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## Manufacturing Industries Development and Economic Role in Ethiopia

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### Abstract

Ethiopia's manufacturing sector is among the key productive sectors of the economy identified under GTP I (2010-2015) which can spur economic growth and development because of its immense potential for wealth creation, employment generation and poverty alleviation.

The manufacturing sector makes an important contribution to the Ethiopian economy and employs about 173 thousand people in the year 2012/2013. The sector had about 2,610 manufacturing establishments in the same year and for the purpose of this study purpose it is divided into eight broad subsectors namely food and beverage products, textile and apparel products, leather and leather products, wood and pulp products, chemical and chemical products, rubber and plastic products, other non-metallic minerals products and metal and engineering products industries.

The top two manufacturing subsector; food and beverage and metal and engineering industries accounted for 51% of the sector's GDP and the food and beverage sector alone accounted 38% of the employment in the sector in the year 2012/2013.

The manufacturing sector contribution to the GDP in 2014/2015 was 4.8%.<sup>1</sup> The performance of the sector has been affected by low productivity of workers and use of obsolete technologies which is attributed to the poor state of physical infrastructure, limited access to finance, limited research and development, poor institutional framework, and inadequate managerial technical skills.

**KEYWORD:** Ethiopia, Manufacturing, Development, Economic role

## **HISTORICAL BACKGROUND**

In Ethiopia, industry in the modern sense of the term emerged as an economic entity only at the turn of the 20th century. The establishment of a strong central government, expansion of cities associated with the installation of railways and the strengthening of foreign relations increased the demand for imported manufacturing commodities.

The process of industrialization in Sub-Saharan Africa occurred in two phases: a first step, even very early during the colonial regime began around the 1920s<sup>i</sup> and ended in the late forties; a second phase of industrialization began in the late fifties and gained momentum in the sixties, when import substitution was implemented more widely.

This, in turn, encouraged the establishment of import-substituting factories domestically and as a result modern manufacturing enterprises began to emerge in the 1920s. After a brief disruption in the Second World War period, the manufacturing sector started to get momentum in the 1950s. During this period a number of new industries which significantly contributed to the development of the national economy were established. The 1950s are also marked by the start of a comprehensive plan to stimulate and guide the country's industrial and economic development in general.

Ethiopia has seen three regimes over the last eight decades. Keeping with the political ideologies governing the economic principles of the time, these successive regimes adopted different policies for the development of industry in the country. The industrial policies have distinctive features when looking at the guiding vision (policy), ownership structure, and market orientation. Broadly, they can be characterized as the import substitution and private sector-led (from early 1950s to 1974, the Imperial regime); the import substitution and state-led (from 1974 to 1991, the Dergue regime), and the export-orientated and private sector-led (since 1991, the Ethiopian People's Revolutionary Democratic Front, (EPRDF)-led government). In what follows, the salient features of the industrial policies of these three periods will briefly be reviewed. Table 1 summarizes these episodes.

### **The Imperial regime (pre-1974)**

A conscious move to stimulate industrial growth began in the mid-1950s with the formulation of the First Five-Year Plan (FFYP) that covered the period 1958-62. The plan envisaged to achieve industrial development through the development of import-substituting light industries which produced consumer goods for the domestic market. In the plan it was anticipated that foreign direct private investment would play the leading role in financing the investment capital required for the sector. Various policy measures were introduced to encourage investment in manufacturing including protection of the domestic industry through high tariff and banning of certain imports, fiscal incentives, and provision of credit. The plan also foresaw other roles for the government in boosting the industrial development including infrastructure and human resource development and direct investment in selected sectors mainly those require high capital such as oil refinery, cement, sugar, and textile.

Two more five-year plans, the Second Five-Year Plan (SFYP) and the Third Five-Year Plan (TFYP), were launched between 1963 and 1973. During this period the government extended the incentives to attract investors and continued to strengthen its presence in economic activities by making direct investment in manufacturing. The driving philosophy of the industrial policy in the imperial period can be characterized as in favour of market and private sector but sought gaps

whereby the government should play a role including direct ownership in selected sectors. In practice, the incentive structure was biased towards import-substituting, larger, capital-intensive, and foreign-dominated industrial activities.

