial phase of development when the agriculture sector is the main driving sector of the development of the economy, it plays a crucial role in establishing the framework for industrialization (Fei and Ranis 1961, Kuznets 1965). Agriculture supplies raw materials and key inputs including labor to industry while it in turn uses important industrial outputs as productivity enhancing farm implements and machineries. These forward and backward interlinkages between the sectors are important elements of the development process. Thus, the assessment of sectoral linkages lays the foundation to ensure sustainable economic development. Therefore, a proper understanding of sectoral linkages between agriculture and industry is necessary for designing appropriate long-term policies and strategies to achieve a sustainable development by addressing the following research questions.

- To what extent do the priority industries (agro-processing) have backward and forward linkages? To what extent are manufacturing sectors linked to the agricultural sectors?
- How do manufacturing link to existing and emerging formal market outlets in Ethiopia?
- What are the hindering factors for sectors to have high sectoral linkages within the economy?

There is a wide range of empirical studies on the topic of sectoral linkages in Ethiopia. However, these studies heavily focused on examining the impact of external shocks (Tadele and Philip, 2005; Fekadu, 2007; Solomon, 2015). Critical examination of the policy context of Ethiopia from a sectoral linkages perspective using a mix of both qualitative and quantitative methods of analysis is lacking. Thus, this study aims at filling the research gaps using a Social Accounting Matrix (SAM) multiplier analysis and an additional qualitative assessment that has augmented the results of the SAM multiplier analysis by providing the necessary contextual dimensions and insights.

This study assesses and generates evidence on the opportunities and constraints that Ethiopia faced in creating decent employment opportunities in industries over the past decades. Furthermore, the study examines factors behind the weak structural transformation that has been observed in Ethiopia's economy (mainly from agriculture dominated economy to industry dominated in terms of value added, exports, and job creation) over the past decades and propose policy recommendations that help overcome this in the subsequent years of development endeavors.

1.3. Objectives

The general objective of the study is to assess the nature of the agriculture-industry linkages and the role of the linkages in employment creation and structural transformation of the Ethiopian economy. This general objective has been explored through the following specific objectives:

- to identify factors behind weak structural transformation observed in the Ethiopian economy despite the double-digit growth registered during the last decades;
- to assess the contribution of agriculture and industry sectors in general, and manufacturing in particular to employment creation and overall economy of the country;
- to assess the extent of the agriculture-industry linkages in the Ethiopian economy and its role in fostering economic structural transformation;
- to review experiences and lessons of other countries which remarkably transformed their economies from a predominantly agrarian economy into industrialized economy; and
- to review the existing agriculture-industry linkage policy and strategy documents, examine the documents and identify their shortcomings, if any, and propose policy reforms that are necessary for ensuring strong and effective agriculture-industry linkages that will bring the needed structural transformation of the country's economy.

2. Review of the Literature

2.1 Market and sectoral linkages theories

Efficient resource allocation is one of the central issues in economic development. This is because scarce resources ought to go into key sectors which could induce sustainable development, promote sectoral linkages, ensure broader spillover effects, and create greater employment opportunities. Because of this, the issue of sectoral linkages has remained as an anchor subject matter in the realm of economic development since long time. Particularly, in the 1950s when "industry first" was a prominent approach in economic policy, there was huge debate about the best ways of ensuring intersectoral linkages. Some argued that economies should invest in all sectors while others suggested few, but the most important sectors should be given prime attention. Theories including 'big push' (Rosenstein-Rodan, 1943), 'balanced growth' (Nurkse, 1953), and 'take-off into sustained growth' (Rostow, 1956) have proposed the promotion of all sectors equally. The fundamental argument of all theorists was anchored on the fact that the industrial sector could spur economic growth and development by creating linkages in the economy.

In his study, Rosenstein-Rodan (1943) superbly argued that at an early stage of development, the investments of industrializing firms in one sector may raise the profitability of other sectors in the entire economy. Industrialization of many sectors at the same time could be beneficiary for all of them, but no sector would be benefiting industrializing alone.

Lewis (1954) also introduced growth model of development based on the historical experience of the now western industrialized countries. Lewis' theory basically assumed that there are two sectors in a traditional economy notably traditional agricultural sector with surplus labor and a modern industrial sector with high labor productivity. Economic growth in such an economy can be achieved by rapid capital reinvestment in the non-agricultural (e.g., industrial and service) sector, aided by drawing surplus labor from the agricultural sector. In the Lewis theory, an economy gradually transits from the first, 'labor-surplus stage' to the second, 'labor-scarce stage' of development. The linkage between the agricultural and industrial sectors is through labor migration. Fie and Ranis (1961) extended the Lewis growth model, yet they considered agriculture as equally important as manufacturing in the development process. The theory averred that development can happen if there is a shift from the agricultural sector to the industrial sector of the economy, which

happens by the transmission of labor from the agricultural sector to the industrial one. At the same time, growth in the agricultural sector must not be neglected and its output should be sufficient to support the whole economy with food and raw materials. This shows that Fie and Ranis (1961) recognized the importance of the agricultural sector for its contribution to supply labor and raw materials to the industrial sector through its forward linkages.

The issue of sectoral linkages was vividly discussed in the 1960s when the 'balanced' versus 'unbalanced' growth models were much debated. Both approaches emphasized the role of intersectoral linkages in the development process. The difference was basically resided on the way of ensuring effective sectoral linkages. In this regard, Nurkse's balanced growth model claims that all sectors in the economy are important to induce economic development. Accordingly, investment should be made in all sectors in such a way the supply and demand bottlenecks could be squashed simultaneously through effective sectoral linkages. This signifies that Nurkse recognized the expansion and intersectoral balance between agriculture and manufacturing as a necessary condition to bring effective sectoral linkages in the economy. However, unbalanced growth models such as the one provided by Lewis (1954) claims that investments in selected sector would create a spill-over effect on other sectors and ultimately lead to overall economic transformation.

Though the Nurkse 'balanced growth model' is important to do away with sectoral linkages in a coordinated way, its applicability in developing economies remains doubtful since developing economies have deficiencies of resources, enterprises, and entrepreneurship. Because of this, Hirschman's (1958) unbalanced growth model have gotten wider acceptance in the developing world. The theory claims that economic growth and development could begin from promoting some prominent sectors which have strong backward and forward linkages. Hirschman pointed out that underdeveloped countries cannot develop all the sectors simultaneously rather one or two strategic sectors or industries should be given priority. The criteria of selecting priority sectors depend on the capacity of the sectors to bring backward and forward linkages in the economy.

The issue of sectoral linkages has long been one of the areas of focus in the theories of growth and development. For instance, O-ring model of economic development posits coordination failure as one of the salient reasons for underdevelopment in developing economies (Kremer, 1993). The proponents of the theory claim that effective coordination along the chain of production and distribution is quite important. This again signifies the importance of forward and

backward linkages across different economic agents in the production and distribution processes to induce structural transformation and sustainable economic development. The theory also pointed out that complementarities between several conditions are necessary for successful economic development.

2.2. Theories on structural transformation

Most economists in the classical tradition, from Adam Smith up to the early 20th century, supposed that laissez-faire economics could achieve sustained economic growth and structural transformation due to the believe that the market system ensures efficient allocation of resources. The role of structural transformation for economic development has been glorified by Kutznets (1979) who argues that the ultimate sources of higher rate of economic growth of per capital income is achieved if there is successful structural transformation. The concern of how to achieve structural transformation paved the way for the emergence of various theories on structural transformation. For instance, Prebisch (1950) indicated that by specializing in commodities and resource intensive outputs where many of them have a comparative advantage, developing countries could miss their chances of industrializing. He suggests that this direction of structural transformation tend to make their terms of trade decline thereby exacerbating the balance-of-payments constraint on economic growth. However, empirical research vindicated that, since the mid-1970s, there has been a downward trend in the terms of trade of manufactures produced by developing countries compared to those produced by developed economies (Sarkar and Singer, 1991). In other words, developing economies that specialized in low-tech, low-skill-intensive manufactures couldn't escape the problem of declining terms of trade, while those that managed to upgrade their exports into high-tech, high-skill-intensive manufactures could improve their terms of trade. This implies that an export-oriented diversification strategy towards manufacturing does not necessarily solve the terms-of-trade issue noted by Prebisch, which in turn emphasizes the key role of upgrading and technological change.

The interest in structural transformation has been declined in the 1980s and 1990s, mainly due to the prevalence of Washington Consensus. However new strand of economic theories notably the new structural economics literature, the new Latin American structuralism, Schumpeterian, or evolutionary, economics, the global value chain literature and resource-based industrialization have been emerged since 2005. For instance, according to the new structural economics literature approach,

firms would move up the industrial ladder and become progressively more competitive in more capital- and skill-intensive products. This in turn would lead to an upgrade of the overall economy's factor endowment and industrial structure (Ju et al., 2009). The evolutionary approach to structural change relies on the idea that the scope for technological change varies substantially across industries, and that the speed of technological progress thus crucially depends on the dynamics of structural transformation in an economy (Dosi et al., 1990). The value-chain literature argues that structural transformation has also been revived by the observation that production today is globally fragmented, giving rise to global value chains. The new Latin American structuralism shows how productive heterogeneity and the direction of structural transformation that prevailed in recent decades hampered technological change and development. Latin American economies are characterized by strong heterogeneity such that resource-based industries are highly productive and technologically advanced, whereas manufacturing industries are less productive and advanced. Structural transformation favoring resource-based industries at the expense of manufacturing industries ceased industrialization and slowed technological change, learning, and accumulation of capabilities (Cimoli, 2005)

2.3. Empirical literature review

There are empirical evidence that deals with the contribution and influence of sectoral linkages on economic development and employment creation in different countries. Some studies applied time series econometrics while others deployed SAM multiplier analysis. In addition, some of the studies are country specific while some others have multi-country dimension. Tiffin and Irz (2006), using a co-integration framework and Granger-causality tests on 85 countries data, study found that agricultural value added is the causal variable to bring economic growth in developing countries. A study by De Souza (2015) estimates the relationship between the growth rate of agricultural productivity and the manufacturing sector for 62 developing countries. The study shows that a one percentage increase in agricultural output raises manufacturing output growth between 0.47 percent and 0.56 percent in the general model and between 0.28 percent and 0.47 percent for the parsimonious model.

The importance of agriculture for growth in the context of the ADLI strategy has been demonstrated by Vogel (1994), who estimated the forward and backward SAM multipliers for agriculture and non-agriculture for a variety of developing and

developed countries and found out that the backward multipliers of agriculture are much larger than the forward multipliers at all development levels. The finding entails that the agriculture sector contributes considerably to industrial sector growth and overall economic growth in different countries.

Yao (2000) also demonstrated how agriculture has contributed to China's economic development using a co-integration analysis. Although agriculture's share in GDP declined sharply over time, it remained an important force for the growth of other sectors notably the industrial sector. Subramaniam and Michael (2009) estimated the linkages among agriculture, manufacturing, service and trade for Poland and Romania using an econometric model. The long run relationship shows that the industrial sector in Poland has positive contribution to the agricultural sector and in Romania the industrial sector is detrimental to the growth of the agricultural sector. Fiess and Verner (2001) signified agricultural sector as a major driving force in sectoral growth in Ecuador.

On the other hand, Kanwar (2000) found out that effective linkages among agriculture, infrastructure, and service sectors significantly affect the process of income generation in the manufacturing and constructions sectors in India. Saikia (2011) found that India's 'agriculture-industry' linkage has undergone directional changes as both the production and demand linkages, which were primarily from industry to agriculture in the pre-reform period and transformed to agriculture to industry in the post-reform period. It has been shown that improved agriculture performance will provide the necessary raw material for industries to thrive in Africa (Diao et al., 2018). Blunch and Verner (2006) found empirical evidence to support a large degree of interdependence in long-run sectoral growth in Cote d'Ivoire, Ghana, and Zimbabwe, and concluded that the sectors grow together since there are externalities or spillovers.

Hoai et al. (2016) using a SAM multiplier and decomposition analysis has shown that for several important manufacturing subsectors, inter-industry interaction has contributed positively to the change in gross output between 2000 and 2012 in Vietnam, confirming the existence of higher backward linkage multipliers for these activities. Chitonge and Kabinga (2019), using SAM multiplier analysis, have shown that the agriculture and manufacturing sectors have strong backward linkages in the Zambian economy while the services sector revealed weak backward and forward linkages to the rest of the economy between 1994 and 2010. This suggests that manufacturing, particularly agro-processing relies on the agricultural sector for input supplies Indeed, the subsector still relies on imports of non-agricultural intermediate

goods. They further claimed that the local market for agro-processing products has been limited and inhibits growth in the agro-processing sector. Apart from this, they pinpointed that the subsector is hampered by policy inconsistencies and logistical constraints, which not only reduce the competitiveness of local producers but also act as a barrier to the subsector from realizing its full potential.

