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Ministry of Science and Higher Education - Ethiopia

MINISTRY OF SCIENCE AND HIGHER EDUCATION

NATIONAL MANUFACTURING SECTOR RESEARCH AND DEVELOPMENT PRIORITY THEMATIC AREAS

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1. Background

1.1. Ethiopian Manufacturing Sector

Manufacturing is the production of goods using labour, machines, tools, and chemical or biological processing or formulation. It may refer to a range of human activity, from handicraft to high-tech, but it is mostly applied to large-scale industrial productions in which raw materials and semi-finished products are transformed into valuable and marketable products. Such products may be sold to other manufacturers to produce more complex products such as aircraft, household appliances, furniture, sports equipment, and automobiles; or distributed to end-users. Nowadays, the economic development of the manufacturing sector highly depends on the technological advancement of the manufacturing systems. This indicated the need for the transformation of the economy from traditional low production systems into modern mass production systems.

The contribution of the manufacturing sector is significant in the GDP of many countries. However, in the case of Ethiopia, its contribution to the national GDP is very low. According to the World Bank report (Bank, 2020), the contribution of the manufacturing sector to the Ethiopian national GDP is about 5% in 2020 while the values for Sudan, Kenya, and Tanzania are 6%, 8%, and 9%, respectively. The contribution of the manufacturing sector in South Africa, Vietnam, and Malaysia's national GDPs in the same year are 12%, 17%, and 22%, respectively. This shows that the Ethiopian manufacturing sector is still far from being an engine of growth and economic transformation (Oqubay, 2018). In the last two decades, various attempts have been made to enhance the contribution of the manufacturing sector in the national GDP and foreign exchange even though only a slight improvement has been achieved in the overall manufacturing sector. For instance, the foreign currency obtained from textile and garment, meat and meat products, and food process and pharmaceutical products in 2011 are 62.2 million, 67.4 million, and 34.5 million USD, respectively. In 2020, the values increased to 171.6 million, 72.5 million, and 66.5 million USD for textile and garment, meat and meat products, and food and pharmaceutical products, respectively (FDRPDC 2020). For leather and leather products, the foreign currency obtained was decreased from 104.3 million (in 2011) to 72.6 million (in 2020) (FDRPDC, 2020).

Despite the tremendous efforts made to improve the Ethiopian manufacturing sector, the improvements achieved by the sector remain beleaguered by structural problems. The major challenges faced by this sector are shortage of manufacturing inputs, lack of well-skilled

manpower, application of traditional production process and technology, poor production system and quality management, low productivity, weak linkages between among the manufacturing sectors and research and higher institutions, and manufacturing industries themselves, weak research and development for the sector, poor infrastructure as well as utility supplies (DRT, 2014; FDRPDC, 2020). In the current national 10 years (2020-2030) strategic plan, the manufacturing sector has been considered as one of the five strategic economic pillars of the country. Fostering the manufacturing sector will drive other key sectors such as agriculture, mining, ICT, and tourism. The manufacturing sector can support these key sectors through forward-backward integration with other sectors. It can also contribute to import substitutions, wealth generations, job creation, and international competitiveness advancements.

1.2. Ethiopia manufacturing sub-sectors

The Ethiopian manufacturing sector is dominated by small firms and resource-based industries, and weak inter-sectoral and intra-sectoral linkages (Oqubay, 2018). The major manufacturing industries cover the following sub-sectors.

1. Textiles and apparel.
2. Leather and leather products.
3. Food and beverage
4. Meat & diary
5. Pharmaceutical and cosmetics.
6. Chemicals and allied industries.
7. Metal industries
8. Automotive and allied machinery.
9. Agro-processing industries
10. Ceramic industries and construction inputs.
11. Rubber and plastic industries.
12. Wood, pulp, and paper products.
13. Indigenous knowledge-based products and technologies.
14. Miscellaneous segments

As mentioned earlier, these industries have been facing tremendous challenges. The government has been attempting to overcome the challenges facing the sector and exploit the opportunities to expand and diversify the manufacturing industries and their products.