According to a World Bank (1985) Report the implementation of these initiatives attracted foreign investors and gave boost to the manufacturing sector in Ethiopia. However by the end of the plan period, the overall industrial base of the country remained weak and was characterized by a dual structure – a rudimentary small-scale and handicraft sub-sector and a modern medium-large-scale sub-sector, each contributing about half of the manufacturing value added. In this period the modern medium- and large-scale manufacturing sector, which employs ten or more people and use power-driven machinery (hereafter, MLSM) created no more than 60,000 jobs in total and it was predominantly foreign owned.

**Table 1: The Ethiopian industrial policy and development phases**

	Imperial period (pre-1974)	The Dergue regime (1975-91)	The EPRDF regime (post-1992)
Guiding policy/vision	Market-oriented	Command economy	Market-oriented
Public/private role	Private-led	State-led	Private-led but also strong state role
Ownership structure	Dominance of foreign-owned enterprises	Dominance of public-owned enterprise	Dominance of domestic private-owned enterprises
Target industries	Import- substituting and labor intensive industries (e.g. textile, food, cement)	Import-substituting and labor-intensive industries but also basic industries	Export-oriented & labour-intensive industries (e.g. Textile, leather, agro-processing, cement)
Envisaged key player	Foreign investment	Public sector investment	Domestic private sector
Policy instruments	Protection of domestic market through high tariff and banning of certain imports Provision of economic incentives (tax holidays, remission of indirect tax on capital goods etc.) & preferential credit scheme	Protection of domestic market through high tariff and quantitative restrictions Financing, subsidizing, and ensuring monopoly power for the state-owned enterprises	Direct support for selected export sectors through capacity building and other means Provision of economic incentives (tax holidays, remission of indirect tax on capital goods etc.) & preferential credit scheme

Government role	Infrastructure & human resource development and ownership of selective industries	Mainly government ownership	Infrastructure & human resource development, ownership of selective industries, and capacity building of the private sector
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Source: Researcher’s compilation

**The Dergue Regime (1974-91)**

In 1974 the Ethiopian Revolution erupted while the country was preparing the fourth five-year development plan. The military government nationalized most of the MLSM enterprises, which were later reorganized under state corporations. The government also declared ‘a socialist economic policy’ (PMAC 1975) and introduced various restrictions on the private sector and the market. Private investment was restricted to not exceed half a million Birr (approximately a quarter of a million US\$) and entrepreneurs may participate in only one venture. Price controls were instituted covering a wide range of products and the labour market highly regulated. The imports were also subjected to quantitative restrictions and higher tariffs in this period. The Ethiopian national currency, the Birr, was set fixed at about 2.07 per US\$1 and continued at this rate throughout the period of the military regime (1974/75-1990/91).

The manufacturing sector exhibited a sharp decline particularly in the first few years following the revolution. In 1977/78 the government initiated a successive production campaign locally known as ‘zemecha’ to improve productivity mainly through increasing capacity utilization and have partly reversed the declining trend. Nevertheless, the government had no industrial policy per se until the mid-1980s. A central planning body was established in 1984 and a Ten-Year Perspective Plan (TYPP) was formulated. This comprises a macro-economic framework, a public investment programme, an indicative portfolio of projects and production targets for the period 1984/85-1993/94. The main focus of the industrial development plan in this period was to promote the import-substituting and labour-intensive industries. The public sector investment was considered as the main mechanism in the progress toward industrialization (World Bank 1985).

The nationalization and continued systematic restriction of the private sector from engaging in major economic activities had virtually reduced the emerging vibrant sector into micro- and small-scale manufacturing activities. In contrast the state became the sole responsible organ owning and operating the MLSM activities. In 1985/86, one decade after the revolution, the state-owned enterprises (SOEs) managed to command 95 per cent of the value added and 93 per cent of the employment of all MLSM enterprises (see Table 2).

They continued to dominate the sector until the last year of the regime (1990/91). Despite their largest share in the sector, the SOEs financial position became increasingly weak and had to rely on government subsidies and overdraft facilities for their working capital requirements (UNIDO 1991: 13). Manufacturing establishments were seriously constrained by shortages of foreign exchange, raw material supply, working capital and the like. Most were forced to operate far below

their installed capacity and because of the poor quality of produced product, they were unable to meet the local demand let alone compete in the international market.