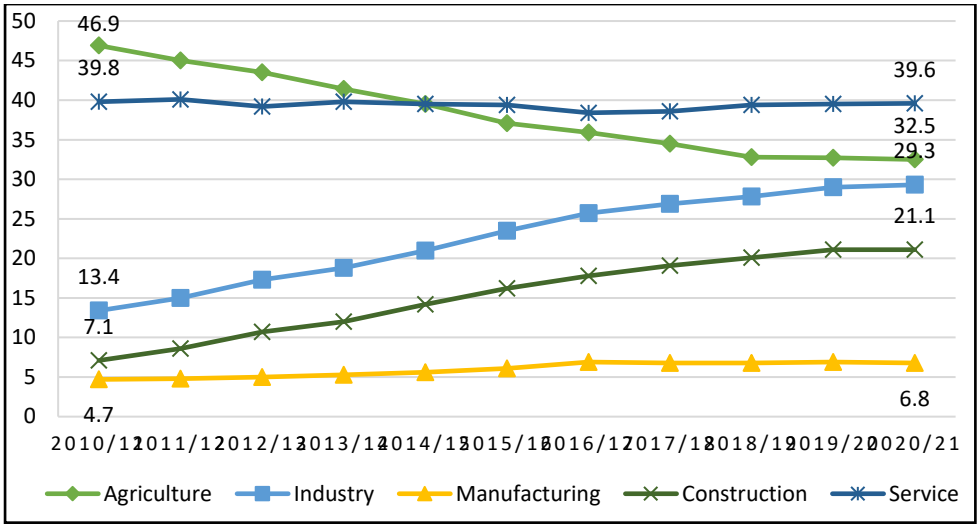
2.4 Overview of the Ethiopian economy

2.4.1 General structure of the Ethiopian economy

Ethiopia is one of the poorest countries in the world. The country's per capita income reached US$ 1,092 in 2020/21 (PDC, 2021) which is substantially lower than the SSA regional average of US$ 1,645. In Ethiopia the average economic growth rate of 10.5 percent from 2004-2018 over the last decade was far beyond the average 5.2 percent economic growth rate recorded in Sub-Saharan Africa (SSA) countries, (PDC, 2021). As a result, the level of poverty in Ethiopia has declined from 45.5 percent in 1995 to 29.6 percent, in 2011 (MoFED, 2012) and is estimated to reach as low as 19 percent in 2020 (PDC, 2021).

Nevertheless, such remarkable growth has not been accompanied by adequate structural transformation of the economy which should be reflected by a sustainable shift from low productivity and labor-intensive activities such as agriculture to high productivity and skills-intensive activities both within and between sectors and subsectors. Although the share of agriculture in GDP had been steadily shrinking from about 47 percent of GDP in 2010/11 to 32.5 percent in 2020/21 (Figure 4.1), the share of the manufacturing sub-sector in GDP increased from 4.7 percent in 2010/11 to 6.8 percent by 2020/21. An apparently interesting development is that the country's high growth rate has been driven primarily by growth in the service and industrial sectors (which was driven by the boom in the construction sector) which, respectively, accounted for 39 percent and 29 percent of GDP in 2020/21.

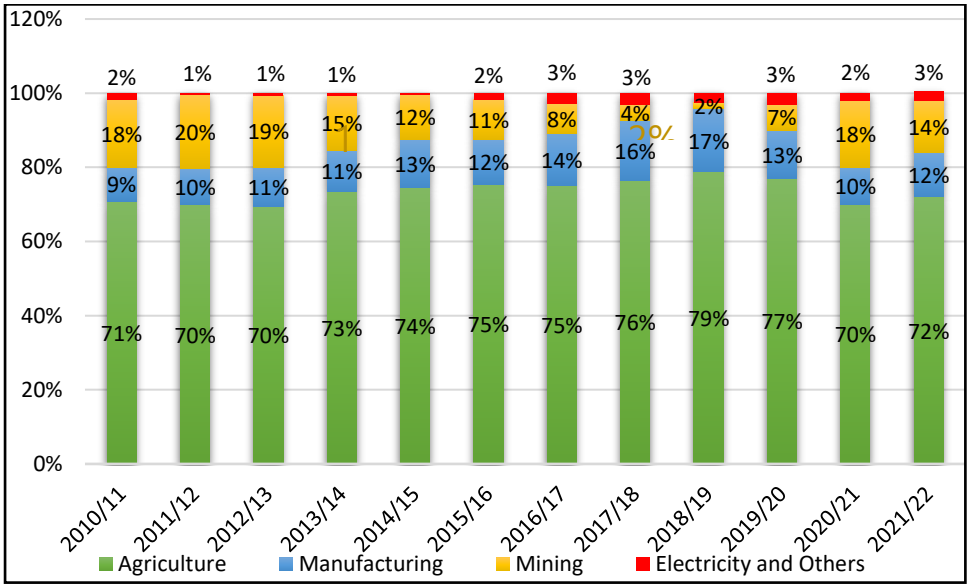
Figure 1: Share of major economic sectors in total GDP (percent)



Source: Ministry of Planning and Development (2021)

On the other hand, there has been encouraging results in the total value of merchandise exports in recent years. However, diversifying exports remained arduous and the main export commodities continue to be dominated by agricultural products, especially coffee, sesame, cut flowers, khat, as well as gold. One of the indicators of economic structural change is the change in the composition of merchandise exports, particularly a rise in the share of manufacturing goods in total merchandise export. In this regard, the share of manufacturing goods in total merchandise export increased from 9 percent in 2010/11 to 17 percent by 2018/19, while the share of agriculture in merchandize export increased from 71 percent to 79 percent during the same period (Figure 2). However, the share of manufacturing fell back to 10 percent in 2020/21 before slightly reviving to 12 percent a year later. Thus, there has not been a shift both in terms of the diversity of the products and the sectoral composition in exports – implying weak structural change in the economy. Besides, the weak performance in exports coupled with high import demands led to huge trade deficits.

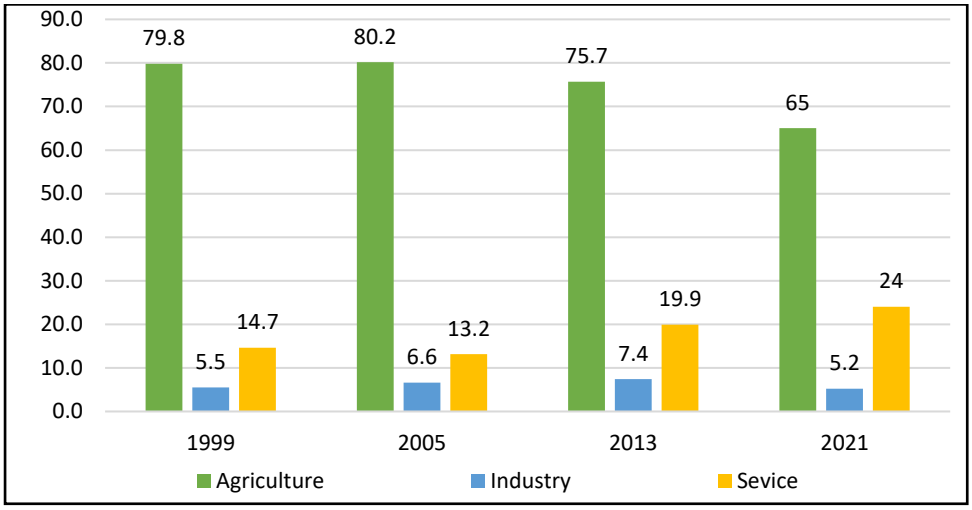
Figure 2: Trends in sectoral share in merchandise export (percent)



Source: Compiled Based on data from National Bank of Ethiopia

Besides changes in the sectoral compositions of GDP and export, structural change can also be mirrored through shifts in the composition of labour force participation in the economy. The economy has been highly dependent on agriculture and primary activities in terms of labour force participation. At the national level, 65 percent of the labour force are engaged in agricultural activities in 2021, which declined from 80 percent in 1999 and 72.7 percent in 2012/13 (CSA, 1999 and 2013; ESS, 2021). The data also indicates that the share of labour force participation in industry sector which includes manufacturing, mining, quarrying and construction activities together employ only 5.2 percent of the labour force in 2020/21. This is a significant decline from 7.4 percent in 2013 (Figure 3). While the labour force participation in agriculture noticeably declined over the past two decades, this was compensated by rise in share of services and informal sector since the industry sector's share has been falling during the same period, testifying challenges for economic structural change.

Figure 3: Change in the composition of labour force (percent)



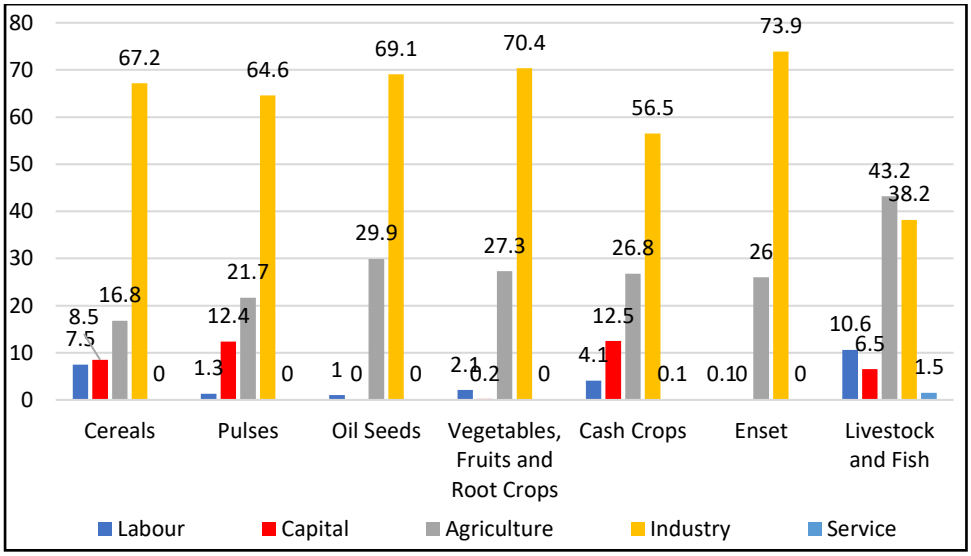
Source: Based on data from CSA (1999, 2005, 2013) and ESS (2021)

2.4.2 The SAM description of the structure of the economy

The production system of agricultural and industrial activities determines the level of sectoral linkages in the economy. In this regard, SAM (2015/16) based characterization has been made on the input consumption pattern of manufacturing and agricultural activities. The results have shown that agricultural activities relatively use more of labor and capital[3] than intermediate inputs. For instance, the share of labor out of the total value added of cereals is 67.2 percent and the figures go as high as 70.4 percent and 73.9 percent for vegetables/frits/root crops and Enset, respectively (Figure 4). On the other hand, the share of intermediate inputs from the industry sector by cereals is only 7.5% and it is as low as 1.1% for oil seeds. The results further revealed that the agricultural activities mainly use intermediate inputs from the agricultural sector itself. This is evidenced by the fact that the share of intermediate inputs from the agricultural sectors by cereals and pulse out of the value of the total output are 8.5 percent and 12.4 percent, respectively. The figure goes as high as 12.5 percent by cash crops. This entails that the linkage of the agricultural sector with the industrial sector is relatively weak.

[3] Land is included in capital for simplicity.

Figure 4: Share of production factors and intermediate inputs from total value of agricultural outputs (percent)

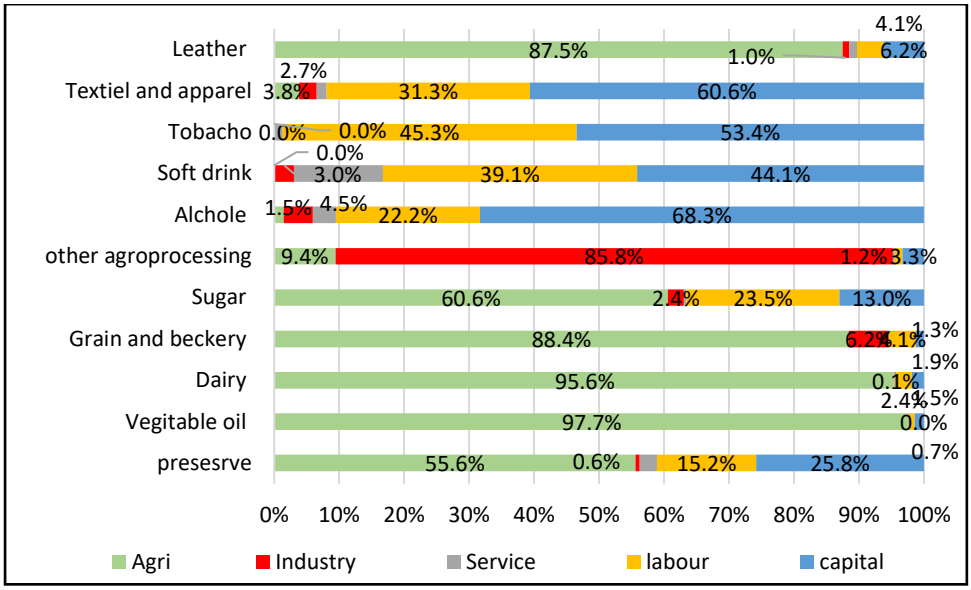


Source: Authors' computation based on SAM (2015/16)

Since the agricultural activities are mostly rainfed and do not use that much agro-chemicals and fertilizer, the share of agro-chemicals and fertilizers from the total value of the agricultural outputs is low.

The industrial sector relatively uses more of intermediate inputs compared to the agricultural sector. The input consumption pattern of manufactured activities varies across activities. Some use more of intermediate inputs while others use production factors intensively. For instance, 87.5 percent of the total value of the leather sector goes to the agricultural intermediate inputs. The figures go as high as 97.7 percent, 95.6 percent, and 88.4 percent for vegetable oil and dairy processing industries, and millers/bakeries respectively. Some of the industries notably textile and apparel, tobacco, beverage and alcohol use labor and capital intensively (Figure 5). For example, from the total value of textile 60.6 percent goes to capital and 31.3 percent of it goes to labor. This entails that these industries have the potential to create more employment opportunities.