Therefore, it is important to support the industries with research and development activities. Broadly speaking, manufacturing-related research and development cover improvements of existing processes and technologies or the development of new processes, technologies, and manufacturing systems. For this purpose, it is important to identify major research and development thematic areas to support the manufacturing sector. Six broad research and development thematic areas were identified to support the manufacturing sector. The following section presents a brief description of the identified research thematic areas and potential research problems for the manufacturing sector.

2. Manufacturing sector research thematic areas

The identified research and development thematic areas for the manufacturing sector include production inputs substitution and input sustainability, product development and process development, technology adoption, adaptation and transfer, productivity improvement and, marketing and sustainable manufacturing system. All the identified research and development thematic areas may address all manufacturing subsectors as they face similar almost similar challenges. However, it's very important to identify the most urgent research problems while formulating research proposals and ensuring quality research and development activities.

2.1. Manufacturing Inputs (substitution and sustainability)

Raw material and intermediate inputs utilization vary depending on the nature of the manufacturing industry. Sectors such as the food and beverage, leather industries predominantly utilize domestic raw materials. On the other hand, manufacturing sub-sectors like metal and engineering, chemical and plastic industries imports material inputs for their production. Therefore, research and development on the inputs of manufacturing sector inputs are important. The research areas under manufacturing inputs cover:

- Input availability, accessibility, quality and sustainability.
- inputs substitutions.
- Sustainable resource utilizations.

2.2. Product/Process/Technology Development

Product/process/ technology development involves modification of the existing products/ processes/ technologies or development of the new ones. Products/ processes/ technologies

development is one of the key elements in ensuring the national goals in the manufacturing sector. The thematic research areas under this category are:

- Development of new product/process/ technology.
- Modification/improvement/adaptation of existing product/process/ technology.
- Product and process standardization for quality assurance.
- Product lifecycle management.
- Process and manufacturing plants integration.
- Indigenous knowledge-based product/ process/ technology.

2.3. Manufacturing Productivity

Most of the manufacturing sub-sector in Ethiopia operate under their expected capacity due to various reasons. Therefore, it is important to identify the bottlenecks and propose the appropriate corrective actions. Research and development thematic area for manufacturing sector productivity includes:

- Labour/workforce productivity.
- Capacity utilization
- Manufacturing system improvement and management.
- Optimizations and controls.
- Measurements, instrumentations, and calibrations for precision.
- Automation and intelligent manufacturing systems.
- Flexible manufacturing and mass customization.
- Additive manufacturing.
- Computer integrated manufacturing system
- Other research related to manufacturing plants and manufacturing sector productivity.

2.4. Marketing and Sustainability

Efficient marketing and ensuring sustainability are very important for the manufacturing sector. This research thematic area covers manufacturing products marketing, market sustainability, and creation of manufactured products through economically sound processes that minimize negative environmental impacts while natural resources and enhances employee, community, and product safety and stabilities. The marketing and sustainability research thematic area covers:

- Research on products, markets, sales methods and policies, advertising and promotions, pricing, distributions, and business environment
- Value and supply chains and manufacturing sector integration.
- Product branding, promotions, and marketing of local products, identification of cost barriers to commercialization; creation of new markets, and the uptake of products.
- Sustainable manufacturing.
- Industrial waste management and implementation of the eco-industrial cluster system.
- Reduction of the environmental footprint of products.
- Resource and utility utilization efficiency.
- Regulatory Compliance to national & international practices in Manufacturing

2.5. Manufacturing Sector Policies, Strategies, and Management

The manufacturing sector requires appropriate sectoral policies, strategies, and management of the sector. Therefore, it is important to assess the policies, strategies, impacts and management of manufacturing sectors from time to time. Hence, this can be a research thematic area for higher education institutions, manufacturing sectors, and sector-based institutions.

2.6. Technology Transfer

The application of new and emerging technologies is very important in manufacturing industries. Most of these technologies exist in the international markets. Therefore, it is important to identify, adopt, adapt and transfer these technologies to local manufacturing sectors. The research on technology transfer may cover:

- Knowledge production transfer, innovation, technology transfer.
- Knowledge/technology transfer processes, strategies and implementation.
- Technology transfer in university-industry-government cooperative research.
- Other projects related to technology transfer.

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