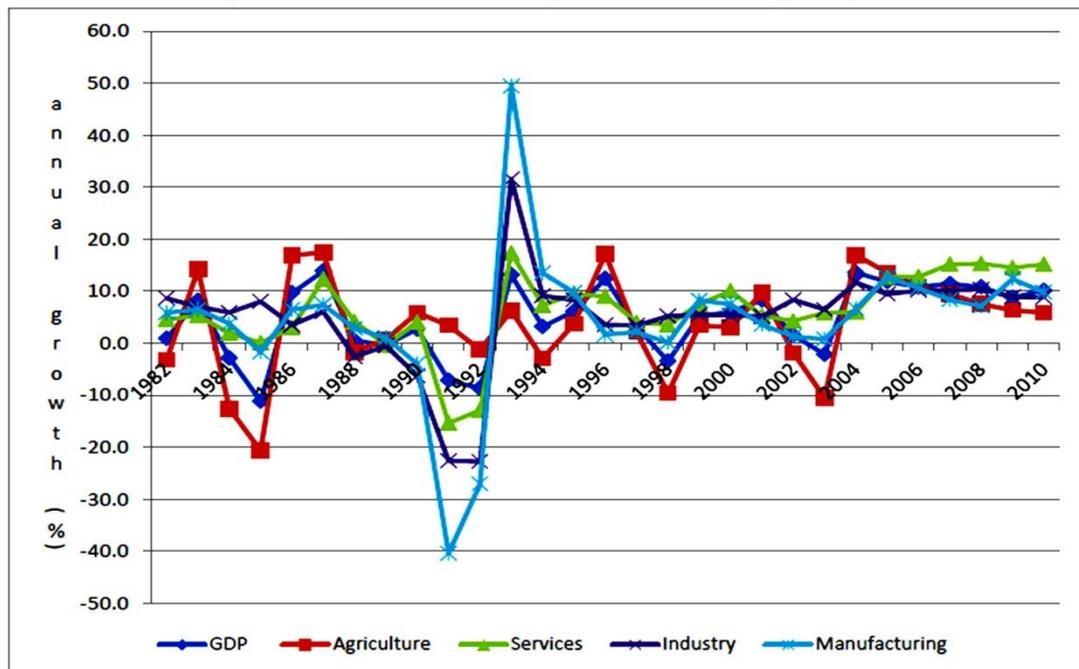
Table 2 Number of establishments, employment, and value added by ownership in the Ethiopian MLSM, 1979/80–2010

	No. of establishments		No. of employees		Value added	
	Total	Public share (%)	Total	Public share (%)	Total (mill. Birr)	Public share (%)
1979/80	351	45.3	76,631	88.85	589.7	95.0
1985/86	369	48.8	90,845	93.33	715.3	95.2
1990/91	275	52.4	84,000	93.08	460.2	94.0
1995/96	627	25.7	90,039	86.25	1,593.8	87.9
1999/00	788	15.5	95,708	56.13	2,279.3	72.5
2004/05	1,207	10.4	110,160	48.70	3,030.6	N/A
2009/10	2,172	6.4	186,799	25.67	11,369.6	31.2

Source: CSA (various years)

The last years of the Dergue regime sought another sharp decline in the Ethiopian economy. Figure 1 sketches the growth of gross domestic product (GDP) and all major sectors over the period 1981-2010. The figure shows a continuous decline in GDP and all other major sectors particularly in the period 1987-91. The manufacturing sector was the most affected by this turmoil and exhibited an about 40 per cent decline in value added in 1991 alone. The number of establishments in the MLSM sector also shrunk from about 380 in 1987/88 to 275 in 1990/91 with a corresponding decline in employment. The hostile policies toward the private sector, large inefficiency in the public sector and intensification of the then undergoing conflict in the country were some of the major causes of this decline. In March 1990, the regime adopted a mixed economic policy to shift the country from one of a centrally managed economy to a modest liberal economy. This initiative was, however, too late and short-lived without bearing fruit, as there was a regime change in May 1991.

Figure 1: Growth of GDP and major sectors 1981-2010, Ethiopia



Source: World Development Indicators (various years).