Figure 5: Share of production factors and intermediate inputs from total values of agro-processing



Source: Authors' computation based on SAM (2015/16)

Sectoral linkages also depend on the consumption pattern of households and other economic agents. For instance, if households, firms and the government consume more of domestically produced goods that heavily use domestically produced raw materials and intermediate inputs, then they will induce more linkages and spillover effects in the economy. In this regard, agro-processing firms which use domestically produced agricultural outputs as intermediate inputs can boost demand for domestically produced agricultural goods through its backward linkage. Cognizant to this, assessment has been made on the sources of demand for goods and services. Results have revealed that from the total production of cereals, 85 percent is consumed as intermediate input by agro-processing enterprises, mainly grain mills and bakeries/grain mills. The rest 8 percent and 7 percent are consumed by households for final consumption and as intermediate input by the agriculture sector itself (e.g., seed usage), respectively. Similar demand pattern holds true for pulses and oil seeds (Table 1). But the lion shares of the demand of vegetables, Enset, cash crops, and livestock are consumed directly by households. This reality signals that many of the agro-processing enterprises are engaging in very few sectors notably grain mill, bakery, and vegetable oil production while agro-processing related to fruit and vegetables and livestock are not well developed.

Table 1: Demand structure for agricultural commodities (percent)

Type of Commodity	Intermediate input for agricultural sector	Intermediate input for industrial sector	Consumption by households	Investment	Export
Cereals	7	85	8	0	0
Pulses	11	57	13	0	19
Oilseeds	0	60	23	0	17
Vegetables and fruits	0	34	64	0	1
Cash crop	10	12	34	0	43
Enset	0	0	100	0	0
Livestock and fish	6	27	63	2	2

Source: Authors' computation based on SAM (2015/16)

It is evident that the lion's share of the manufacturing sector in Ethiopia are comprised of agro-processing and simple labor-intensive industries. Examining the sources of demand for these products helps to scrutinize the level of linkages they tend to create with the rest of the activities in the economy. For instance, the lion's share of the demand for the agro-processed products come from households. This signifies that these products are not heavily used as intermediate inputs. It is mainly the textile and the leather industries which export their outputs to the rest of the world.

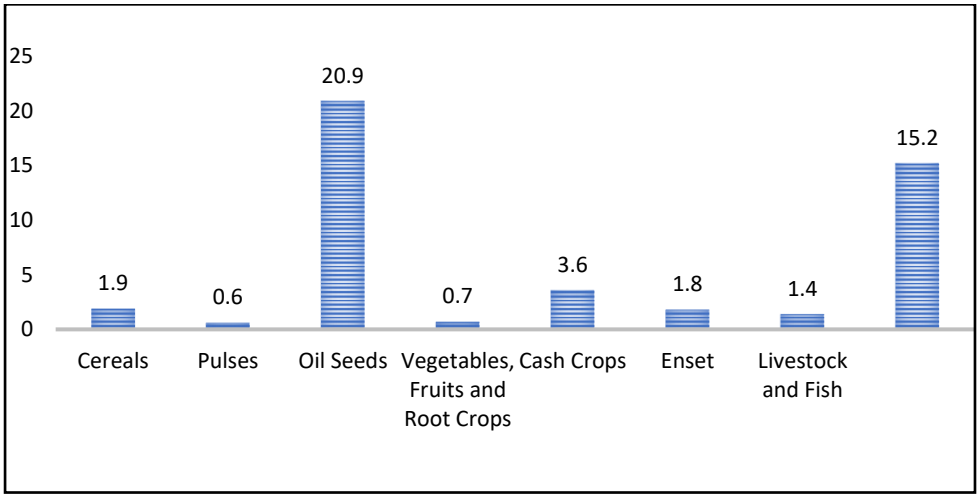
Table 2: Demand structure for agro-processed commodities

Type of Agro-processed commodities	Intermediate input for agricultural sector	Intermediate input for industrial sector	Consumption by households	Export
Preserve	0	36	52	12
Vegetable oil	24	18	58	0
Dairy	0	8	92	0
Bakery and grain	0	28	71	1
Sugar	0	20	80	0
Other agro-	23	2	75	0
Alcohol	0	3	97	0
Beverage	0	52	48	1
Tobacco	0	47	53	0
Textile/apparel	0	9	85	6
Leather	0	2	90	9

Source: Authors' computation based on SAM (2015/16)

An assessment has been made on the consumption pattern of different households in Ethiopia based on the 2015/16 SAM. Households nearly spend 55 percent of their income on food which are heavily coming from domestic sources. Bakery/grain mills constitutes the highest share of expenditure of the households followed by livestock and fish.

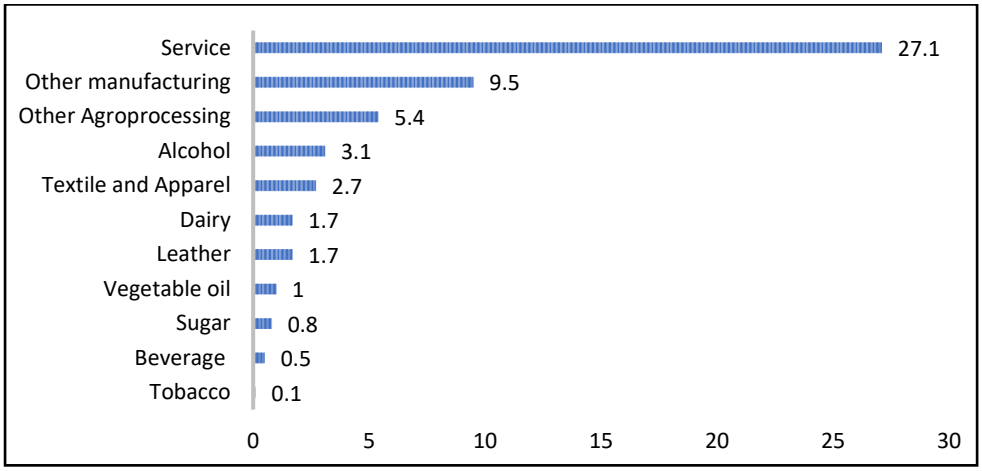
Figure 6: Household consumption patterns of agricultural commodities



Source: Authors' computation based on SAM (2015/16)

Households spend nearly 27 percent of their expenditure on services. textile and apparel and leather together accounts 5 percent of the total expenditure of households. "Other agro-processing", alcohol and dairy are the other important commodities where households spend their income. Besides, the share of imports in total supply of basic cereals is less than 0.5 percent which is extremely small. However, the corresponding import shares of textile (38 percent), paper (37 percent), sugar (11 percent), and leather (6 percent) are relatively higher. It is only the leather industry which exports more than it imports.

Figure 7: Share of expenditures of households on non-agricultural commodities



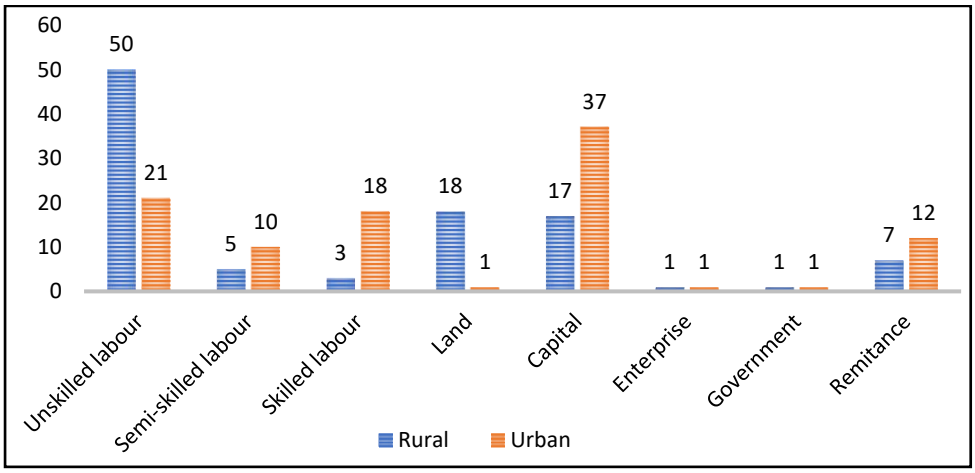
Source: Authors' computation based on SAM (2015/16)

Households get income mainly from labor (64.7 percent), capital (33.6 percent), land (1.14 percent), and remittance (0.3 percent). These are agricultural labour, non-agricultural labour, capital and land. These factors contribute more than 90 percent of the income of poor rural households. This figure is more than 83 percent for non-poor rural households. Indeed, the pattern is different between poor and non-poor households. The non-poor households earn their income from agricultural labor and non-agricultural capital. But the poor households earn their income mainly from agricultural labor. This is because non-poor households have non-agricultural assets using which they fetch additional incomes. On the other hand, urban households earn much of their income from skilled, unskilled, and professional labors. For instance, all urban households earn more than 60 percent of income from skilled labor. Small urban non-poor households obtain 20 percent of their income share from unskilled labor (Figure 8).

Thorough analysis has been made on the sources of income of households. The result shows that rural households earn nearly 50 percent of the total income from unskilled labor while the share is as low as 21 percent for urban household which earn 37 percent and 18 percent of its income from capital and skilled labor, respectively. Apart from this, both rural and urban households get income from the government in the form of transfers. The contribution of the government to both rural and urban households is extremely infinitesimal. In this regard, government transfers a higher income share to the urban households compared to the rural households. The other source of income of households is remittance from the rest of the world.

This is evidenced by the fact that nearly 12 percent of the income of the urban households and 7 percent of the rural households come from remittances sent from the rest of the world.

Figure 8: Sources of income of households (percent)



Source: Authors' computation based on SAM (2015/16)

3. Methodology

3.1. Data

Both primary and secondary data were collected using appropriate data collection tools. Secondary data were collected from various sources including national and sectoral plans, policies, strategies, reports, national accounts statistics, and other relevant documents. Macroeconomic and sectoral data were collected mainly on agriculture and manufacturing especially from Ethiopian Statistics Service, Ministry of Planning and Development, Ministry of Industry, Ministry of Agriculture, Ministry of Trade and Regional Integration, Ethiopian Investment Commission, Ministry of Finance, and the National Bank of Ethiopia. In addition to the secondary data, primary data was collected from industries and agri-businesses in Addis Ababa city administration and Hawassa town using Key Informant Interviews (KII) and Focus Group Discussions (FGD). The FGD were held with representatives from selected enterprises, government policy makers, and sectoral associations to get comprehensive insights on the agriculture-industry linkages and possible policy options.

3.2. Ethiopia's Social Accounting Matrix (SAM)

The most recent SAM of Ethiopia that was constructed in 2015/16. The 2005/6 and 2015/16 SAMs have been used to carry out the analysis. The 2015/16 SAM contains 81 activities and 83 commodities. The factor accounts include agricultural labor, non-irrigated land, irrigated land, skilled labor, semi-skilled labor, other agricultural capital, and capital. The SAM also has four household accounts: urban poor, urban non-poor, rural poor, and rural non-poor. Similarly, the tax account contains direct tax, sales tax, value Added tax, excise tax, and import duty. For this analysis, the SAM has been re-adjusted in such a way that it fits to the purpose of our analysis.

The 2015/16 SAM for Ethiopia used multiple surveys covering different dimensions of economic activities. We have also used the GDP and the 2020/21 Supply and Use Table (SUT)[4], generated by the Ministry of Planning and Development (MoPD) of Ethiopia, to fill the data gap in the service activities as well as to align the preliminary SAM estimates with national account statistics. Likewise, the SAM used certain coefficients of the service sector built from the most recent Tanzanian SAM (Randriamamonjy and Thurlow, 2015) to fill the data gap considering the similarity in economic structure and the level of economic development between Ethiopia and Tanzania as per international practices and the recommendations of the system of national accounts[5].

Table 3 lists the main data sources used for the 2015/2016 SAM's construction. Most of the input data are originated from the Central Statistics Agency (CSA). The SAM exhaustively utilized "Meher" Season Post Harvest Survey data to estimate agricultural components of the activity account. Multiple surveys covering various aspects of economic activity were used to construct Ethiopia's SAM. We also used the National Account Statistics (NAS) data for subjects not adequately covered by surveys.

[4] The SAM greatly benefited from the Ethiopia's first-ever supply use table constructed in 2020/21 covering economic features for the year 2015/16.

[5] When data for specific economic activities are inadequate, alternative constructs might be used, according to the most recent System of National Accounts (SNA) (2008).

Table 3: Data sources for the construction of the 2015/16 SAM for Ethiopia

Source of Data	Title of the Survey	Abbreviation
CSA	The 2015/16 Agricultural Sample Survey	AgSS
CSA	The 2015/16 Ethiopian Socioeconomic Survey	ESS
CSA	The 2015/16 Large and Medium Scale Manufacturing and Electricity Industries Survey	LMMIS
CSA	The 2015/16 Small Scale Manufacturing Industries Survey	SMS
CSA	The 2015/16 Ethiopian Household Consumption – Expenditure Survey	HCES
CSA	Retail and Producer Price Survey Data for the Year 2015/16	RPPSD
PDC	2015/16 Supply and Use Table	SUT
PDC	2015/16 Annual GDP estimate	XX
Randriamamonjy and Thurlow	2015 Social Accounting Matrix for Tanzania	XX

Source: Authors' compilation and elaboration

The two SAMs have been modified into a form that is suitable to compare results and to conduct the SAM decomposition analysis. Toward this end, the agricultural activities have been aggregated into cereals, pulses, oil seeds, fruits, vegetable and root crops, enset, cash crops and livestock and fish. The industrial sectors have been aggregated into agro-processed and non-agro-processed activities. Since the main aim of the study is to look at the linkage between agriculture and manufacturing sectors, the agro-processed activities have been disaggregated into preserve, vegetable oils, dairy, bakery and grain, sugar, other agro-processed, alcohol, beverage and soft drinks, tobacco, textile and apparel and leather. The activity and the commodity account have been merged so that the SAM decomposition analysis can be carried out.

Document reviews: Secondary data sources were garnered from various national and international industry documents as well as other sector level sources. This include documents regarding the Agricultural Development Led Industrialization Strategy (ADLI-1994), the National Industrial Development Strategy (NIDS-2002/03), Sustainable Development and Poverty Reduction Program (SDPRP-2002/03-2004/05), Plan for Accelerated and Sustained Development to End Poverty (PASDEP-2005/06-2009/10); GTP I, GTP II, the homegrown economic reform agenda (2019/20-2022/23), and the Ten-Year Development Plan (202021-2029/30). Additional secondary data were also obtained from international organizations such as the World Bank, United Nations Conference on Trade and Development (UNCTAD), the IMF, United Nations Industrial Development Organization (UNIDO), and others.

Focus Group Discussions (FGD): This was used to get more information about the industry agriculture linkage through a participatory discussion. Two FGDs in Hawassa and Addis Ababa were conducted. In the FGD eight participants were included from relevant governmental and non-governmental agencies, enterprises, supermarkets as well as other relevant actors in Addis Ababa and 10 participants from different manufacturing sectors notably from garment, leather, textile, flour took part in the discussion in Hawassa.

Key Informant Interview (KII): This method is used to explore more firsthand data about the nature and level of Agriculture-Industry Linkages and their contribution to employment and economic Transformation in Ethiopia. The initial guiding questions were prepared and followed up by posing more probing questions based on the responses during the discussions as a way of validating some of the explanations. The key informants were selected from Ethiopian government agencies notably Ministry of Industry, Ministry of Planning and Development, Ethiopian Chamber of Commerce, sectoral associations, and producers' associations.

3.3. Methods of analysis

A qualitative-quantitative mixed approach was used in this study. The task started with establishing the basis for understanding of policy making processes and policy priorities in Ethiopia through a systematic review of Ethiopia's past development plans, policies and implementation strategies starting with the ADLI strategy and all the way until the Ten-Year Development Plan. The implementation, shortcomings, and the content of the recent development plans, policies and

strategies in terms of planning and strategic development for inclusive and sustainable structural transformation were reviewed. To determine the extent of the linkage among agricultural and industrial sectors, a SAM multiplier analysis using the 2005/6 and 2015/16 SAMs has been used. This enabled to sort out subsectors with strong forward and backward linkages during the two periods and make comparisons. This enabled to sort out subsectors with strong forward and backward linkages in these two periods. In addition, SAM decomposition and structural change analysis have been conducted using the same data sets. The details of the approach are featured below.

3.3.1. SAM multiplier analysis

The input-output analysis and the subsequent measurement of linkage coefficients including SAM multiplier analysis has been used excessively for the identification of key economic sectors. Since the pioneering work of Rasmussen (1958), Chenery and Watanabe (1958) and Hirschman (1958), numerous studies applying input-output techniques have relied on linkage analysis to describe the linkage between economic sectors and to assist in the formulation of economic development policies and strategies.

In order to examine forward and backward linkages of agricultural and industrial sectors, the study employed a SAM-multiplier analysis. To use this technique, endogenous and exogenous accounts have been specified in order to capture the magnitude of influence caused by one sector over the other sector. The accounts of production activities, factors of production and domestic or institutions (such as households) were considered as endogenous, and those of government, combined capital and the rest of the world accounts were considered as exogenous.

The product of an economic activity is consumed by the sector (activity) itself, used as intermediate input by other activities (by endogenous accounts in other words) or consumed by households and institutions as final goods. This could be presented using the following matrix representation:

$$\mathrm{Y} = (I - A)^{-1} X = MX \qquad \textbf{(1)}$$

where Y represents the column vector of outputs or products in the left-hand side, X represents the column vector of the final consumptions, A represents the coefficients, and I is the nxn identity matrix. The matrix $M = (I - A)^{-1}$ is known as the accounting

multiplier matrix. Each cell M_{ij} of M quantifies the change in total income of account i as a result of a unitary increase in the exogenous component of account j. The forward linkage (in percentage terms) of sector j quantifies the change in income in sector r relative to the average change in the economy, caused by a unitary injection in the final demand of all sectors. If the forward linkage for sector j is greater than 100 percent, the change in sector j's income is higher than the average income changes in the economy after a unitary injection in all sectors. On the other hand, the backward linkage of sector j quantifies the change in economy wide income relative to the average change in the economy, caused by a unitary injection in the final demand of sector j. A key sector is usually defined as one with both backward and forward linkages greater than 1. If a sector has a backward linkage greater than 1, and forward linkage less than 1, is called backward oriented. On the other hand, if it has a forward linkage greater than 1, and backward linkage less than 1, it is called forward oriented. If none of the linkages is greater than 1, the sector is said to have weak linkages with other sectors (Parra and Wodon, 2009).

Let V denote the sum of all cells of the inverse matrix: $V = \sum_i \sum_j M_{ij}$. Let $M_{i\bullet}$ and $M_{j\bullet}$ denote the sum of the ith row and the jth column of the inverse matrix, respectively. $M_{i\bullet} = \sum_k M_{ik}$, and $M_{j\bullet} = \sum_k M_{jk}$. Then the Hirschman-Rasmussen backward linkage index of sector i is given by $BL = \frac{nM_{\bullet i}}{V}$ **(2,)** and the forward linkage index is given by $FL = \frac{nM_{\bullet j}}{V}$. **(3)**

The Hirschman-Rasmussen indices do not consider the relative importance of each sector in terms of GDP, final demand, or total production. Thus, adjustment has been made to capture the importance of the sector in the economy using weighed average. In this regard, a total production share of activities has been computed so that a weighted linkages index can be formulated as follows. Let α_i be sector i's total production share; the weighted sums of the ith row and column of the inverse matrix are given by $WM_{i\bullet} = \sum_i \alpha_i M_{ik}$ and $WM_{j\bullet} = \sum_j \alpha_k M_{jk}$ respectively. The weighted backward and forward linkage indices can be written as $WBL_i = \frac{nWM_{\bullet i}}{WBV}$

and $WFL_i = \frac{nWM_{i\bullet}}{WBV}$ respectively, where $WVB = \sum_i \sum_j \alpha_i M_{ij}$ and $WVF = \sum_i \sum_j \alpha_j M_{ij}$. A unitary injection in sector k will cause a change in income across other sectors in the amounts indicated by the kth row of the inverse matrix. These changes can be separated into self-induced component and non-self-induced component, together adding up to one. On the output side, the self-induced effects for sector k (in percentage) can be computed as $\frac{M_{kk}}{M_{k\bullet}}$. On the input side, these effects can be computed as $\frac{M_{kk}}{M_{\bullet k}}$, also in percentage.

The description assumes prices as fixed, technology as given, supply as flexible, and the existence of unitary expenditure elasticities. The assumption of unitary expenditure elasticities also holds true in Ethiopia (Nigussie, 2012). As prices and technologies are not responsive in the short run, assuming a given technology and fixed prices seems plausible.

3.3.2. SAM decomposition

The above multiplier matrix can be decomposed into three economically meaningful components or sub-matrices following Stone (1981), Pyatt and Round (1979), and Round (1985) decomposition techniques (see the detailed specification in the Appendix 2). This enables to identify which of these linkages induce higher multiplier in the economy. The multiplicative form is depicted below.

$$\bar{Y_n} = M_{a3}M_{a2}M_{a1}F \quad \textbf{(4)}$$

The above specification could be converted into an additive form in the following way.

$$\bar{Y_n} = (I + (M_{a1} - I) + (M_{a2} - I) * M_{a1} + (M_{a3} - I) * M_{a2} * M_{a1})\text{*F} \quad \textbf{(5)}$$

$$d\bar{Y_n} = d(I + (M_{a1} - I) + (M_{a2} - I) * M_{a1} + (M_{a3} - I) * M_{a2} * M_{a1}) \quad \textbf{(6)}$$

Since the above equation is in additive form, the total change on y could be written as

$$\bar{dY_n} = \big(I + (M_{a1} - I)\big) * dF + (M_{a2} - I) * M_{a1}) * dF + d(M_{a3} - I) * M_{a2} * M_{a1}) * dF. \quad \textbf{(7)}$$

Since the multiplier component is constant in each sub matrix in the above expression, the change in total output is the result of the multiplication of the change in total demand and the multiplier component.

The first of these matrix ($(M1 = M_{a1} - I)$) shows both the direct effects on the endogenous accounts of one-unit exogenous shocks (appearing as unit increases in the diagonal) and subsequent interaction effects among accounts within the same institutional group. The direct effect captures the multiplier effects resulting from direct transfers within institutions, households and the interindustry transfers. This component of the SAM multiplier depicts the part of the multiplier that mainly comes from the forward and backward linkages among activities in Ethiopia where intra-household transfer is limited. The first part of the M1 which is $(I - A_{11})^{-1} - I$ is the only active matrix in Ethiopia and it shows the typical input-output multiplier in the economy.

$$M_1 = \begin{bmatrix} (I - A_{11})^{-1} - I & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & (I - A_{33})^{-1} - I \end{bmatrix} \quad \textbf{(8)}$$

The second component, the open-loop matrix, captures cross-effects between different institutional groups. These effects are transmitted from one category of endogenous institutions to other endogenous categories, and in turn, set in motion multiplier processes of within-category interaction effects, which amplify the initial stimulus. The open-loop effects capture the interactions among and between the three endogenous accounts notably activities, production factors, and households. The diagonal elements are zero and this component of the multiplier captures the off-diagonal elements which are typically cross account effects.

$$\text{OL}= \begin{bmatrix} 0 & A_{13}^{*}A_{32}^{*} & A_{13}^{*}(I - A_{33})^{-1} \\ A_{21}^{*}(I - A_{11})^{-1} & 0 & A_{21}^{*}A_{13}^{*}(I - A_{33})^{-1} \\ A_{32}^{*}A_{21}^{*}(I - A_{11})^{-1} & A_{32}^{*} & 0 \end{bmatrix} \quad \textbf{(9)}$$

The third component, closed-loop matrix details the multiplier effects of an exogenous change on one institutional group, after it has travelled through the rest of endogenous accounts and returned to the original recipient. Thus, the closed-loop matrix captures the full circular multiplier effects net of own and open loop effects; i.e., from production activities to factors to institutions and then back to activities in the form of consumption demand. This component is basically linked to the consumption effect of an external shock that comes from institution to the activity account.

$$\text{CL} = \begin{bmatrix} C_{132}(I-A_{11})^{-1} & C_{132}A_{13}^{*}A_{32}^{*} & C_{132}A_{13}^{*}(I-A_{33})^{-1} \\ C_{213}A_{21}^{*}(I-A_{11})^{-1} & C_{213} & C_{213}A_{21}^{*}A_{13}^{*}(I-A_{33})^{-1} \\ C_{321}A_{32}^{*}A_{21}^{*}(I-A_{11})^{-1} & C_{321}A_{32}^{*} & C_{321}(I-A_{33})^{-1} \end{bmatrix}$$

$$C_{132} = (I - A_{13}^{*}A_{32}^{*}A_{21}^{*})^{-1} - I, C_{213} = (I - A_{21}^{*}A_{13}^{*}A_{32}^{*})^{-1} - I, C_{321} = (I - A_{32}^{*}A_{21}^{*}A_{13}^{*})^{-1} - I \quad \textbf{(10)}$$

Thus, decomposing the general multiplier analysis into the above three components could clearly sort out which of these linkages are strong in the Ethiopian agricultural and manufacturing sectors.

3.3.3. Structural transformation

The speed of technological progress in different sectors crucially depends on the dynamics of structural transformation in an economy (Dosi et al., 1990). Therefore, the speed of technical changes in different sectors could be a good proxy to examine the rate of structural transformation in Ethiopia. It is evident that the changes in a sector's level of output could emanate from two sources, namely changes in technology and changes in final demand. Here, positive contributions in change to output due to changes in technology should be interpreted as the degree to which interactions amongst activities have increased and leakages out of the domestic economy have declined. We follow the approach and notation of Millar and Blair (2009) and Hoai et al. (2016). Gross output in year 2005 and year 2015 can be written as:

$$\Delta \text{Y} = (I - M)_{2015}{}^{-1} F_{d2015} - (I - M)_{2005}{}^{-1} F_{d2005} \quad \textbf{(11)}$$

We have two components on the right-hand side, notably $(I-M)_{2005}{}^{-1}$ and F_d. The $(I-M)_{2015}{}^{-1}$ shows the multiplier part while F indicated the final demand of commodities. Thus, it is possible to decompose the change in output, ΔY, as the change in these two components. Changes in $(\boldsymbol{I-M})^{-1}$ and F can be weighted in terms of the year 2005 or the year 2015's final demands and technologies respectively or a combination thereof. We take an unweighted average and derive the decomposition in the following way:

$$\Delta Y = \left(\frac{1}{2}\right)\left((I-M)_{2015}{}^{-1} - (I-M)_{2005}{}^{-1}\right)(F_{d2015} + F_{d2005}) + \left(\frac{1}{2}\right)\left((I-M)_{2005}{}^{-1} + (I-M)_{2015}{}^{-1}\right)(F_{d2015} - F_{d2005}) \quad \dots \quad \textbf{(12)}$$

In this way, the component that is attributed to changes in technology is weighted by the unweighted average of the final demands of the initial and final year while the change in the final demand component is weighted by the average of the initial and final technologies.

3.3.4. Qualitative method of analysis

It is obvious that effective linkage between the agriculture, manufacturing and markets is ensured if effective policies are carefully formulated and properly implemented to promote strong linkages among agriculture and industry sectors. To modernize the sectors and also bring about structural transformation, both inter-sectoral and intra-sectoral linkages are important. Apart from this, the existence of monitoring framework and institutional capacities are extremely important to have effective implementation of plans. Cognizant of this, the study used sequential approaches. First, Ethiopian development and sectoral policies were extensively examined from the perspectives of inter-sectoral and intra-sectoral linkages using the SAM multiplier analysis. A desk review of policy, strategy and plan documents and detail qualitative assessment were then carried out at industry and sub-industry levels to explore the most binding factors that cause poor linkages among agriculture, manufacturing, and the market systems in the economy.