### The Ethiopia People Revolutionary and Democratic Front (EPRDF) Regime (post-1991)

The EPRDF-led transitional government soon after it seized power announced that the country will follow a market-led economic policy. The first decade of the EPRDF regime (1991-99) was marked by a series of reforms under the Structural Adjustment Program(SAP) with the aim of reversing the command economic system by the way of fostering competition, opening the economy and promoting the private sector. In this period the government implemented three phases of IMF/WB sponsored reform programs. The first phase of the structural and economic reform programme took place during 1992/93-1994/95. Measures undertaken during this period include among others:

Liberalization of the foreign exchange market starting with a massive devaluation of the Birr by about 150 per cent in October 1992;

- Rationalization of public expenditure;
- Introduction of a new investment code, labour and public enterprise laws;
- Removal of subsidies and export tax rebate;
- Liberalization of prices except for petroleum;
- Reduction of the maximum import tariff from 230 per cent to 80 per cent; and
- Liberalization of payments for invisible transactions, and easing of market entry for privately-owned banks and insurance companies.

The second phase of the economic reform program (1994/95-1996/97) aimed at limiting the role of the state in the economic activities and promotion of greater private capital participation. By October 1996, the country entered a three-year Enhanced Structural Adjustment Facility (ESAF) arrangement with the IMF and began the third phase of the reform program spanning the period

1996/97-1998/99. Under this arrangement, the government committed itself to achieve broad-based economic growth with a stable macro-economic environment, while the liberalization measures were further strengthened.

The favorable policy environment created by the economic reforms, coupled with macro-economic stability, revitalized the manufacturing sector and the economy in general. For example, in 1993 the industry and manufacturing value added grew by about 31 per cent and 49 per cent respectively, reversing the declining trend in the three preceding years (see Figure 1). The high growth period, however, did not last long and started to slow down by 1996. The value added growth of the industry and the manufacturing sector in the period 1996-2003 was only 5 and 3 per cent annual average, respectively, which is only modest in comparison to the preceding years. In 1998, the Ethiopian government adopted an export promotion strategy in an effort to address the lack of progress in export diversification. The strategy aimed at promoting high value agricultural exports (e.g. horticulture products and meat) and labour-intensive manufacturing products (clothing, textile, leather and leather products). This strategy was, nonetheless, relatively narrow in scope. A comprehensive industrial policy was then formulated in 2002/03. The industrial policy was more concretized into action by various sub-sector strategies and by the successive development plans such as Sustainable Development and Poverty Reduction Program (SDPRP) 2002/03-2004/05, the Plan of Action for Sustainable Development and Eradication of Poverty (PASDEP) 2005/06-2009/10, and the Growth and Transformation Plan (GTP) 2010/11-2014/15. The first development plan gave great emphasis to smallholder agriculture, while in the second and third ones the policy scope was broadened to encompass urban and the industrial sector development. The main emphasis of the IDS is to actively support the export-oriented and labour-intensive sectors. Various policy instruments were introduced to support and guide industrial development.

Ethiopia has experienced a double digit economic growth following the start of the implementation of these policies. Between 2003/04 and 2010/11, GDP grew by about 10.6 per cent annual average. All the major sectors including industry also grew by more than 10 per cent over this period. Despite high and continuous growth over the last decade, the structure of the Ethiopian economy basically remained unchanged. Table 2 gives the share of the value added of the major sectors in GDP for the period 2000/01-2009/10. The only feasible change in the sectoral value added composition is that service has become the largest sector overtaking agriculture since 2007/08. The industry value added share to GDP, however, remained relatively static and never exceeded 14 per cent in the last decade.

**Table 3: Sectoral contribution (value added % GDP) 2000/01-2009/2010, Ethiopia**

Year	Agriculture Value added(% of GDP)	Service Value added(% of GDP)	Manufacturing	Construction	Electricity	Mining	Industry total
2000/01	50.9	38.0	5.3	4.3	2.1	0.5	12.1
2001/02	49.1	38.6	5.3	4.9	2.2	0.5	12.9
2002/03	44.9	41.7	5.4	5.7	2.4	0.5	14.0
2003/04	47.0	39.7	5.2	6.1	2.3	0.5	14.0
2004/05	47.4	39.7	5.2	5.8	2.2	0.4	13.6
2005/06	47.1	40.4	6.1	4.3	2.5	0.5	13.4
2006/07	46.1	41.7	5.0	5.7	2.2	0.4	13.2
2007/08	44.6	43.5	4.8	5.6	2.2	0.4	13.0
2008/09	43.2	45.1	4.9	5.8	1.9	0.4	13.0
2009/10	42.0	46.1	4.9	5.8	1.8	0.5	13.0

Source: National Bank of Ethiopia (various years).