The qualitative analysis was specifically conducted to attempt to answer the why question by seeking answers to why some of the linkages have been weak after the levels of the strengths of the linkages have been identified by the SAM multiplier. The critical review and synthesis of existing national planning, policy, and strategy documents particularly helped to identify the key gaps in national development

programmes regarding intersectoral linkages. The major national documents reviewed include the National Industrial Development Strategy, ADLI, the SDPRP, PASDEP, GTP I, GTP II, the Homegrown Economic Reform Agenda, and the Ten-Year Development Plan. Thus, besides analyzing why the linkages have been weak using primary data, the study also conducted a gap analysis by examining how the issue of sectoral linkages between agriculture and industry have been depicted in the national development plans, policies, and strategies during different periods.

4. Results and Discussion

4.1. Forward and backward linkages

In Ethiopia, agro-industries and food and beverages contribute about 50 percent to the manufacturing sector output in the country. However, the sector's exports constituted only 1.3 percent in 2013 and import dependency remained strong (UNCTAD, 2021). This signifies that the sector has weak linkage with the rest of the economy. The degree of economic linkage is expressed by the level of backward and forward linkages of activities in a given economic system. Backward linkages show the extent of dependence of an activity on inputs produced from other activities in the domestic economy while forward linkages capture the economic sector's role in supplying inputs to other sectors. These two linkages are very decisive to identify key and weakly linked sectors of an economy and to design effective intervention plans and strategies.

The multiplier analysis has shown that the main agricultural commodities, except cereals and livestock, have weak forward linkages. Yet, almost all agricultural commodities have relatively strong backward linkages. Specifically, cereals, livestock, and bakery/grain are the key leading sectors with strong forward and backward linkages in the economy. Of all agricultural activities, livestock has the highest forward and backward linkages followed by cereals. The major agricultural products including cereals, oilseeds, cash crops, and fruits and vegetables have high backward linkages. This signifies that any demand change in the outputs of these commodities can create significant spillover effects in the economy through backward linkages.

Table 4: Forward and backward linkages of key agricultural outputs/activities

Type of Commodity	2015/16		2005/06	
	Backward Linkage	Forward Linkage	Backward Linkage	Forward Linkage
Cereals	1.042	1.428	1.090	1.32
Pulses	1.188	0.352	1.242	0.34
Oilseeds	1.141	0.372	1.193	0.32
Vegetables, fruits, & root crops	1.142	0.378	1.194	0.52
Cash crops	1.160	0.329	1.213	0.44
Enset	1.184	0.199	1.238	0.21
Livestock and Fish	1.199	1.412	1.255	1.35

Source: Authors' computation based on SAM (2005/06, 2015/16)

The analysis has shown that the status of the backward and forward linkages of activities did not significantly change in the decade preceding 2016. This could be partly because the production pattern of activities did not technically alter between 2005 and 2016. For instance, when we compare the technical coefficients of 2005/06 and 2015/16 SAM of Ethiopia, there is no as such huge difference on the share of factors of production and input intensity of activities. This shows that there has not been any significant change in the mode of production and the level of integration among activities in the Ethiopian economy during the decade under consideration

Since Ethiopia has one of the least developed manufacturing sectors in the world, the majority of the main agro-processing industries have fallen under weakly linked sectors with weak forward and backward linkages. This signifies that any increases in the final demand for the agro-processing activities will have limited impact on the overall economy and agricultural sectors. Particularly, except the bakery and grain mill, all agro-processing activities have weak forward linkages. This is partly because the biggest demand of these goods come from households. Some agro processing activities notably bakery/grain, vegetable oil, dairy and alcohol have higher backward linkages while the rest of agro processing sectors have weak forward and backward linkages. This is mainly because many of the agro-processing sectors rely on imported intermediate inputs so that their impact on domestic production via backward linkages is weak.

Table 5: Forward and backward linkages of agro-processing outputs/activities

Type of Commodity	2015/16		2005/06	
	Backward Linkage	Forward Linkage	Backward Linkage	Forward Linkage
Preserve	0.817	0.139	0.857	0.15
Vegetable oils	1.269	0.211	1.387	0.14
Dairy	1.322	0.214	0.140	0.37
Bakery and grain mills	1.188	1.631	1.247	0.91
Sugar	0.888	0.175	0.931	0.2
Other agro-processing	1.308	0.491	1.374	0.27
Alcohol	1.072	0.284	1.116	0.13
Beverage and soft drink	0.947	0.165	0.989	0.33
Tobacco	0.643	0.138	0.674	0.17
Textile and apparel	0.584	0.264	0.613	0.4
Leather	0.816	0.214	0.857	0.17

Source: Authors' computation based on SAM (2005/06, 2015/16)

Detailed analysis has also been made to examine the impact of a unit increase in the production of agro-processing activities on the demand for key agricultural activities. The results show that bakery/grain, other agro-processing, vegetable oils, and dairy activities create relatively more demand for the key agricultural products. When we look at the level of linkages of each agricultural items with the agro-processing manufacturing activities, oilseeds, and livestock will have relatively higher demand if the production of the key agro-processing activities increase. For instance, if the demand for agro-processed products increases by one unit, the demand for cereals, livestock, and oilseed tend to increase by 0.97, 0.42, and 0.04, respectively. In the same way, if there is an expansion of vegetable oil by one unit, the demand for oilseed increases by 1.01 which shows that the sector tend to create a strong backward linkage with the agricultural activity (Table 6).

Table 6: Inter-sectoral multipliers between agricultural and agro-processing outputs/activities

	Preserve	Vegetable oils	Dairy	Bakery & grain mill	Sugar	Agro-processing	Alcohol	Beverage	Tobacco	Textile & apparel	Leather	Wood	Total
Cereals	0.25	0.38	0.43	1.09	0.26	0.97	0.36	0.30	0.19	0.17	0.25	0.30	4.95
Pulse	0.04	0.06	0.07	0.16	0.04	0.15	0.06	0.05	0.03	0.03	0.04	0.05	0.78
Oilseeds	0.03	1.01	0.06	0.03	0.03	0.04	0.04	0.03	0.02	0.02	0.03	0.03	1.37
Vegetable & fruits	0.05	0.09	0.09	0.08	0.06	0.08	0.08	0.07	0.04	0.04	0.05	0.06	0.79
Cash crops	0.03	0.04	0.04	0.04	0.46	0.04	0.04	0.04	0.02	0.03	0.03	0.03	0.84
Enset	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.2
Livestock	0.51	0.35	1.38	0.32	0.24	0.42	0.33	0.28	0.18	0.16	0.75	0.26	5.18
Total	0.92	1.95	2.09	1.74	1.11	1.72	0.93	0.79	0.49	0.46	1.16	0.75	

Source: Authors' Computation

4.2. SAM decomposition analysis and sectoral linkages

The previous results of the SAM multipliers do not allow tracking the relative contribution of direct and indirect effects to sectoral linkages. The SAM multiplier decomposition enables to scrutinize which linkage induces more spillover effect in the economy. In a nutshell, there are three distinct effects in the SAM multiplier analysis. These are the own or the within effect, the open-loop effect, and the closed-loop effect. Since institutional/household transfer is limited in Ethiopia, the within effect captures the part of the multiplier occurring within activities through forward and backward linkages.

The magnitude of the within effect basically depends on the strength of forward and backward linkages among sectors in the economy. The open-loop or spill-over effect captures the part of the spillover effect that flows from activities to households via factor payments. The closed-loop or feedback effect shows the increase in the production of activities that emanates from household consumption after activities pay to factors and factors pay to households.

Results of the within effect have also revealed that an increase in the demand of cereals by one unit induces demand for agriculture, other industries, and services by 0.09, 0.07, and 0.19, respectively. Since cereals sector do not normally use any

input from the agro-processing sector, it's within effect multiplier on agro-processing can safely be set to zero.

When we look at the strength of the consumption effect which comes from the consumption of goods and services by households through the closed-loop effects, they are quite stronger than the within effect. For instance, the total within effect of an increase in production of cereals by one unit goes as low as 0.35 while the closed-loop effect goes as high as 2.35. In the same way, an increase in demand for livestock by one unit increases the within production effect among activities by 0.51 while the closed-loop effect goes as high as 2.69. When we split the effect across sectors, the highest within effect is created by the agro-processing (0.16) while the closed-loop effect for the agro-processing for the same demand change goes as high as 0.81 (Table 7).

Table 7 clearly shows that the closed-loop effects of cereals and other agricultural crops creates more spillover effects and linkages with the agro-processing manufacturing activities. The change in demand of cereals or any of the agricultural activities by households or any agent induces more production. Feedback effect that goes from industries' factor payments to households' income will stimulate production activities through demand effects. Because of this, the change in the final demand is the salient driver of the change in economy-wide gross output in Ethiopia. This is because much of the commodities produced by various activities are consumed as final demands by households and government than used as intermediate inputs by activities. This limits the spillover effect created in the economy through forward and backward linkages.

The same as agricultural goods, the lion's share of outputs from the manufacturing activities are consumed by households. In addition, some agro-processing activities are labor intensive while some other activities intensively use more of agricultural intermediate inputs. Because of this, the linkage and spillover effect of agro-processing activities coming from the within and closed-loop effects differ. For instance, the increase in demand for vegetable oil, bakery, and dairy by one unit will induce additional demand for agricultural commodities through its within effect by 1.26, 1.47, and 1.38, respectively.

Table 7: Within and closed loop multipliers induced by agricultural activities on agro-processed outputs/activities

		Cereals	Pulses	Oilseeds	Fruit & Vegetable	Cash crops	Enset	Livestock
Within effects	Agriculture	0.09	0.14	0.02	0.02	0.14	0.03	0.16
	Agro-processing	0.00	0.00	0.00	0.01	0.01	0.01	0.16
	Other industries	0.07	0.02	0.02	0.03	0.05	0.01	0.02
	Service	0.19	0.17	0.24	0.30	0.29	0.36	0.19
	Total	0.35	0.33	0.28	0.36	0.49	0.41	0.53
Closed-loop effects	Agriculture	0.55	0.64	0.62	0.61	0.61	0.64	0.63
	Agro-processing	0.71	0.83	0.79	0.79	0.79	0.82	0.81
	Other industries	0.23	0.27	0.26	0.25	0.25	0.26	0.26
	Service	0.86	1.01	0.97	0.96	0.96	0.99	0.99
	Total	2.35	2.75	2.64	2.61	2.61	2.71	2.69

Source: Authors' computation based on SAM (2016)

Other key sectors such as beverage, textile, and leather sectors don't generate strong within spillover effects. For instance, a unit increase in demand of the textile and the leather sectors only induces 0.02 and 0.58 demand for output of the agricultural sector activities. This is because these commodities do not intensively use domestically produced agricultural goods as intermediate inputs. In the same way, when there is a unit increase in demand of vegetable oil, it generates 0.62 demand for agricultural outputs via closed-loop effect but the value goes as low as 0.28 and 0.37 for textile and leather, respectively.

The other channel of the multiplier effect is through consumption. The increase in household income increases the production of agricultural activities through consumption effect. Agro-processing activities tend to have higher closed-loop effects since they are heavily consumed by household. For instance, dairy and vegetable oils have the highest closed-loop effect. Since households relatively spend the lion's share of their income on food, agriculture, and agro-processing activities entertain more demand from household when income of household increases. The result in general entails that the consumption effect creates the highest spillover effect and sectoral linkages. This is because the consumption of goods and services

by households are greater than the amount used as intermediate inputs by activities. In relative terms, activities such as dairy and bakery/grain mills and other agro-processing create more demand and linkage with the agricultural sector through direct and closed-loop effects compared to other agro-processing activities. This is because they intensively use domestically produced agricultural goods and are heavily consumed by households.