Table 3 also gives the share of industry sub-components' value added to GDP. The construction and the manufacturing are the two most important sub-sectors in the industry sector. For example in 2009/10, they respectively accounted for 5.8 and 4.9 per cent of GDP. Driven by the recent construction boom in the country, the construction sub-sector overtook the manufacturing since 2004. Unlike to many other African countries the mining sub-sector in Ethiopia contributes the least, i.e. only accounting for less than half a per cent of GDP over the review period.

### **MANUFACTURING SECTOR STATUS**

The Ethiopian government has initiated a new push towards creating framework to ensure economic and social development. The International Monetary Fund (IMF) ranks Ethiopia as among the five fastest growing economies in the world. After a decade of continuous expansion (during which real GDP growth averaged 10.8% per annum), in 2013/14 the economy grew for its 11<sup>th</sup> consecutive year posting 10.3% growth. Ethiopia's economy is based on agriculture, which accounts 40.2 % of GDP, 60 % of the export earning, and 80 % of total employment. The industrial sector accounts 14.3% of GDP, 9.5 % of total employment, and 21.2 % of export earnings. While the service sector accounts for 46.2% of GDP Ethiopian manufacturing sector contribute for export, employment and national output. The sector accounts for 70%of the industrial sector. Within the manufacturing sector, the agro processing subsector (food and beverage subsector hereinafter) is the largest subsector, accounting for 36%of the total gross value of production (GVP) and 38%of the value added at basic price (VAMP) of large and medium scale manufacturing industry (CSA, 2014). The number of manufacturing units which was 408 in 1980/81 increased to 2,610 in 2012/13. Declining growth between 1980 and 1991(408 to 283), lower growth between 1991 and 2001 (283 to 909), modest growth between 2001 and 2013(909 to 2610).

Table 4, Major Manufacturing sectors

No.	Types of Manufacturing unites	No. of Establishment	Employment
1	food and beverage	670	67,000
2	by non -metallic mineral products	544	17,230
3	metal and engineering products	433	13,238
4	wood and paper products	196	14,064
5	rubber and plastic products	154	10,984
6	chemical and chemical products	143	9,801
7	leather and leather products	141	14,019
8	textile products	104	19,233

Source : Researcher’s compiled from CSA 2012/2013 Report.

Table 4 among the large and medium manufacturing processors, which has total 2,610 manufacturing units 670 establishments are in the food and beverage subsector and employed more than 67,000 people, followed by non-metallic mineral products, metal and engineering products, wood and paper products, rubber and plastic products, chemical and chemical products, leather and leather products and textile products industries with 544, 433, 196, 154, 143, 141 and 104 totals establishments for each and 17,230, 13,238, 14,064, 10,984, 9,801, 14,019 and 19,233 total jobs created again by each categories for the year 2012/2013(2005 E.C.) according to CSA report.

**Leather**

The government of Ethiopia also considered manufacturing (especially the leather) industry a priority sector for growth. It has significant international comparative advantages owing to its abundant and available raw materials, highly disciplined workforce and cheap prices. The country boasts the largest livestock production in Africa, and the 10th largest in the world Ethiopian leather and leather products industry encompasses tanning and dressing of leather, manufacture of luggage and hand bags, and manufacture of footwear’s. The firms in the industry produce products such as leather shoes and boots, canvas and rubber shoes, plastic footwear’s, leather upper and lining, leather sole, semi processed skins, leather garment, plastic sole and crust hides, and wet blue hides.

According to CSA survey of the Ethiopian manufacturing sector in 2012/13, there were 141 firms engaged in manufacturing of leather and leather products, except one firm which was owned by the government, the rest were private firms.