Table 8: Within and closed loop inter-sectoral multipliers induced by agro-processing activities on agricultural activities

		Preserve	Vegetable oil	Dairy	Bakery & grain mill	Sugar	Agro-processing	Alcohol	Beverage	Tobacco	Textile	Leather	Other manufacturing
Within effect	Agriculture	0.33	0.99	1.10	0.88	0.45	0.83	0.03	0.03	0.00	0.02	0.58	0.05
	Agro-processing	0.05	0.01	0.16	0.06	0.01	0.89	0.03	0.02	0.00	0.01	0.08	0.03
	Other industries	0.01	0.02	0.02	0.06	0.04	0.05	0.02	0.02	0.00	0.01	0.02	0.45
	Service	0.25	0.24	0.19	0.38	0.18	0.40	0.24	0.26	0.06	0.08	0.12	0.08
	Total	0.64	1.26	1.47	1.38	0.68	2.17	0.32	0.33	0.06	0.12	0.8	0.61
Closed- Loop effect	Agriculture	0.38	0.62	0.63	0.56	0.42	0.57	0.57	0.49	0.32	0.28	0.37	0.94
	Agro-processing	0.49	0.79	0.81	0.72	0.55	0.73	0.73	0.63	0.41	0.36	0.47	1.21
	Other industries	0.16	0.26	0.26	0.23	0.18	0.24	0.24	0.20	0.13	0.12	0.15	0.39
	Service	0.60	0.97	0.99	0.87	0.66	0.89	0.89	0.77	0.50	0.43	0.58	1.47
	Total	1.63	2.64	2.69	2.38	1.81	2.43	2.43	2.09	1.36	1.19	1.57	4.01

Source: Authors' computation based on SAM (2016)

4.3. Welfare and employment effects of sectoral linkages

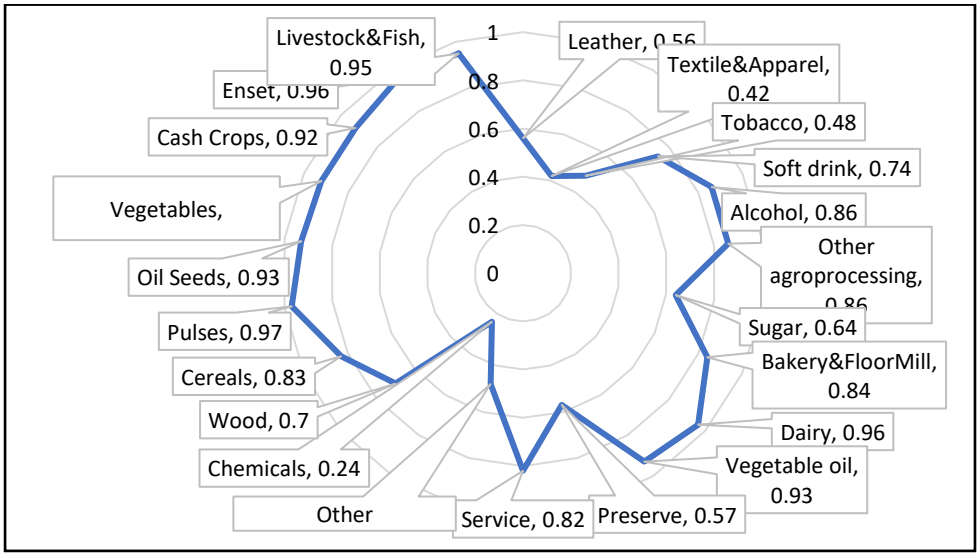
The impact of an expansion of agro-processing and agricultural activities on the welfare of households partly depends on its effect on income. The effect of an increase in the production activities on income of households partly depends on the share of labor and capital in the values of goods and services. The results revealed that all agricultural activities; namely pulses, oilseeds, fruits and vegetables, cash

crops, Enset, and livestock induce higher impact on household's income compared to manufacturing activities. However, from the agro-processing activities, edible oils, dairy, bakery and grain mill, sugar, and alcohol ensure higher income gain compared to other manufacturing activities.

The results show that an increase in the demand of pulse, oil seeds, and livestock by one unit increase the income of households by 0.97, 0.93, and 0.95, respectively. The figures for textile, tobacco and leather go as low as 0.42, 0.48, and 0.56 in the order they are mentioned. This entails that those agro-processing activities that intensively use domestically produced agricultural goods as intermediate inputs, and which are labor intensive, induce higher impact on the income of households.

Unemployment has remained one of the chronic problems of many developing countries including Ethiopia. Thus, the decision to prioritize or expand the production of commodities from some of the key sectors partly depend on sector's capacity to create sustainable and decent employment opportunities. Particularly in a situation where there is massive unemployment, an increase in income of labor from a certain shock would entail that more employment would be created. In general, the impact of the expansion of activities on creating employment opportunity apparently depends on the effect of the expansion of activities on labor.

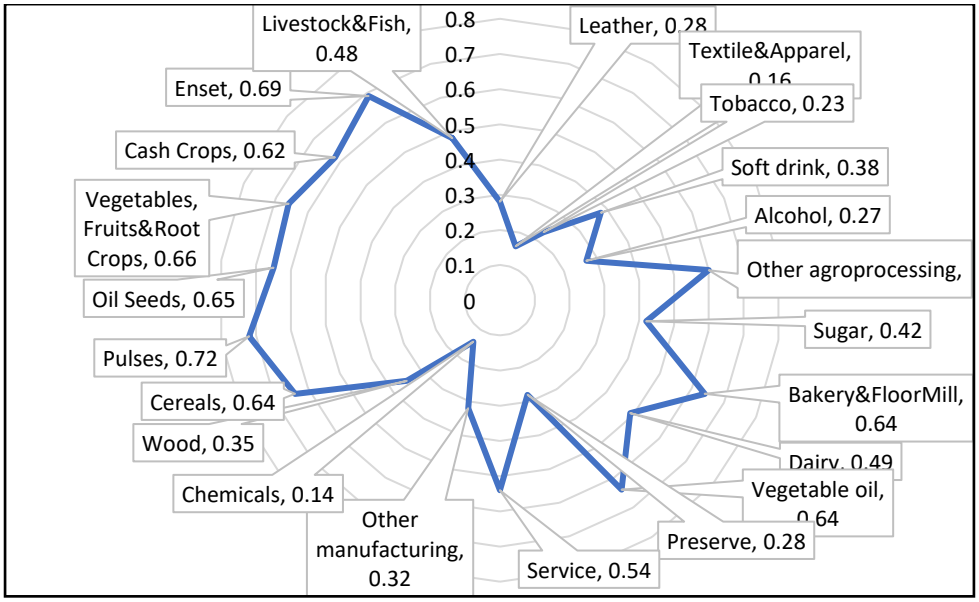
Figure 9: Spillover effects from activities on household income



Source: Authors' computation based on SAM (2016)

The results of the analysis have shown that the agricultural activities induce more demand for labor than the industrial sector. From all activities of the agro-processing, bakery and grain, dairy, and vegetable oil and other agro-processing activities induce more demand for labor than other sectors. The result has revealed that other agro-processing activities do not create more employment opportunities. This is because they either intensively use intermediate inputs or capital in their production systems. For instance, a one unit increase in the demand for cereals and oil seeds each, their effect on income of labor would be 0.64 and 0.75, respectively. If the same shock happens on textile, leather, and sugar, their impact on labor income would be 0.16, 0.28, and 0.48 in the order mentioned.

Figure 10: Spillover effects from activities on labor employment



Source: Authors' computation based on SAM (2016)

4.4. Decomposition and technical change

It has been observed that there is a change in the production of goods and services in Ethiopia in recent decades. There are two sources for this change of production patterns. One of it is the change in technical capabilities emanating from strong backward and forward linkages among sectors; and the other is the change in the final demand by economic agents. When the income of households increases, it again increases the demand for goods and services that eventually increases the

demand for goods and services. This may not be accompanied by increased domestic production or strong technical change. The closed loop shows the effect of consumption effects on the production of goods and services. The result of this study clearly shows that the change in the production of goods and services in the economy occurred because of a boom in consumption. The results have shown that there is no significant change in the nature of the production function on sectoral linkages.

Table 9: Decomposition of technical and demand changes of activities

Activities	Technical change	Change in Demand	Total Change
Cereals	(15.37)	303.10	287.72
Pulses	17.78	44.33	62.10
Oil seeds	1.48	35.45	36.93
Fruits and vegetables	(2.22)	68.56	66.34
Cash crops	(3.16)	74.03	70.87
Enset	(0.76)	18.86	18.10
Livestock and fish	14.34	277.41	291.74
Preserve	0.06	3.49	3.55
Vegetable oil	3.73	17.28	21.02
Dairy	(3.08)	29.20	26.12
Grain and bakery	44.18	311.15	355.33
Sugar	(3.56)	16.32	12.76
Agro-processing	4.52	81.55	86.07
Alcohol	0.42	36.09	36.51
Soft drink	(6.80)	20.42	13.62
Tobacco	0.32	2.19	2.51
Textile and Apparel	(2.86)	44.31	41.45
Leather	(0.08)	23.68	23.60

Source: Authors' computation based on SAM (2006 and 2016)

Decomposition of change in gross value of production between 2005/6 and 2015/16 shows contributions by changes in technology and changes in final demand. The results for this decomposition of change in gross output are presented in Table 9. The results show that the change in economy-wide gross output is predominantly due to the change in the final demand, with changes in technology only contributing

a very infinitesimal amount. Although, final demand is the main driver of change in economy-wide gross output over the period under study, results vary across activities. Several activities rely solely on final demand effects while their technology effects associated with backward linkages to the other activities have become less intense. Pulses, oilseed, livestock, vegetable oil, grain and bakery, and agro-processing exhibit positive technology effects, although for all these activities final demand remains the main source. The limited role of technical change indicates that there was no significant structural transformation in the economy over the ten years between 2005/6 and 2015/16.

4.5. Ethiopia's national planning experience and sectoral linkages

Ethiopia has gone through various ideologically distinct regimes which implemented different economic development policies since 1950s. The country formulated its first national development plan in 1957. There were three consecutives between 1957 and 1973 all under the Imperial era. These are the first five-year plan (1957-1962), the second five-year plan (1963-1967), and the third five-year plan (1968-1973).

The first-five-year plan emphasized the improved production and productivity of mainly commercial crops as a starting point to develop the economy (Welteji, 2018). The second five-year plan was, on the other hand, emphasized on industrial development through the promotion of large-scale agricultural production such as cotton and sugar for the promotion of the required input for the industrial sector (Alemu et al., 2002). The third five-year development again re-emphasized the development of the agricultural sector as a response to the rising challenges to ensure food security in the country (Alemu et al., 2002).

It is evident that while the Imperial government managed to design national development plans its missions have been shifting from agriculture sector focus under the first five-year plan period to industry sector focus during the second five-year plan period and then back to agriculture sector focus during the third five-year plan period. The priorities were shifting based on partly by the aspirations to transform the economy, and partly by the need to respond to the overriding challenges facing the country such as food security issues which was the key factor behind reverting back to focusing on agriculture sector under the third five-year plan while the non-agricultural sector was acknowledged to be the key driver of development.

To achieve its goals during the three plans, the country engaged in an export promotion strategy with generous incentive packages given to attract foreign direct investment. These incentive packages and measures included generous tax incentives and high levels of tariff protection for selected industries and easy access to domestic credit for production of manufactured goods (Bigsten et al., 2009). In addition to this, every development effort, including provision of infrastructure, was tied to the expansion of primary exports such as coffee, hides and skins. Some achievements related to raising the linkages between agriculture and industry have been registered. For instance, between 1962 and 1969, following the expansion of the textile industry, cotton's share in employment and output reached 40 percent and 33 percent, respectively, with numbers of people employed doubling from 10,100 to 21,610. Though textile production stimulated backward linkages to cotton production, its effects on forward linkages (such as stimulating the apparel industry) were weak. In the textile sector, import substitution strategy (ISS) brought benefits in employment creation and foreign exchange savings. However, the policy was not as such designed to promote systemic and sustainable linkage between the agricultural and the manufacturing sectors through the promotion of the agribusiness industry in other sectors.

After 1974, the country was led by a socialist political economic ideology with initial focus on industry led development strategy. The regime undertook very bold actions including nationalization of both medium and large-scale industries in 1975 to centrally command the economy. In addition, the government used relatively high import tariff rates and other non-tariff trade barriers to promote domestic industries. During this period, sectors such as food and beverages, textiles, leather, cement, and the chemical industry continued to be considered as priorities. The food and textile sectors showed some degree of competitiveness. Other sectors couldn't be competitive. Rather, they had been struggling to exist. This was because the nationalization of industries curtailed the expansion of the private sector investment, which resulted in the decline of the contribution of privately owned manufacturing industries to employment and production. For example, the contribution of the private sector to employment and production was only 4 percent and 8 percent, respectively, in 1988/89 (CSA, 1990).

After 1991, the country has taken various radical policy initiations including privatization, liberalization, and trade reforms. The government endorsed ADLI strategy in 1994 as an umbrella strategy to bring about rapid agricultural transformation which should subsequently lead to industrialization. Subsequently,

Industrial Development Strategy (IDS) was introduced in 2003. The strategy focused mainly on industries that are labor intensive, have broad linkages with the rest of the economy, use agricultural products as inputs, are export oriented and import substituting, and contribute to rapid technological transfer. The policy was more concretized into action by various sub-sector strategies. The focus has been on sectors such as leather and leather products, apparel and textiles, meat processing, food processing and beverages, cement and steel, and horticulture (IDS, 2002). These priority industries were dominated by agro-processing and other sectors which had strong linkage to the agricultural sector. This entails that the strategy intuitively recognized the importance of intersectoral linkages to achieve successful industrialization in Ethiopia. For instance, the IDS priorities indicated that developing a leather shoes export industry fosters the promotion of other leather and leather products industries which in turn paves the way for the expansion of livestock resources, and the establishment of qualitative and standardized modern abattoirs.

Once ADLI was crafted as a guiding framework for national development, the government came up with the Sustainable Development and Poverty Reduction Program (SDPRP) which as the same implies, affirmed the need to focus on agricultural development to reduce poverty (MoFED, 2002). Although it recognized the need for a multi-sectoral development approach, the SDPRP did not put forward any clear mechanism for strengthening intersectoral linkages.

It was the Plan of Action for Sustainable Development to End Poverty (PASDEP) which laid the foundation for a more comprehensive view to national development by widening the focus to urban area development although agricultural development remained a national priority during 2004/5-2009/10. As such, it has been the first clear attempt of the government to leverage the linkages between agriculture and the non-agricultural or urban based sectors.

The country embarked on the first Growth and Transformation Plan (GTP I) in 2010/11 to build on the experiences from PASDEP and widen the national development agenda towards industrialization and ultimately achieve economic structural transformation. While recognizing the importance of developing agriculture, the plan focuses on developing labor-intensive small-scale manufacturing as a way of creating linkages between other sectors. The second Growth and Transformation Plan (GTP II) was designed in 2015/16 to build on the experiences of the GTP I and continue the industrialization drive in the country by reemphasizing the potentials of development urban areas and the manufacturing

sector. The country aimed to become the hub for light manufacturing in Africa under GTP II.

The GTP I and GTP II have clearly sorted out specific sectors that have been promoted by medium and large industries. These include textile and garment industry, leather and leather products industry, sugar and sugar related industries, cement industry, metal and engineering industry, chemical industry, pharmaceutical industry, and the agro-processing industry. During this plan period, several tangible institutional changes have been introduced including the establishment of new (or strengthening of existing) specialized capacity building and technology institutes for sub-sectors (such as leather and leather products, textile and apparel, sugar, metal, dairy and meat, and horticulture), and the elaboration of a detailed sector strategies for the leather industry (Zerihun, 2008).

Ambitious reforms have been initiated to supply skilled manpower via the development of extensive Technical Vocational Education and Training (TVET) system. The plans yielded some successful achievements though they failed to meet the expectations and planned targets. For instance, the export earnings from the textile and garment industry sub-sector stood at USD 98.1 million which shows significant improvement though it was far below the USD 1 billion target set for the end of the plan period.

In addition, the total export revenue of the leather and leather products industry over the GTP I period totaled USD 596.2 million. In 2014/15 alone, the export revenue from this subsector stood at USD 131.6 million, which was more than double the value for the base year (base year value of USD 56.4 million). During GTP I period, the agro processing industry subsector registered USD 196 million export earnings while creating job opportunities for 52,000 citizens. On the other hand, during the plan period, USD 416.56 million was generated from the export of meat, milk, and honey. The pharmaceuticals industry has also registered USD 20.92 million in export earnings during the plan period (NPC, 2015).

The KII with selected participants from the policy circles participated in the preparations of the two GTPs revealed that sectoral linkages were not set as anchor element during the preparation of both GTPs and other prior plans in the country. Every sector and line ministries set their goals and targets without adequate consideration for intersectional issues and complementarities in their setting of targets as well as choice of priorities and strategies. For instance, the priority activities indicated in the industrial strategy, which were dominated by agro-processing, were not supported by equivalent attention and emphasis by the

agricultural sector to feed agro-processing activities with quality agricultural inputs. Because of this, the agro-processing industries have remained to be heavily relying on imported intermediate inputs.

In addition, the country continued to import massive agro-processed commodities from the rest of the world to meet the ever-rising demand for such commodities among the urban population whose consumption pattern has been changing. Apart from this, the agricultural and agro-processing sectors were not monitoring common outcomes to achieve a common national goal (well developed and synchronized agro-processing sector) together as one entity. This made the country squander the benefits that would have been accrued if the sectors were linked with each other through the right and parallel development of priority activities which would feed each other along the value chains. The discussants revealed that still, the combination of rapid urbanization and population growth induces more demand for processed foods, which brings about an opportunity for expanding agro-processing industries to meet the local demand with locally produced inputs.

The key informants have shown that the planning process of the Ten-Year Development Plan has attempted to fix the problems by promoting joint planning across sectors which have been thought to have strong linkages so that the linkage between industries and agriculture will be fostered to achieve a common goal. These joint planning will squash input shortages of agro-processing which remains as one of the priority activities in the ten-year plan implementation period ending in 2029/30. Apart from this, the plan envisioned the establishment of growth corridors in different areas based on consideration for potentials so that the linkage between agriculture and agro-processing can be strengthened.

The country has also embarked on a three years (2019-2022) homegrown economic reform agenda towards the end of the GTP II because of protest induced changes in the country's political leadership and subsequent changes of the economic directions towards more opening up. Under the homegrown economic reform agenda, the government identified key challenges facing the economy and designed interventions to redress macroeconomic imbalances, solve structural bottlenecks, and enhance productivity and efficiency in selected sectors. While there has not been much in terms of linking them, agriculture and manufacturing were among five key sectors selected for interventions aimed at improving capacity utilization, productivity, and efficiency. The following schemata summarizes the planning experience of Ethiopia since 1950s.

Table 10: Schematic summary of Ethiopian development plans and sectoral linkages

Epochs	Focus of attention	Global initiations	
Imperial regime	✓ Industrialization	"Industry first argument "was prevalent throughout the world	Incentivizing big industries Import substitution as a policy tool Big farming expanded to provide input to industries Intersectoral linkage was envisioned, and some achievements have bene registered
Dergue regime	✓ Socialism	Socialism has been promoted in many developing countries	Public ownership of industries Cooperatives and villagization to promote agricultural productivity Poor sectoral linkages Only few agro-processing sectors namely textile and leather withstood the competition
EPRDG regime Pre-GTP I (Sustainable Development Poverty Reduction Programme) IDS (industrial development strategy	Agricultural led industrialization	Structural Adjustment Program	Structural adjustment polices Privatization Agricultural transformation by increasing productivity of smallholders Increased agricultural production, but poor linkage with agro-processing Surge in import of agro-processing following rising demand for goods and services "One leg on the ground" to promote agricultural transformation
Growth and Transformation Plan I	Industrialization by promoting selected industrialization Climate resilient Green Economy (CRGE) introduced	Structural Adjustment Programs and Millennium Development Goals	Incentives (Credit rationing) was introduced to promote selected industries
Growth and Transformation Plan II	Industrialization by promoting selected industrialization Commercialization CRGE mainstreamed	Structural Adjustment Programs Sustainable Development Goals	Incentives (Credit rationing) was introduced to promote selected industries Commercial farming promoted

Epochs	Focus of attention	Global initiations	
Current Regime	Agriculture	G-20 Common Framework Resolutions	Capacity utilization
	Manufacturing	for debt restructuring	Import substitution
Homegrown Economic	Tourism		Export promotion
Reform	Mining		Productivity and efficiency
	ICT		Competitiveness
Ten-Year Development Plan	Multi-sectoral sources of growth	SDG (Agenda 2030)	Integration across sectors promoted
	and job opportunities	AU Agenda 2063	Climate resilient green economy
	Sustainable and inclusive	AfCFTA	Promoting competitiveness through improved competitiveness
	development financing	WTO	Private sector led economic development
	Demographic dividend		Modernizing the agricultural sector
	Quality and efficiency of		
	infrastructure projects		
	Urban development and		
	sustainable urbanization		
	Peace, Justice, and inclusive		
	institutions		

Source: Authors' compilation based on desk review

4.6. Key insights from focus group discussions and key informant interviews

The SAM multiplier analysis and results have shown that the agriculture and the agro-processing sectors are weakly linked with each other. Recognizing this evidence, more analysis has been conducted using a qualitative analysis to explore the possible reasons. FGD and KKI were undertaken with carefully selected participants from diverse group of actors engaged in production and policy making circles. The FGDs were conducted in Addis Ababa and Hawassa by two senior and well-experienced investigators. The selection of participants were undertaken at sector level since every sector has its own unique and distinct features that require a deep understanding and separate analysis as the saying goes "the same size doesn't fit all".

The FGD participants have explained that Ethiopia has massive potentials for agro-processing if effective linkage between agriculture, the agro-processing and the market linkage is aided by sound policies and effective incentives that promote the right investment decisions along the value chains of each agro-processing sectors. However, participants generally indicated that there are a lot of hurdles that hinder and disrupt the agriculture and the industrial linkages. Even though the reasons varies across sectors, the main challenges that have been commonly indicated by the participants include poor quality of raw materials domestically along the value chains, policy and institutional problems which don't give much attentions to sectoral linkages and investment alignments, incidences of high prevalence of illegal trade particularly in the livestock sector, challenges to access financial services to operate at optimal scale, inadequate provisions of strategic raw materials, lack of access to reliable markets, and poor logistic services. The following subsection provides insights from the FGD at the sub-sectoral level.

Textile and garment

The participants have explained that illegal trade and contraband (synthetic of equal quality with leather) hampers the sector not to grow to the required level. But, the most salient problem explained by the participants is related to the lack of domestically produced thread and fabric to feed the ever-rising garment industries. The fabric and other auxiliary sectors within the industry could not be developed to a state that enables to feed the garment sector in adequately sustainable and reliable manner. This is partly because the agricultural sector could not supply the require

raw materials to the sectors. Because of this, the garment sector heavily relies on imported raw materials that deter the competitiveness of the sector.

Another very concerning issue raised by the FGD participants is that high price has been an additional challenge limiting the use of domestic raw materials. Despite being inferior quality wise, the domestic raw materials are often more expensive than the imported ones. This has made the challenge even worse for those would want to use domestically available raw materials to produce garment and textiles and derivative products. Ideas raised in this regard have been consistent between the discussants who took part in the FGD in the two locations, indicating that much of these problems might not be location specific and hence require greater attention.

Meat and livestock

The participants in both locations share the long-held claim that Ethiopia is endowed with large numbers of livestock and presents significant potential for development if the right policies and strategies are in place. The meat sector is particularly one of the most promising sectors in the economy. However, the meat processing sector is more of traditional, and households usually slaughter animals to meet their meat demand often during cultural festivities and other irregular events. The culture to buy a certain portion of meat from proper markets such as supermarkets or slaughterhouses for household consumption are rare, if not uncommon.

The participants claimed that the commercial livestock sector is very backward even by African standards. Apart from this, households don't buy cattle from the ranches; rather they rely on the local markets which do not follow proper regulatory framework related to quality assurance including certifying for sanitary and Phyto-sanitary issues. This deters the sector not to strive to produce quality livestock that would have also been beneficial from the consumers' point of view. In addition, rural households usually supply older animals to the market often after using them for plowing for several years, and hence the supply of lean meat of calf younger than 3 years is difficult to meet the demand of the local and the export markets.

Illegal trade is also the key problem that challenges the sector according to the explanations of the FGD participants. According to the participants the sector has problems related to provision of adequate land, access to financial services, and technological supports to achieve high performance. The participants suggest the country to establish an independent institution that deal with livestock, hides and

skins and meat. There have been several cases raised by the participants as to how illegal livestock trade across the borders and also in the country have been affecting their businesses. More effort is required to integrate the meat processing sector with a formal and modern livestock sector by also better protecting cross-border trade and smuggling of livestock.

Sweeteners

The discussants have shown that due to its small size and less emphases given by the government, to the sub-sector, the Ethiopian sweets and sugar producers are not developed and cannot compete with imported items which are often better packaged and marketed than the domestic ones regardless of quality and prices. The ideas that came out during the discussions revealed that the current government policy towards sugars and sweets is discouraging for their businesses. The participants have indicated that the current tax policy towards glucose encourages illegal trade. Apart from this, the necessary intermediate inputs are not domestically produced, and the participants pleaded that the government better understand the sector and fixes problems along the value chains for domestic companies to play their role in production and job creation.

Leather

The participants have shown that the country is endowed with abundant livestock resources with potentially high-quality natural skins although that will not always be the case due to lack of proper care. Since the subsector is one of the areas that has been given prime attention during recent decades, it has been growing faster. However, there has been serious issues linked to the quality and quantity supply of raw hides and skins to the extent that the leather companies were sometimes compelled to dump the skins and hides they collected due to serious deficiencies to meet the quality threshold for processing. The participants explained that in recent days, the prices of skins and hides have drastically decreased, so has been the quality.

Though price reduction seems that it helps the leather subsector, since the lion share of skins come from households, the low price of skins has further reduced the quality as well as the supply of the skin as less attention is given to the quality of leather and skin during slaughtering. During slaughtering, some households were said to have thrown away the skins due to extremely low value that it brings compared to the transaction cost of selling it in the markets. Apart from this, higher order industries which could absorb finished leather are less in number. In addition,

the participants have also explained that almost all chemical and intermediate inputs other than the skin are imported.

Agro-processing

There are currently no formal forward and backward linkages in the supply chains particularly in the fruits and vegetables. In Ethiopia, fruits and vegetables are mainly produced by smallholders, with only a few dedicated commercial farms in the upper and lower Awash, Koka, Meki, Batu, and a few other areas. Supermarket owners have shown that import of fruits have increased in Ethiopia notably oranges, mandarins, apples and grapes. Post-harvest loss is the significant problems that affect the supply of fruits and vegetables. Participants claimed that fruit and vegetable growers in Ethiopia are not well organized to negotiate contracts with major buyers. As a result, information and knowledge about quality standards in fruits and vegetables is only limitedly available within the supply chain. The role of middlemen has also been raised as one of the major obstacles in the market for fruits and vegetables. The supermarkets source produce from distributors or their own agents in the production areas.

The participants have indicated the following corrective actions to be considered:

- For the government to conduct a comprehensive and detailed diagnostic assessment along the value chain and carefully look at the potentials of each subsector as well as complementarities that could serve as a basis for developing strong and sustainable intersectoral linkages;
- For all actors along the value chain to effectively contribute their shares to ensure improved competitiveness of the subsectors;
- For policies and strategies be designed to give special privileges and incentives to local manufacturers at least for a defined short period of time to protect them against unfair competition from foreign firms;
- For the government to work decisively to solve administrative and bureaucratic bottlenecks that hinders investments and development;
- For the government to revise the existing investment policy and incentive structures to support the development of the subsectors and to possibly enhance the use of domestic inputs and encourage intersectoral linkages

5. Conclusion and Policy Implications

The analysis has generated various results both through the quantitative and the qualitative analyses. The results have shown that there is weak linkage between the agricultural and agro-processing sectors in Ethiopia. Particularly, agro-processing sectors have weak linkages with agricultural activities. The linkage has been found to be very weak especially in the fruits and vegetables subsector although several other subsector activities have also exhibited weak intersectoral linkages with other sectors. On the contrary, cereals have strong forward linkage showing that the agro-processing is concentrating on flour production and bread production or bakery business which is fundamental for household consumption and catering businesses.

In the quantitative analysis using SAM, decomposition has been applied to the effects of an injection of income to the account of activities on household's income and then of an injection to different kinds of factors to household's income. The SAM decomposition analysis has shown that the closed loop effect is the strongest form which shows that it is the consumption effect which is stronger than the within effect which is linked to the forward and backward linkages of activities. The structural analysis has also shown that the change in production of activities has been caused by the change in consumption than technical changes.