**Production and Value Addition**

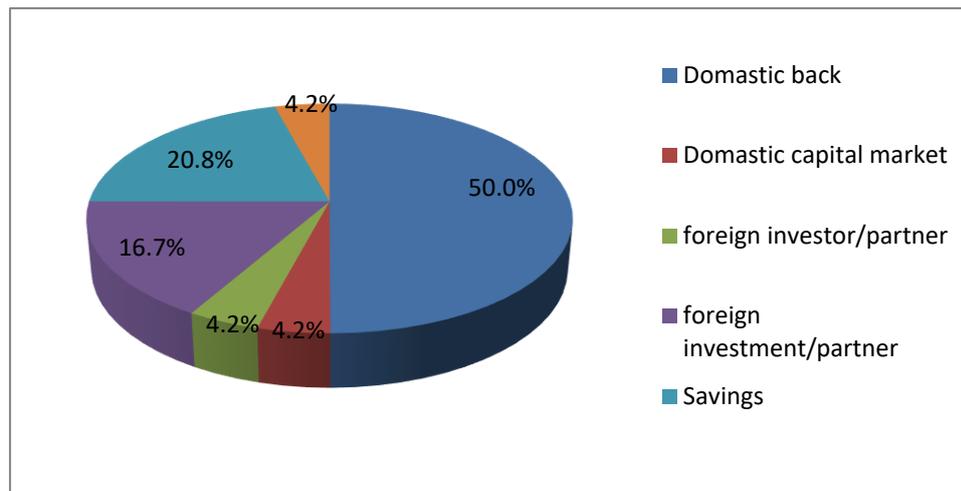
Ethiopia annually produces 2.7 million hides, 8.1 million sheepskins and 7.5 million goatskins. This comparative advantage is further underlined by the fact that the costs of raw hides and skins constitute on average 55-60% of the production of semi processed leather. The gross value of production of leather and leather products industry in 2012/13 was around 9 billion birr out of these firms owned by the private produce 8 billion birr and the government firms produce 1 billion birr. The value added of the industry in 2012/13 was 2.2 billion birr.

### Sources of Finance

Total value of fixed capital assets of leather and footwear industry was around 1.8 billion Birr and the new investment in fixed capital for the 2012/2013 fiscal year worth around 260 million Birr. In the same year, annual wage and salary expenditure reached around 1.5 billion Birr. Formal local financial institutions, foreign investment and savings are the major sources of finance for the industry.

Based on secondary data almost half the subsectors' financial sources, as can be seen from figure 2 below come from domestic banks.<sup>ii</sup> Detailed of the remaining sources can be read from figure below.

Figure 2: Source of Finance



Source: Manufacturing Survey 2014

### Size Distribution

The Ethiopian manufacturing sector is dominated by small and micro-firms.<sup>9</sup> In 2007/08, for example, 43,338 (96 per cent) of the 45,268 manufacturing establishments that use power driven machineries were micro-firms employing fewer than ten people. When looking at the employment distribution we observe two strong modes, one at the micro-size firms and another at the large firms employing 50+ workers.

In terms of value added the size distribution is skewed to the largest size group (50+ employees). The large size group accounts for about 83 per cent of manufacturing value added, while the micro-firms contribute only 11 per cent of the manufacturing value added.

**Sectoral Composition**

Table 5 Sectoral distribution of the Ethiopian manufacturing sector (2007/08)

	Name of manufacturing	SSM sectoral share (%)		Value Added	MLSM sectoral share (%)		Value Added
		No. of Est.	Employment		No. of Est.	Employment	
1	food and beverage	56.76	53.8	47	25.1	31.2	42.3
2	of which grain mills	(53.2)	(50.4)	(42)			
3	tobacco				0.1	0.9	3.8
4	textile				1.3	9.0	2.1
5	apparel	7.2	4.7	5.3	2.0	5.7	1.3
6	leather				4.3	6.5	4.0
7	wood products				3.6	2.4	0.6
8	paper and printing				7.4	6.7	5.1
9	chemicals				4.1	5.8	5.8
10	rubber and plastic				4.2	6.5	4.9
11	other non-metallic mineral				25.3	13.2	18.6
12	basic iron and steel		11	15.6	0.8	1.0	3.1
13	fabricated metal				5.2	3.9	4.8
14	Machin. and equipment				0.2	0.2	0.1
15	vehicles, trailers, semi-		25	24.3	0.8	1.3	1.8
16	furniture	19.8	5	8	15.5	5.6	1.8
17	other	6	138,951	47			42.3
	<b>Total</b>	<b>43,338</b>	<b>53.8</b>	<b>1.14 (bil.Birr)</b>	<b>1,930</b>	<b>133,673</b>	<b>9.17 (bil.birr)</b>

**Source:** *Source:* Computing from CSA (2010) reports

Table 5 shows the separate sectoral composition for Ethiopian manufacturing establishments in 2007/08 for SSM and MLSM. The first three columns report the share of the different sectors of the SSM. The grain mills sector is the dominant industry of this size category and accounts for about 53 per cent of the total number of SSMs.