On the other hand, the qualitative analysis in general depicted that there are no concrete steps and efforts in policy design for promoting systemic and sustainable linkages between the agricultural and manufacturing activities. The focus group discussions as well as the key informant interviews also revealed that there is input shortage both in terms of quality and quantity entailing the fact that the agricultural and the industrial sectors were not well linked to each other to induce economic structural transformation. Apart from this, the previous development plans, policies, and strategies were not designed in a way that can sustainably and effectively promote the linkages between the agricultural and industrial sectors although there were intentions to do so as indicated by some policy and strategy documents.

In general, this study made it clear that the intersectoral linkages between agriculture and industry sectors in Ethiopia are weak. This implies that the there is a long way to inducing effective structural transformation and creating jobs in the country if we continue to do things the same way. The major problem regarding weak linkages is more resulting from the structure of the economy and weak implementation of the plans, policies and strategies rather than the existence of such documents. It will remain an uphill to achieve sustainable development without building high quality value chains and linkages within and between agriculture and

industry sectors, fostering economic structural transformation, and ensuring a vibrant business environment for the private sector to flourish. The study recommends that the policy making should focus on improving implementation capacity to promote systemic linkages between the agricultural and the industrial sectors. Particular attention should be given to the fruits and vegetable sectors where the forward linkages of vegetable and fruits are extremely weaker.

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Appendices

Appendix 1: Forward linkages

Forward linkages	Within effects				Closed-loop effects			
	Agriculture	Agro-processing	Other industries	Service	Agriculture	Agro processing	Other industries	Service
Cereals	0.15	1.49	0.02	0.03	2.60	3.15	-	0.33
Pulse	0.14	0.22	0.00	0.00	0.42	0.51	0.57	0.05
Oilseeds	0.02	1.01	0.00	0.00	0.26	0.31	0.09	0.03
Fruits and Vegetables	0.04	0.05	0.00	0.03	0.56	0.68	0.06	0.07
Cash crops	0.12	0.46	0.00	0.00	0.30	0.36	0.12	0.04
Enset	-	-	-	-	0.17	0.20	0.06	0.02
Livestock and fish	0.12	2.02	0.02	0.04	2.41	2.92	0.04	0.30
Preserve	-	-	0.00	0.00	0.02	0.02	0.53	0.00
Vegetable Oil	0.02	0.04	0.00	0.00	0.17	0.21	0.00	0.02
Dairy	-	0.01	0.00	-	0.20	0.24	0.04	0.02
Bakery and grain	0.08	1.06	0.01	0.01	3.26	3.95	0.04	0.41
Sugar	-	0.02	0.00	0.00	0.10	0.12	0.71	0.01
Agro-processing	0.08	0.15	0.00	0.00	0.80	0.97	0.02	0.10
Alcohol	-	.02	-	-	0.36	0.44	0.17	0.05
Beverage	0.01	0.01	0.00	0.00	0.08	0.09	0.08	0.01
Tobacco	-	-	-	0.00	0.02	0.02	0.02	0.00
Textile and apparel	-	0.00	0.00	0.00	0.32	0.39	0.00	0.04
Leather	-	0.00	-	-	0.20	0.24	0.07	0.03

Appendix 2: SAM decomposition

We recall that

$$Y_n = A_n \bar{Y}_n + X$$

Where Yn the total of each endogenous account. An is define as the matrix of average expenditure propensities. Xn represents the exogenous accounts. From the multiplier analysis,

$\bar{Y}_n = (I - A_n)^{-1} X$ we can denote the multiplier matric as $M_a = (I - A_n)^{-1}$

$$\bar{Y}_n = M_a X$$

This matrix could be decomposed following Pyatt and Round (1978) into three economically meaningful components. These are a transfer, an open-loop matrix, and a closed-loop matrix.

Recall

$$Y_n = A_n \bar{Y}_n + X$$

Let us add and subtracted the same expression

$\bar{A}_n \bar{Y}_n$

$Y_n = A_n \bar{Y}_n - \bar{A}_n \bar{Y}_n + \bar{A}_n \bar{Y}_n + X$; $(I - \bar{A}_n)\bar{Y}_n = (A_n - \bar{A}_n)\bar{Y}_n + X$;

$$Y_n - \bar{A}_n \bar{Y}_n = (A_n - \bar{A}_n)\bar{Y}_n + X$$

$$\bar{Y}_n = (I - \bar{A}_n)^{-1}(A_n - \bar{A}_n)\bar{Y}_n + (I - \bar{A}_n)^{-1} X$$

Let $A^* = (I - \bar{A}_n)^{-1}(A_n - \bar{A}_n)$

$$\bar{Y}_n = A^* \bar{Y}_n + (I - \bar{A}_n)^{-1} X$$

$$\bar{Y}_n - (I - \bar{A}_n)^{-1} X = A^* \bar{Y}_n$$

Multiply $\bar{Y}_n = A^* \bar{Y}_n + (I - \bar{A}_n)^{-1} X$ by A^*

$A^* \bar{Y}_n = A^{*2} \bar{Y}_n + A^* (I - \bar{A}_n)^{-1} X$ but $\bar{Y}_n - (I - \bar{A}_n)^{-1} X = A^* \bar{Y}_n$

$$\bar{Y}_n - (I - \bar{A}_n)^{-1} X = A^{*2} \bar{Y}_n + A^* (I - \bar{A}_n)^{-1} X$$

$$\bar{Y}_n - (I - \bar{A}_n)^{-1} X = A^{*2} \bar{Y}_n + A^* (I - \bar{A}_n)^{-1} X$$

$$\bar{Y_n} = A^{*2}\bar{Y_n} + A^{*}(I - \bar{A_n})^{-1}X + (I - \bar{A_n})^{-1}X$$

$$\bar{Y_n} = A^{*2}\bar{Y_n} + (A^{*}(I - \bar{A_n})^{-1} + (I - \bar{A_n})^{-1})X$$

$$\bar{Y_n} - (A^{*}(I - \bar{A_n})^{-1} + (I - \bar{A_n})^{-1})X = A^{*2}\bar{Y_n}$$

Multiply $\bar{Y_n} = A^{*}\bar{Y_n} + (I - \bar{A_n})^{-1}X$ by A^{*2}

$$A^{*2}\bar{Y_n} = A^{*3}\bar{Y_n} + A^{*2}(I - \bar{A_n})^{-1}X$$

replace $A^{*2}\bar{Y_n}$

$$\bar{Y_n} - (A^{*}(I - \bar{A_n})^{-1} + (I - \bar{A_n})^{-1})X = A^{*3}\bar{Y_n} + A^{*2}(I - \bar{A_n})^{-1}X$$

$$\bar{Y_n} = A^{*3}\bar{Y_n} + A^{*2}(I - \bar{A_n})^{-1}X + (A^{*}(I - \bar{A_n})^{-1} + (I - \bar{A_n})^{-1})X$$

$$\bar{Y_n} - A^{*3}\bar{Y_n} = (A^{*2} + A^{*-1} + I)(I - \bar{A_n})^{-1}X$$

$$(I - A^{*3})\bar{Y_n} = (A^{*2} + A^{*-1} + I)(I - \bar{A_n})^{-1}X$$

$$\bar{Y_n} = (I - A^{*3})^{-1}(A^{*2} + A^{*-1} + I)(I - \bar{A_n})^{-1}X$$

Let $Ma_1 = (I - \bar{A_n})^{-1}$ $Ma_2 = (A^{*2} + A^{*-1} + I)$ $Ma_3 = (I - A^{*3})^{-1}$

So,

$$\bar{Y_n} = M_{a3}M_{a2}M_{a1}X$$

We can convert the afore mentioned expression into additive form

$$\bar{Y_n} = I + (M_{a1} - I) + (M_{a2} - I) * M_{a1} + (M_{a3} - I) * M_{a2} * M_{a1}$$

I = the initial unitary injection

$(M_{a1} - I)$ = captures the net effect of a group of accounts on itself through direct transfers

$(M_{a2} - I) * M_{a1}$ = net contribution of open loop or cross multiplier effects

$(M_{a3} - I) * M_{a2} * M_{a1}$ = net contribution of circular or closed loop multiplier effect.

The nxn matrix A (a partition of A) was chosen as follows, considering that the first row (and column) corresponds to the block of activities/commodities, the second to the block of production factors, and the third to the block of enterprises/households:

$$\bar{A} = \begin{bmatrix} A_{11} & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & A_{33} \end{bmatrix}$$

Given a matrix

$$A = \begin{bmatrix} A_{11} & 0 & A_{13} \\ A_{21} & 0 & 0 \\ 0 & A_{32} & A_{33} \end{bmatrix} \text{ such that } A - \bar{A} \text{ is } \quad A = \begin{bmatrix} A_{11} & 0 & A_{13} \\ A_{21} & 0 & 0 \\ 0 & A_{32} & A_{33} \end{bmatrix}$$

$$A^* = (I - \bar{A})^{-1}(A - \bar{A})$$

$$= \begin{bmatrix} (I - A_{11})^{-1} & 0 & 0 \\ 0 & I & 0 \\ 0 & 0 & (I - A_{33})^{-1} \end{bmatrix} \begin{bmatrix} 0 & 0 & A_{13} \\ A_{21} & 0 & 0 \\ 0 & A_{32} & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & 0 & A^*_{13} \\ A^*_{21} & 0 & 0 \\ 0 & A^*_{32} & 0 \end{bmatrix} \text{ where } A^*_{13} = (I - A_{11})^{-1} * A_{13}, A^*_{21} = A_{21}, A^*_{32} = (I - A_{33})^{-1} * A_{32}$$

$$M_1 = \begin{bmatrix} (I - A_{11})^{-1} & 0 & 0 \\ 0 & I & 0 \\ 0 & 0 & (I - A_{33})^{-1} \end{bmatrix}$$

$$A^{*2} = A^* * A^* = \begin{bmatrix} 0 & 0 & A^*_{13} \\ A^*_{21} & 0 & 0 \\ 0 & A^*_{32} & 0 \end{bmatrix} * \begin{bmatrix} 0 & 0 & A^*_{13} \\ A^*_{21} & 0 & 0 \\ 0 & A^*_{32} & 0 \end{bmatrix} = \begin{bmatrix} 0 & A^*_{13}A^*_{32} & 0 \\ 0 & 0 & A^*_{21}A^*_{13} \\ A^*_{32}A^*_{21} & 0 & 0 \end{bmatrix}$$

$$M_2 = I + A^* + A^{*2} = \begin{bmatrix} I & 0 & 0 \\ 0 & I & 0 \\ 0 & 0 & I \end{bmatrix} + \begin{bmatrix} 0 & 0 & A^*_{13} \\ A^*_{21} & 0 & 0 \\ 0 & A^*_{32} & 0 \end{bmatrix} + \begin{bmatrix} 0 & A^*_{13}A^*_{32} & 0 \\ 0 & 0 & A^*_{21}A^*_{13} \\ A^*_{32}A^*_{21} & 0 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} I & A^*_{13}A^*_{32} & A^*_{13} \\ A^*_{21} & I & A^*_{21}A^*_{13} \\ A^*_{32}A^*_{21} & A^*_{32} & I \end{bmatrix}$$

$$A^{*3} = A^{*2} * A^* = \begin{bmatrix} 0 & A^*_{13}A^*_{32} & 0 \\ 0 & 0 & A^*_{21}A^*_{13} \\ A^*_{32}A^*_{21} & 0 & 0 \end{bmatrix} \begin{bmatrix} 0 & 0 & A^*_{13} \\ A^*_{21} & 0 & 0 \\ 0 & A^*_{32} & 0 \end{bmatrix}$$

$$= \begin{bmatrix} A^*_{13}A^*_{32}A^*_{21} & 0 & 0 \\ 0 & A^*_{21}A^*_{13}A^*_{32} & 0 \\ 0 & 0 & A^*_{32}A^*_{21}A^*_{13} \end{bmatrix}$$

$$Ma_3 = (I - A^{*3})^{-1} = \begin{bmatrix} (I - A^*_{13}A^*_{32}A^*_{21})^{-1} & 0 & 0 \\ 0 & (I - A^*_{21}A^*_{13}A^*_{32})^{-1} & 0 \\ 0 & 0 & (I - A^*_{32}A^*_{21}A^*_{13})^{-1} \end{bmatrix}$$

$$M_1 = \begin{bmatrix} (I - A_{11})^{-1} - I & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & (I - A_{33})^{-1} - I \end{bmatrix}$$

$$\text{OL} = \begin{bmatrix} 0 & A^*_{13}A^*_{32} & A^*_{13}(I - A_{33})^{-1} \\ A^*_{21}(I - A_{11})^{-1} & 0 & A^*_{21}A^*_{13}(I - A_{33})^{-1} \\ A^*_{32}A^*_{21}(I - A_{11})^{-1} & A^*_{32} & 0 \end{bmatrix}$$

$$\text{CL} = \begin{bmatrix} C_{132}(I - A_{11})^{-1} & C_{132}A^*_{13}A^*_{32} & C_{132}A^*_{13}(I - A_{33})^{-1} \\ C_{213}A^*_{21}(I - A_{11})^{-1} & C_{213} & C_{213}A^*_{21}A^*_{13}(I - A_{33})^{-1} \\ C_{321}A^*_{32}A^*_{21}(I - A_{11})^{-1} & C_{321}A^*_{32} & C_{321}(I - A_{33})^{-1} \end{bmatrix}$$

$$C_{132} = (I - A^*_{13}A^*_{32}A^*_{21})^{-1} - I, C_{213} = (I - A^*_{21}A^*_{13}A^*_{32})^{-1} - I, C_{321} = (I - A^*_{32}A^*_{21}A^*_{13})^{-1} - I$$