The last three columns of Table 5 report the sectoral composition of the MLSM. This formal sector is characterized by a high concentration of a limited range of light manufacturing activities such as food and beverage, textile, leather, non-metallic, and furniture. In 2007/08, the food and beverage sector accounted for about a quarter of the number of establishments, one-third of employment, and 42 per cent of the value added of the MLSM sector. The second important industry is the manufacture of other non-metallic mineral products. Some basic sectors, such as chemical, basic metal, and engineering, are as yet underdeveloped.

### **Challenges Facing the Manufacturing Sector**

Under the Growth and Transformation Plan (GTP), the government envisions creating a foundation for the industrial sector to take a leading role in the economy. But the manufacturing industry is still struggling with the same challenges that gripped it for decades. Major challenges of the manufacturing sector in Ethiopia as identified through industry level survey, key informant interview and through desk review are listed below but not limited to:

- Limited access to finance to fund projects in manufacturing sector
- Application proper capital budgeting techniques
- Shortage of foreign currency to import raw materials and capital goods
- Low productivity of laborers working in manufacturing industries
- Low productivity of plants and machineries
- Low capacity utilization
- Quality problem in finished products
- Shortage of supply of skilled manpower in the labor market
- High cost of importing raw materials from foreign market
- Limited supply of raw material in domestic market
- High rate of employees turnover

### **Opportunities to Invest in Manufacturing Industries in Ethiopia**

Despite the current performance and contribution to national economy of Ethiopian manufacturing sector is influenced by multifaceted challenges, there are good chances to invest in this sector of the economy, too. Free copy of a brochure prepared by the Ethiopian Investment Commission (EIC)<sup>7</sup> in 2014 listed out the following opportunities to be the attractive environment if one wants to invest in the manufacturing sector

- Political and social stability
- Macroeconomic stability and rapidly growing economy
- Excellent climate, fertile soils and abundant mineral resources
- Private sector friendly government
- Strong investment guarantees
- Relatively cheap labor force and rapidly increasing number of trained peoples
- Relatively cheap electricity supply compared to any African country and growing size of electricity production

### **CONCLUSION AND RECOMMENDATIONS**

Enhance Access to Finance:

Limited access to finance to fund manufacturing projects and shortage of foreign currency to import raw material and intermediary goods are the main problems of the manufacturing firms in Ethiopia. Thus, the government should alleviate this problem by coordinately working with financial service providers found both within Ethiopia and abroad in order to make available funds for new investment in manufacturing sector in addition to giving due attention to reserve foreign currently that useful for importing raw materials and capital goods Improving.

Availability of Material Inputs:

Although the country's major natural resource base is its rich agricultural potential, it has not been utilized for the development of the industrial sector. As a result this, manufacturing industries which primarily

consuming agricultural inputs such as agro-processing, textile and leather industries encountered facing chronic raw material supply shortage.

Ethiopia is also known to possess a wide variety of mineral resources. However, their utilization is yet to be realized, mineral exploration and exploitation still being at its infancy. This thwarted the expansion of industries based on mineral resources.

#### Upgrading Technological Capability of the Firms:

Developing technological capability require adequate and continuous investment not only on equipment, machinery and related assets; but also investment on information, labor, educations and technological know-how.

#### Promoting Investment in the Manufacturing Sector:

Encourage investment in manufacturing industries, especially, attracting foreign investors to invest, because they do not only invest their capital but also new technology. As new technology comes to the country or expanded by domestic investors, it is easy to transfer from one firm to another so that possible way of expansion of new technology, without incurring high costs. This technological level is developed either by carried out of R&D by firms or research institutions in addition by providing on-the-job learning and trainings to works.

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